Kanoria PG Mahila Mahavidyalaya Jaipur

CRITERIA: III

3.3 Research Publication and Awards

SUPPORTING DOCUMENT FOR 3.3.2

3.3.2 Number of research papers per teachers in the Journals notified on UGC website during the last five years.

Title of paper	Name of the author/s	Year of Publication	Page No.
2016			**8**
M-Commerce: A Necessity for Future India	Dr. Priyanka Khurana	2016	9-11
Taxonomic Account of Green algae from Alwar (Rajasthan) India, - Oedogonles	Ritu Jain	2016	12-15
Non-Performing Assets Of Public, Private And Foreign Banks In India: A Comparative Study	Vishnu priya temani	2016	16-26
साहित्यिक भाषा का स्वरूप	Dharma Yadav	2016	27-32
Foreign Direct Investment	Dr. Neetu Mathur	2016	33-46
Cadmium induced toxicity in plants: Impact on growth, development and biochemical attributes	Reema Srivastava, A. Anand and P. Mathur	2016	47-58
Driving Forces of Investment Decisions in Mutual Funds	Dr. Priyanka Khurana	2016	59-63
Banking Sector Reforms in India	Damyanti Sodha	2016	64-71
M-Commerce (Mobile Commerce) in India	Dr. Mrinali Kankar	2016	72-79
Impact of GST on the Economic Growth of India	Vishnu priya temani	2016	80-86
A Comparative Study of the Public and PrivateSector Bank with Special Reference to Punjab National Bank and ICICI Bank	Dr. Mrinali Kankar	2016	87-93
Comparing Stress Levels In Female Doctors Of Selected Public And Private Sector Hospitals.	Dr. Surabhi Sharma and Manish Kumar Sharma	2016	94-103
Social networking creating gap in interpersonal communication	Dr.Preeti Agarwal	2016	104-110
Metabolically healthy but obese or metabolically obese but normal weight: Debate on Health	Dr. Richa Chaturvedi & Dr. Nimali Singh	2016	111-116

Title of paper	Name of the author/s	Year of Publication	Page No.
Impact of Social Determinants on cancer patients and their caregivers well being: A study at cancer speciality hospital in Jaipur	Mohita Chaturvedi Sharma	2018	367-374
An assessment of teacher's job satisfaction and its possible effects on student achievements	Pradeep Singh Kachhawa, Anushree Joshi, Anita..	2018	375-382
Challenges to Indian Federalism in Special Reference to Goods and Services Tax	Dr. Palu Joshi	2018	383-388
Morphological evaluation of Trigonella foenum graecum under the influence of colchicine with special reference..	Reema Srivastava, S. Singh, T. Sharma, Bhavya and N.	2018	389-398
युगद्रष्टा कवि कमलाकर 'कमल'	Dr. Sheetabh	2018	399-405
Development of an effective electrochemical platform for highly sensitive DNA detection using MoS2….	Shibsankar Dutta, Ankan, Nidhi Agnihotri,	2018	406-415
Strong lensing and observables around 5D Myers Perry black hole spacetime.	Ravi Shankar Kuniyal*, Hemwati,k, Uma Papnoi†	2018	416-425
Payment Methods and Security of Mobile Commerce	Jayanti Goyal	2018	426
Data Security In The Digital Era: Issues And Challenges	Jayanti Goyal	2018	427
2019			**428**
A new fractional exothermic reactions model having constant heat source in porous media with power, …	Devendra Kumar , Jagdev Singh , Kumud Tanwar,	2019	429-434
Study of mixing behavior of Cu-Sn-Se precursors using annealing process to prepare Cu2SnSe3 thin films	Rekha Prajapat, Y.C. Sharma	2019	435-442
Study of Cu2ZnSnSe4 thin films prepared by E- beam evaporation of solid state reacted compound	Rekha Prajapat, Y.C. Sharma,	2019	443-453
Study of mixing behaviour of Cu, Zn, Sn and Se multilayer structure by annealing	Y.C. Sharma, Rekha Prajapat	2019	454-456
Surface statistical properties of solid state reacted CZTSe compounds prepared in five different ratios	Y.C. Sharma, Rekha Prajapat	2019	457-475
Morphological characterization and microstructural study of Cu2ZnSnSe4 thin films with compositional variation	Rekha Prajapat, Y.C. Sharma,	2019	476-483
Statistical analysis of comparison of services of public and private banks after and before demonetization of 2016	Pragati Natani	2019	484-486
Statistical analysis of conventional banking services comparison between public and private sector banks	Pragati Natani	2019	487-490

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Title of paper	Name of the author/s	Year of Publication	Page No.
An off diagonal feed elliptical patch antenna with ring shaped slot in ground plane for microwave imaging of…	Sumita Shekhawat, P.K. Jain, B.R. Sharma, V.K….	2020	574-577
Thermodynamics from field equations for charged radiating rotating black hole near horizon	Uma Papnoi∗ Sushant G. Ghosh	2020	578-586
मानस का चिकूट प्रसंग : एक विराट सांस्कृतिक बिंब	डॉ.शीताभ शर्मा	2020	587-596
Influence of Light on the Germination of Seeds and Growth of planets: An Experimental Study	Dr. Reema Srivastava	2020	597-601
A Hermaneutical Analysis Reading Kavita Kane's Sita's Sister	Swatti Dhanwni	2020	602-609
Health care system: A changing scenario in Rajasthan	Vijay Laxmi Gupta	2020	610-622
Fertility Lifetables of Glasshouse Whitefly Trialeurodes vaporariorum (Westwood) on French Bean cv. Conte…	Jyoti Kapil* and Manica Tomar	2020	623-627
An ecocritical approach to Henry David Thoreau's Walden	Swatti Dhanwni	2020	628-636
Impact of covid-19 pandemic on buying behaviour of women in Jaipur: A comparative study between onlin…	Akanksha Ganda Bindu Jain	2020	637-653
The Medicinal Significance of Datura stramonium: A Review	Dr. Reema Srivastava	2020	654-657
Applications of nanomaterials in wastewater treatment	Priyanka Jangid, Michel Prabhu Inbaraj	2021	658-662
Digital Payment Adoption in India (A comparative study before & after COVID-19)	Dr Vishnupriya Temani &Shivangi Seth	2021	663-671
Rajasthani Saitya ke Anmol attihasik dharohar : Krishi kahavete	Dr Vishnupriya Temani &Shivangi Seth	2021	672-676
Exploring the Realm of fantasy in E.B. White's Charlo…	Swatti Dhanwni	2021	677-679
Effects of Aerobic Exercise on Lipid Profile of Diab..	Anita Gajraj	2021	680-685
Bioremediation of Petrolium Waste Contaminated So..	Neetika Mathur	2021	686-691
Bioremediation of Petrolium Waste Contaminated S…	Jyoti Kapil	2021	686-691
Some important medicinal plants of Rajasthan, India	Yogita Solanki	2021	692-696
"Floristic Diversity of Umari Dham Sacred Grove …	Yogita Solanki*, Amit Kotiya	2021	697-709
Inflationary universe in bianchi type II spacetime with..	Swati singh	2021	710-714

CRITERIA: III

SUPPORTING DOCUMENT FOR 3.3.2

Year	Total No. of Research Papers published in Journals = 112	Page No.
2016	18	8-144
2017	24	145-291
2018	24	292-427
2019	18	428-529
2020-2021	28	530-714

2016

Institute of
Research
Advances

M-Commerce: A Necessity for Future India

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ABSTRACT

Innovation is the change that unlocks new value. With the increased use of mobile internet and innovative smartphones, the business has transformed from direct selling to mobile selling in India. People now-a-day have become 'mobify'. Use of tablets, smartphones and i-pad has become common for a common man. The next generation e-commerce, m-commerce enables buying and selling of goods and services through wireless handheld devices which not only provides convenience but also speedifies the quality and quantity of transactions. Mutual Funds are the most preferred financial investment in today's scenario. M-commerce will help the Mutual Fund Industry to reach greater heights with advancements in technology. The purpose of this study is to evaluate the current status of mobile commerce in India with special reference to Mutual Funds and to establish m-commerce as a necessity for Future India. The researcher has used analytical approach to undertake this study. A questionnaire was prepared and data was collected regarding the financial preference of investors and also the mobile internet users in India. The study concluded that technology based smarter ways of doing business will be the natural favourites for doing business in Future India. India's growth through financial sector and m-commerce will contribute towards shaping India for a better tomorrow. And by 2020, m-commerce will be the most preferred place for marketers, content creators and advertisers to reach out target audience.

Introduction

Innovation is the change that unlocks new value. With the increased use of mobile internet and innovative smartphones, the business has transformed from direct selling to mobile selling in India. People now-a-day have become 'mobify'. Use of tablets, smartphones and i-pad has become common for a common man. According to a report, India contributed to 7 per cent of the global app downloads, ranking fourth behind Indonesia, China and the US. And, the mobile app download is estimated to grow six-fold by the end of this year to 9 billion apps. The country has been the fastest growing mobile app market in both 2014 and 2013. Investment in mutual funds has grown very fast and has spread to almost every remotest part of the country. Due to the growth of Mutual Fund Industry, they are preferred by investors as an investment. Mutual Funds are a special type of investment vehicle that provide variety of schemes to all type of investors along with the benefit of professional management, diversification and balanced risk as compared to other investment avenues. Now an investor can start his investments from `50. Mobile commerce now-a-days is a smarter way of communicating product information to the customers. It is a smarter way ahead for mapping India's growth. Companies have started using Facebook and WatsApp for marketing and selling purposes. With over 431 million internet capable devices in India, internet access is easy for customers and investors. M- commerce market in India will grow at a CAGR of 71.06 % till 2016. The smartphone users today are 44 million in number which is growing at 150% year over year.

M-commerce: Need of the Hour

M- Commerce means exchanging goods and services over the internet by the use of mobile smart phones. With new technologies, mobile phones have transformed direct selling to online selling and now to mobile selling. The next generation e-commerce viz. m-commerce enables buying and selling of goods and services through wireless handheld devices which not only provides convenience but also speedifies the quality and quantity of transactions. M-commerce services comprises of M-Banking, M-Entertainment, M-Shopping, M-Marketing and M-Information services. The trade is just a minute's job. You have to download the app and almost everything is available easily at your fingertips. Mobile apps are now considered as a significant new avenue to target consumers. This is because of increased use of

Findings & Conclusion

In today's world, investors are showing more trust in Mutual Fund than any other financial product. Indian mutual fund industry has grown at a Compounded Annual Growth Rate (CAGR) of 15 per cent from FY09 to FY14. Today, there are 44 mutual fund companies operating various schemes tailored to meet the diversified needs of savers. The total assets under management crossed `12 trillion in February 2015. The young generation prefers SIP as their most preferred investment option which is provided by Mutual Funds. They do online banking, online shopping, online payments, e-ticketing and many others using the mobile internet. Future India is digital India where people mean fast, internet means 4G and business means online. Mobile commerce is undoubtedly a necessity for Future India.

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Taxonomic Account of Green Algae from Alwar (Rajasthan), India, - Oedogoniales

Ritu Jain

Abstract

Two water bodies namely Siliserh Lake and Jaisamand Lake were selected for the present study. This covered the period from July, 1995 to April, 1998. A total of 23 taxa of Oedogoniales were collected and studied. These include 21 species of *Oedogonium* and two of *Bulbochaete*. All the forms are the first record not only from Alwar but also from the state of Rajasthan.

Keywords: Algae, Oedogoniales, Oedogoniaceae

Introduction

Siliserh Lake and Jaisamand Lake are perennial fresh water bodies and afford luxuriant growth of green algae during rains and winters.

The work on algal floristic of Rajasthan is patchy. However, this part of the state has been thoroughly worked out for blue green algae (Jain, 1998) and green algae (Jain, 2000). From other parts of the state, blue-greens have re-ceived more attention than the greens. Some workers from Gujarat (Kamat 1967, Vaidya and Patel 1968, Anantani and Marathe 1972) reported blue-greens of certain areas of Rajasthan. Contri-butions on blue-green algae from the workers of Rajasthan came from (Goyal 1964, Gupta and Kumar 1968, Gupta 1972, Srivastava and Nigam 1979, Srivastava and Dwivedi 1983, Jain *et al.* 2011, 2012). For green algae, Goyal (1964a) re-ported Oedogoniales from Jodhpur. Yadav and Bhardwaja (1977) reported some greens and blue - greens from Ajmer. Parvateesam. (1991) studied Ana Sagar Lake of Ajmer. Srivastava (2006) re-viewed algal flora of the state. Jain and Srivastava (2008) described Conjugales of Alwar. Green al-gae of Ahmadabad were worked out by Kamat (1962). Kamat (1974) also reported green algae from Marathwada, Maharashtra.

Material and Methods

Algal collection was carried out for about three years. Fortnightly samples were collected and placed in glass bottles. Samples were stud-ied in living as well as preserved state. Samples were preserved in 4% formalin. Camera lucida drawings were drawn. For identification, mono-graph on Oedogoniales by Gonzalves (1973) was referred.

Observations

Following are species which were identi-fied from the order Oedogoniales (Family Oe-dogoniaceae).

Oedogonium americanum Trans.

Gonzalves, 1981, p. 318, fig. 9.197 Plate 1, Figures: 7 a, b, c
Collected from Siliserh in April

The filaments were macrandrous, hetero-thallic, while vegetative cells were cylindric. Those of female filaments were 30 μm broad and 56-73 μm long and of male filaments 26 μm broad and 60-73 μm long and terminal cells were obtuse with short spine. The oogonium was sin-gle, globose or depressed globose, 50-60 μm in breath and 56-70 μm in length, poriferous, pore superior, oospore globose, spore wall three lay-ered. The antheridium was single or in twos, which was 7.50 μm long and 2.5 μm wide. The plane of division was horizontal.

Oedogonium brunelii Gonz. and Jain

Gonzalves, 1981, p. 560, fig. 9.498 Plate 2, Figure: 2
Collected from Siliserh in November

The filaments were macrandrous, homo-thallic; while vegetative cells were cylindric, 4-5 μm in diameter, 22-35 μm long but basal cell was elongate. It was 4-6 μm in diameter and 18-20 μm long. The oogonium was single, oblong, 17-20 μm in diameter and 23-28 μm long, porifer-ous, pore superior, oospore globose, 16-18 μm in diameter, 16-23 μm in length. The antheridia, were single or in twos, 4 μm in diameter and 6 μm in length.

Oedogonium capilliforme var. *capilliforme* (Kuetz., Wittr.) Hirn.

Gonzalves, 1981, p. 258, fig. 9.140D Plate 1, Figures: 9 a, b, c
Collected from Siliserh in December

The macrandrous filaments were hetero-

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Plate 1 (Figs. 1-9). 1 *Oedogonium globosum* var. *globosum* (Nordst.) Hirn, 2. a, b, c *O. petri* var. *robusta* Gauth. Live., 3. a, b, *O. multisporum* var. *multisporum* (Wood) Hirn, 4. a, b *O. mitratum* (Him.) 5. *O. irregular* (Wittr) .Him, 6 a, b *O. rivulae* [(Le CL.) AL Br.] Hirn., 7a, b, c *O. americanum* Trans., 8. a, b *O. imahoril* Kam., 9. a, b, c *O. capilliforme* var. *capilliforme* (Kuetz, Wittr.) Hirn.
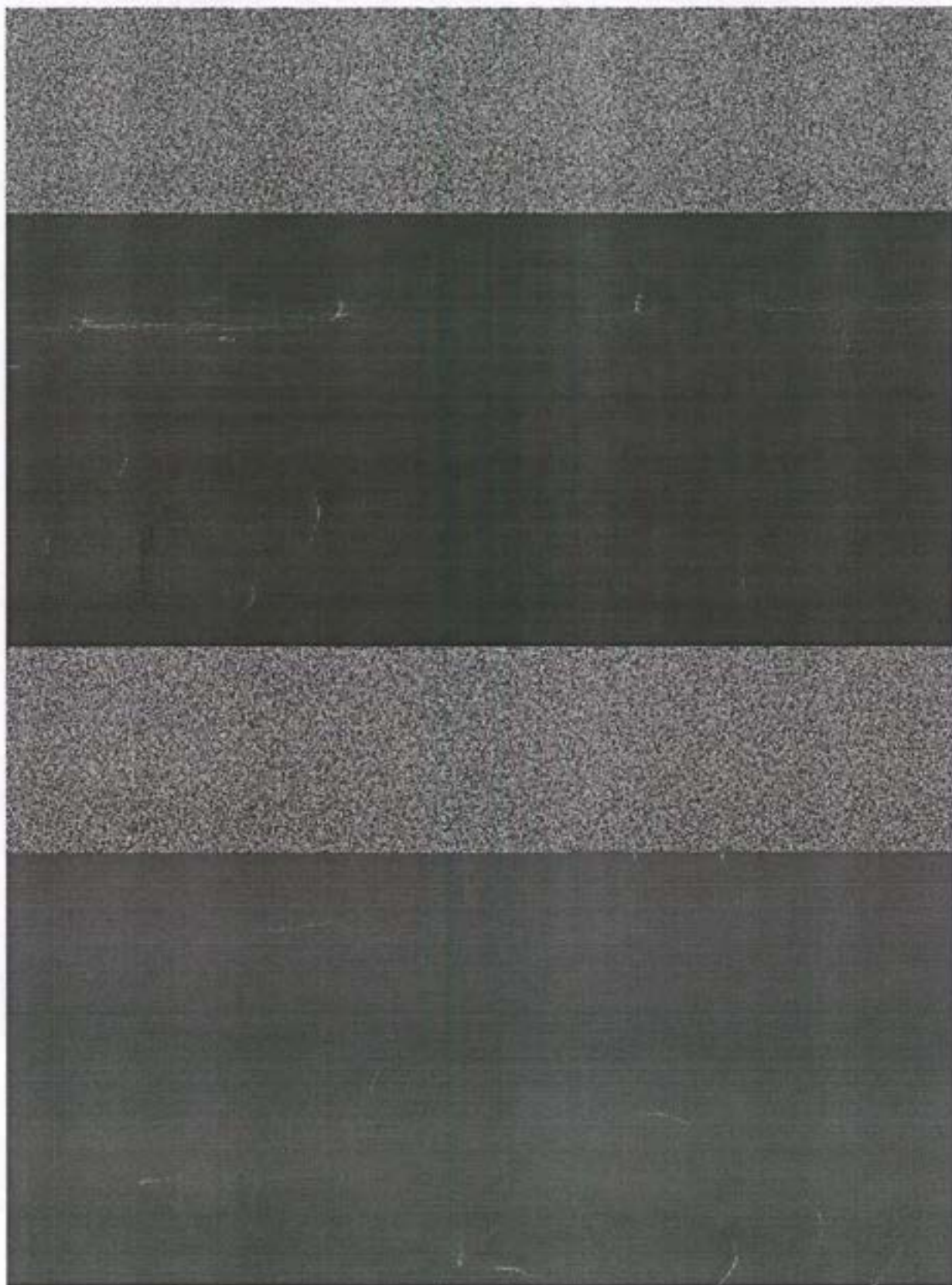
(anth: antheridia, nan: nannandria, o: oogoniz, o.s: oospore)

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Plate 3. (Figs 1-2). 1. a, b, c *Bulbochaete dioca* Gauth-Live 2. a, b *B. nana* var. *nana* Wittr.
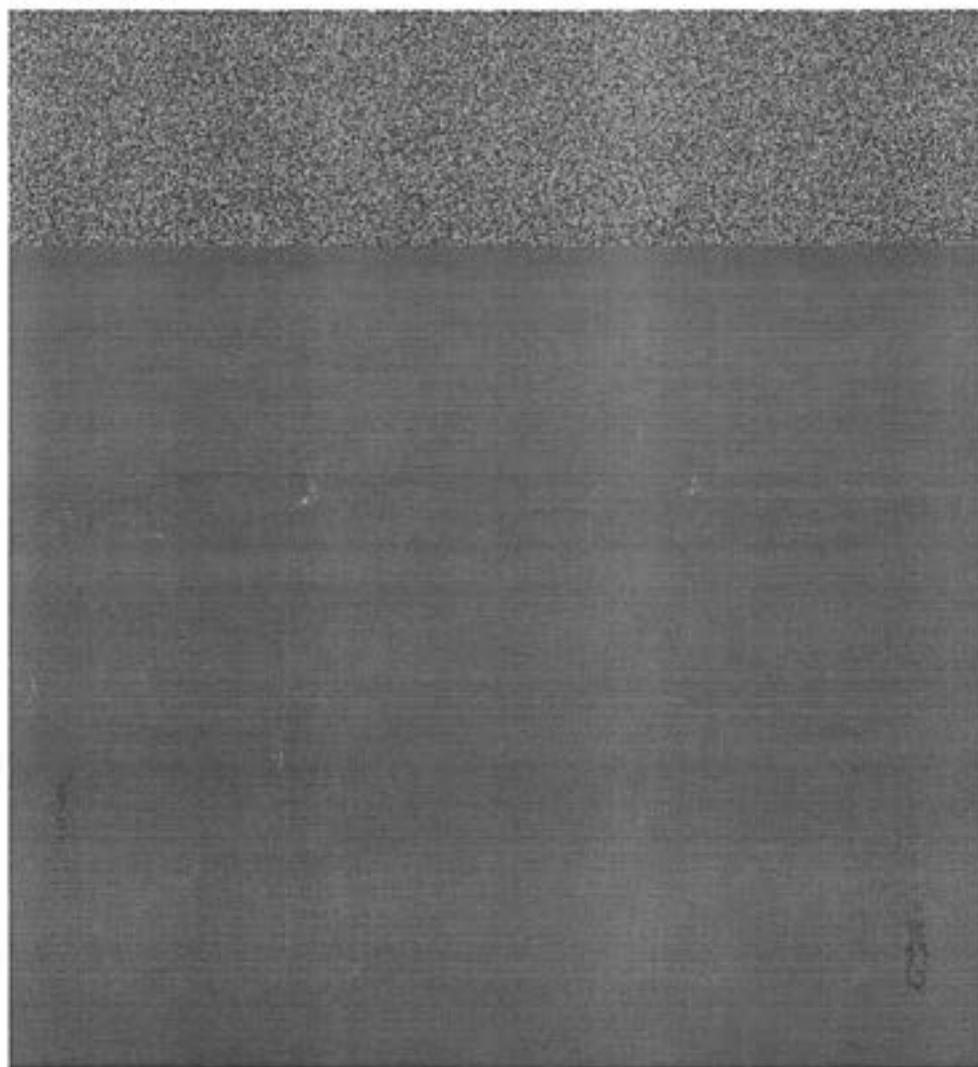
ments were 11-15 µm in diameter and those of male filaments were 11 µm broad and 38-41 µm long. The oogonia were single or in twos, porous, pore nearly superior, 33 µm broad and 41 µm long. The oospore was 28-31 µm in diameter. The oospore wall was smooth and antheridia were 3-5, 7.50-10 µm broad and 11 µm long.

Oedogonium mitratum var. mitratum (Hirn.) Hirn.

Gonzalves, 1981, p. 248, fig. 9.129A Plate 1, Figures: 4 a, b
Collected from Jaisamand in February

The macrandrous filaments were heterothallic with vegetative cells 11-55 µm and oogonia 22 µm broad and 30 µm long, globose or sub globose, operculate, division was supra median, oospore globose; antheridia single, upto 5-5.5 µm in diameter while division was horizontal.

Oedogonium multisporum var. multisporum Wood

Gonzalves, 1981, p. 408, fig. 9.302A Plate 1, Figures: 3 a, b
Collected from Siliserh in November

Nannandrous filaments were gynandrosporous. The vegetative cells were cylindric or slightly capitellate, 9-11 µm broad and 30 µm long. The oogonia were single or two, 26-30 µm, poriferous, pore superior, and oospore was 21-27 µm; dwarf males were 7 µm in diameter.

Oedogonium petri var. robusta Gauth. Liev

Gonzalves, 1981, p. 226, fig. 9.99B
Plate 1, Figures: 2 a, b, c Collected from Siliserh in February

Macrandrous filaments were homothallic. The vegetative cells were 10-11 µm broad and 45 -49 µm long. The oogonia were 37 µm broad and 37 µm long, globose, operculate, pore supra median. The oospore was 30 µm broad and 30 µm long. The wall was thick, smooth while antheridia were two, 6 µm broad and 11 µm long.

Oedogonium prescotti f. dispar Gonz. & Jain

Gonzalves, 1981, p. 300, fig. 9.180B Plate 2, Figure: 6
Collected from Jaisamand in December

Macrandrous filaments were heterothallic. The vegetative cells were 14-16 µm in diame-

Results and Discussion

Jain (2000) studied green algae of Alwar. This revealed the presence of 97 species spread over seven orders, nineteen families and thirty genera. 21 species of *Oedogonium* and two of *Bulbochaete* are being described here. All the species are the first report not only from this part but also from the state of Rajasthan. Of the 21 species of *Oedogonium*, fourteen were recorded from Siliserh and seven from Jaisamand Lake. Both the species of *Bulbochaete* were from Jaisamand Lake. Goyal recorded 20 species of *Oedogonium* and two of *Bulbochaete* from Jodhpur. Kamat (1967) reported five species of *Oedogonium* from Mount Abu. Yadav and Bhardwaja (1977) reported eight species of *Oedogonium* and one of *Bulbochaete* from Ajmer. From Ajmer itself Parvateesam *et al.* (1991) reported two species of *Oedogonium*.

A total of 34 species of *Oedogonium* and three of *Bulbochaete* have been reported from different parts of the state but none is common to those of Alwar. *Oedogonium*, the only species was recorded from Jodhpur as well as Mount Abu. Kamat (1962) reported 26 members of Oedogoniales from Ahmadabad. This included 24 species of *Oedogonium* and one each of *Bulbochaete* and *Oedocladium*. All these members are not shared by Alwar. *Oedogonium varians* has been recorded both from Ahmadabad and Jodh-pur. Kamat (1974) recorded Chlorophyceae of Marathwada, Maharashtra. It included seven species of *Oedogonium*. None of these has been found in Rajasthan. From Alwar only Cyanophyceae and Chlorophyceae have received attention but there is a need to explore other groups of algae also. This may reveal the presence of several new interesting forms.

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CONTENTS

NON PERFORMING ASSETS OF PUBLIC, PRIVATE AND FOREIGN BANKS IN INDIA: A COMPARATIVE STUDY

Dr. Vishnu PriyaTemani[*]

Abstract

Post reform era has changed the whole structure of banking sector of India. The emerging competition has resulted in new challenges for the Indian banks. Hence, parameters for evaluating the performance of banks have also changed. This paper considers the aggregate data of Public Sector, Private Sector and Foreign Banks and attempts to compare analyze and interpret the NPA management from the year 2010-11 to 2014-15. On the conceptual side, it gives an overview of NPA, Types of NPA, causes and on the calculation side, it covers Gross NPA to Gross Advances ratio, use of Least square method for estimating Gross NPAs in the year 2017-18, and also application of ANOVA test to judge the presence of any significant difference between ratio of Gross NPAs to Gross Advances. The findings reveals the percentage of Gross NPAs to Gross advances is increasing for public banks, ratio of Loss Advances to Gross Advances are higher in Foreign Banks, the Estimated Gross NPAs for 2017-18 is also more in public banks as compared to private and Foreign Banks and from the ANOVA test, it is concluded Ratio of Gross NPAs to Gross Advances for Public Sector, Private Sector and Foreign Banks does not have significant difference between 2010-11 to 2014-15.

Keywords: Gross NPAs, Public Banks, Private Banks, Foreign Banks Gross Advances.

Introduction

The incidence of non-performing assets (NPAs) is affecting the performance of the credit institutions both financially and psychologically. Non-performing asset (NPA) is not only non-performing but also makes the banker and the bank non-performing as it:

- Prevents or delays recycling of funds.
- denies income from the asset by way of interest
- Erodes profit by way of provisions.

NPA is a disorder resulting in non-performance of a portion of loan portfolio leading to no recovery or less recovery / income to the lender. NPAs represent the quantified "Credit Risk". It also plays havoc on the mental make-up of the banker where in the banker tries to go slow on lending, fearing future NPAs, it may lead to delay and denial of credit resulting in low off- take of lendable funds. NPAs are an inevitable burden on the banking industry. Hence, the success of a bank depends upon the methods of managing NPAs and keeping them within tolerance level.

Review of Literature

Nonperforming assets are an unavoidable burden for each banking industry. The success of banks depends upon methods of managing NPAs and keeping them within tolerance level. Hence, to change the curve of NPAs, there is only one technique that an effective monitoring and control policy should be planned and executed which is aided by proper legal reforms. The problem of NPAs has been studied over the years to bring insight into the problem of NPAs, its cause and solution. Main focus of the study is NPA incidence and its management in India (Kumar R., 2000; The Price water house Coopers Limited 2002 and Pradeep, 2007).

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In the Indian context, the lending policy and credit policy have crucial influence on non-performing loans (Reddy, 2002 and Karunakar et al., 2008). Confederation of Indian Industry, 1999, refers the changing perspective about non-performing assets for the betterment of Indian financial system. Some studies observed that the problem of NPAs is related to several internal and external factors, which affected the performance of the banks. Khedekar Pooja S. (2012) A strong banking sector is essential for a flourishing economy. The level of NP is act as an indicator showing the credit risks and efficiency of allocation of resources. This not only affects the banks but also the economy as a whole. This paper deals with understanding the concept of NPA, the causes and overview of different sectors in India.

Objectives of the Paper

- To study the concept, types, causes of Non Performing Assets (NPA) in Banks.
- To analyze and interpret Gross NPA to Gross Advances ratio for aggregates of Public Sector, Private Sector and Foreign Banks in India from Financial year 2010-11 to 2014-15.
- To use Least Square method for projecting the amount of NPA in the year 2017-18 for Public Sector, Private Sector and Foreign Banks in India and interpret the same.
- To test that is there any significant differences between ratio of Gross NPA to Gross Advances for aggregates of Public Sector, Private Sector and Foreign Banks in India from Financial year 2010-11 to 2014-15.

Hypothesis

Our Null Hypothesis (H_{01}) is the Ratio of Gross NPA to Gross Advances for Public Sector, Private Sector and Foreign Banks does not differ significantly under study.

Research Methodology

The Analysis in the paper is done on the total i.e. aggregate data starting from 2010-11 to 2014-15 for making comparison between Public Sector Banks and Private Sector Banks and Foreign Banks on the overall basis. This helped us to derive the findings and conclusion-sector wise. Banking industry is taken for the study, where aggregate data related to NPA for Public Sector Banks, Private Sector Banks and Foreign Banks is used. Descriptive research design is used for the study. Data used in the paper is secondary, which is compiled from Reserve Bank of India (RBI) website, and from review of Literature.

Conceptual Frame Work of NPAs

Banking business is mainly that of borrowing from the public and lending it to the needy persons and business at a premium. Lending of money involves a credit risk. When the loans and advances made by banks or financial institutions turn out as non - productive, non-rewarding and non – remunerative, they become Non Performing Assets (NPA). According to SARFAESI 2002, NPA is an asset or account of a borrower, which is classified by a bank or financial institution as sub-standard asset, doubtful asset and loss asset. The definition of an NPA as given by RBI and its various categories is as under:

An asset, including a leased asset, becomes non-performing when it ceases to generate income for the bank. A non performing asset (NPA) is a loan or an advance where;

- Interest and / or installment of principal remain overdue for a period of more than 90 days in respect of a term loan,
- The account remains 'out of order' in respect of an Overdraft / Cash Credit (OD/CC),
- The bill remains overdue for a period of more than 90 days in the case of bills purchased and discounted,
- The installment of principal or interest thereon remains overdue for two crop seasons for short duration crops,
- The installment of principal or interest thereon remains overdue for one crop season for long duration crops,
- The amount of liquidity facility remains outstanding for more than 90 days, in respect of a securitization transaction,
- In respect of derivative transactions, the overdue receivables representing positive mark-to-market value of a derivative contract, if these remain unpaid for a period of 90 days from the specified due date for payment.

Banks should, classify an account as NPA only if the interest due and charged during any quarter is not serviced fully within 90 days from the end of the quarter.

Categories of NPAs

Banks are required to classify non-performing assets further into the following three categories based on the period for which the asset has remained non-performing and the reliability of the dues.

* **Substandard Assets:** A substandard asset would be one, which has remained NPA for a period less than or equal to 12 months. In such cases, the current net worth of the borrower / guarantee or the current market value of the security charged is not enough to ensure recovery of the dues to the bank in full. In other words, such an asset will have well defined credit weaknesses that jeopardize the liquidation of the debt and are characterized by the distinct possibility that the banks will sustain some loss, if deficiencies are not corrected.

* **Doubtful Assets:** An asset would be classified as doubtful if it has remained in the substandard category for a period of 12 months. A loan classified as doubtful has all the weaknesses inherent in assets that were classified as substandard, with the added characteristic that the weaknesses make collection or liquidation in full, on the basis of currently known facts, conditions and values - highly questionable and improbable.

* **Loss Assets:** A loss asset is one where loss has been identified by the bank or internal or external auditors or the RBI inspection but the amount has not been written off wholly. In other words, such an asset is considered uncollectible and of such little value that its continuance as a bankable asset is not warranted although there may be some salvage or recovery value.

Factors Contributing to NPAs

* Diversification of funds for expansion/ modernization, undertaking of new projects and for helping associate concerns. This is coupled with recessionary trends and failure to tap required funds in the capital and debt market.
* Business (Product, marketing, financial) failure, inefficient management, strained labor relation, inappropriate technology, outmoded machinery, technical problems and product obsolescence.
* Recession, input and power shortage, price escalation, accidents, natural calamities, economic problems in other countries leading to non-payment of over dues.
* Time and cost overrun during project implementation stage.
* Government policies like changes in excise duties, pollution control, poor credit decisions in priority sector lending and outdated legal systems
* Willful default, siphoning off funds, fraud and misappropriation by promoters and owners dispute.
* Deficiencies on the part of banks like delay in release of funds and delay in release of subsidy by government.
* Delay in finalization of rehabilitation package.
* Absence of portfolio concentration limits, poor industry analysis, cursory financial analysis of borrowers.
* Excessive reliance on collateral, absence of follow-up action by banks, poor control on loan documentation.

Impact of NPAs on Banking Operations

The efficiency of a bank is not reflected only by the size of its balance sheet but also by the level of return on its assets. The NPAs do not generate interest income for banks. At the same time, banks are required to provide provisions for NPAs from their current profits. The NPAs have deleterious impact on the return on assets in the following ways:

* The interest income of banks will fall and it is to be accounted only on receipt basis.
* Banks profitability is affected adversely because of the providing of doubtful debts and consequent to writing it off as bad debts.
* Return on investments (ROI) is reduced.
* The capital adequacy ratio is disturbed as NPAs enter into its calculation.
* The cost of capital will go up.
* Asset and liability mismatch will widen.
* It limits recycling of the funds.

Analysis and Interpretation of NPAs Under Study

We are analyzing and interpreting Gross NPA to Gross Advances ratio of Public Sector, Private Sector and Foreign Banks in India from Financial Year 2010-11 to 2014-15. The Ratio of Gross NPAs to Gross Advances for Public Sector banks is increasing and decreasing ratio of Private Sector Banks, while the phenomenal decrease in ratio is observed for Foreign Banks too, it can be seen the ratio in Private Sector banks for 2014 and 2015 as compared to other banks is less, showing the efforts taken by Private Banks.

Table 1
Total Gross NPAs to Total Gross Advances as on 31st March

(₹ In Billions)

Bank Name	Financial Year	Gross NPAs	Total Gross Advances	Percentage of NPAs
Public Sector Banks	2011	550.4	26232.91	2.1
	2012	716.16	31405.49	2.28
	2013	888.5	38249.41	2.32
	2014	1406.11	44379.86	3.17
	2015	1948.60	50698.42	3.84
Private Sector Banks	2011	211.12	6500.96	3.25
	2012	216.25	7313.87	2.97
	2013	224.68	9161.91	2.45
	2014	229.01	11015.2	2.08
	2015	249.09	13083.31	1.91
Foreign Banks	2011	91.17	2121.42	4.3
	2012	89.1	2092.51	4.26
	2013	63.31	2491.51	2.54
	2014	78.65	2934.15	2.68
	2015	99.65	3357.65	2.97

Source: Compiled & Computed From Annual Reports For Respective Financial Yeas 2010-11 To 2014-15.

Least Square Method

We are using Least square method for estimating Gross NPA in the year 2017-18 for Public Sector, Private Sector and Foreign Banks

Table 2
Predicting Gross NAPs for 2017-18 (Public Sector Banks)

(₹ in Billion)

Financial Year	Gross NPAs(Y)	X (Year - 2013)	XY	X2
2011	550.4	-2	-1108.8	4
2012	716.16	-1	-716.16	1
2013	888.5	0	0	0
2014	1406.1	1	1406.1	1
2015	1948.62	2	3897.24	4
	5510.22		.3486.38	10

n= 5

Straight line Equation

$y = a + b x$

$b = \Sigma XY / \Sigma X2 = 348.638$

$a = \Sigma y / n = 1102.044$

$y = a + b x$

$y = 1102.44 + 348.638 x$

$y \ 2017\text{-}18 = 1102.44 + 348.638 (5)$

$y \ 2017\text{-}18 = ₹ 2845.63 \ Billion$

Interpretation

From the use of least square method of Gross NPAs for Public Sector Banks will rise by ₹ 2845.63Billion for the year 2017-18, which was ₹ 1948.62 Billion for the financial year 2015.

Table 3
Predicting Gross NPAs for 2017-18 (Private Sector Banks)

(₹ in Billion)

Financial Year	Gross NPAs(Y)	X (Year - 2013)	XY	X2
2011	211.12	-2	-422.24	4
2012	216.25	-1	-216.25	1
2013	224.68	0	0	0
2014	229.01	1	229.01	1
2015	249.9	2	499.8	4
	1139.96		160.32	10

n= 5

Straight line Equation

$y = a + b x$

$b = \Sigma XY / \Sigma X2 = 16.032$

$a = \Sigma y / n = 227.99$

$y = a + b x$

$y = 227.99 + 16.03 x$

$y\ 2017\text{-}18 = 227.99 + 16.03(5)$

$y\ 2017\text{-}18 = ₹\ 308.14$ Billion

Interpretation

From the use of least square method of Gross NPAs for Private Sector Banks will rise by ₹ 308.14 Billion for the year 2017-18, which was ₹ 249.9 Billion for the year 2014-15.

Table 4
Predicting Gross NPAs for 2017-18 (Foreign Banks)

(₹ in Billion)

Financial year	Gross NPAs (Y)	X (Year - 2013)	XY	X2
2011	91.97	-2	-182.34	4
2012	89.1	-1	-59.1	1
2013	63.31	0	0	0
2014	78.25	1	78.25	1
2015	99.65	2	119.3	4
	421.48		6.11	10

n= 5

Straight line Equation

$y = a + b x$

$b = \Sigma XY / \Sigma X2 = 0.611$

$a = \Sigma y / n = 84.296$

$y = a + b x$

$y = 84.296 + 0.611 x$

$y\ 2017\text{-}18 = 84.296 + 0.61(5)$

$y\ 2017\text{-}18 = ₹\ 87.346$ Billion

Interoperation

From the use of least square method of Gross NPA for Foreign Sector Banks will rise by ₹87.346 Billion for the year 2017-18, which was ₹ 99.65 Billion for the year 2014-15.

Analysis of Variance (ANOVA)

We are concluding our null hypothesis by ANOVA test

Table 5
Ratio of Total Gross NPAs to Total Gross

Years	Public Sector Bank	Private Sector Bank	Foreign Sector Bank
2011	2.1	3.25	4.3
2012	2.28	2.97	4.26

	2.32		2.45		
	3.17		2.08		2.54
	3.84		1.91		2.68
					2.97

Table 6
ANOVA for Ratio of Gross NAP to Gross Advances

	Sum of Squares	df	Mean Square	F	F Critical Value (5% Level)
Between Groups	1.805	2	0.902		
Within Groups	6.478	12	0.540	1.672	2.29
Total	8.283	14			

Interpretation

It is evident from the table 6 that the calculated value of F (1.672) is less than the F Critical Value at 5% level (2.29). Hence, the null hypothesis is accepted. Therefore, it is concluded that Ratio of Gross NPAs to Gross Advances for Public Sector, Private Sector and Foreign Banks does not have significant difference between the year 2010-11 to 2014-15.

Findings

- The Ratio of Gross NPAs to Gross Advances is decreasing for Private Sector Banks, which was 3.25 in 2010-11, and has decreased to 1.91 and it is in better situation than Foreign Banks and Public Banks.

- From the least Square Method, the estimated NPA for the year 2017-18 is ₹2845.63 Billion for Public Sector Banks for Private Sector Banks it may rise by ₹308.14 Billion for the year 2017-18 and in case of Foreign Banks it may rise by ₹87.346 Billion for the year 2017-18. The Highest NPAs is predicted for Public Sector Banks in the year 2017-18.

- From ANOVA test it is found, Ratio of Gross NPA to Gross Advances for Public Sector, Private Sector and Foreign Banks does not have significant difference from 2010-11 to 2014-15 and it does not reject our null hypothesis.

Recommendations

- Arresting slippage of accounts through relentless monitoring and focus on the continuous viability of the borrowing concern with improved asset classification is must. At the same time all accounts in the Standard category should not be taken for granted and should be subjected to periodical and in-depth review in a systematic manner through a sound adequate loan review mechanism in place.

- Categorization of standard accounts into A, B, C based on actual recovery of interest and installments due, will help a focused and strengthened monitoring.

- Banks should ensure that they should move with speed and charged with momentum in disposing off the loss assets. This is because as uncertainty increases with the passage of time, there is all possibility that the recoverable value of asset also reduces and it cannot fetch good price. If faced with such a situation than the very purpose of getting protection under the Securitization Act, 2002 would be defeated and the hope of seeing a must have growing banking sector can easily vanish.

- Bank should adhere to "Know Your Customer" norms for identification of borrower, guarantor and verification of their addresses to minimize the risk of default in case of housing sector lending. In respect of agricultural advances, recovery camp should be organized during the harvest season.

- Ongoing monitoring of bank's borrowers is important to understand the primary cause of corporate decline and to be able to identify the symptoms of a potential distress situation. Loan Officers and staff should be alert and diligent for signs of borrower distress. It is essential to identify signs of distress which diminish the Borrowers capacity to repay debt. Early recognition followed by appropriate action is essential if the bank is to minimize NPAs.

- Loan Workout Unit should be created which should be exclusively responsible for managing the performing and under performing loans to maximize the recovery value from a portfolio distressed loans, through the employment of an equitable and professional workout process.

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विशेषांक हिन्दी दिवस

भाषा परिचय

14 सितम्बर, 2016

अनुक्रम

साहित्यिक भाषा का स्वरूप

- डॉ. धर्मा यादव

भाषा मनुष्य के भाव और विचारों की अभिव्यक्ति का सशक्त माध्यम है। सामान्य जीवन में वक्ता सहज, बोधगम्य भाषा का प्रयोग करता है। जिसकी एक सीमा होती है। आनन्दवर्धन के अनुसार, 'सामान्य व्यवहार की भाषा केवल ज्ञान का, जानकारी का माध्यम है और अर्थ बोध हो जाने पर, उसका कोई उपयोग नहीं रहता, किन्तु साहित्य में भाषा की महत्वपूर्ण भूमिका है। यहाँ भाषा का प्रयोग भिन्न स्तर पर होता है। सामान्य भाषा में प्रयुक्त 'चन्द्रमा' व 'पानी' जैसे शब्द साहित्य में परिस्थिति व व्यक्ति विशेष के साथ अलग अर्थ को व्यंजित करते हैं।

साहित्य में भाषा की महत्ता के विश्लेषण के लिए किसी भी साहित्यिक कृति को दो स्तर पर बांट सकते हैं, पहला विद्यात्मक अथवा साहित्यिक स्तर, दूसरा भाषिक स्तर। साहित्यिक स्तर पर कथा वस्तु और उसके ऐतिहासिक, पौराणिक व सामाजिक संदर्भ को देखा जा सकता है। भाषिक स्तर पर रचना अपने कथानक को अभिव्यक्त करने का माध्यम भाषा को ही बनाती है। रचनाकार की अनुभूति, दृष्टिकोण और बौद्धिक चेतना, वस्तु और शिल्प दोनों स्तर पर भाषा द्वारा ही रचना में समाहित होते हैं। भाषा के विभिन्न उपादानों के सहारे रचनाकार अपनी कलात्मकता व अभिव्यक्ति कौशल का परिचय देता है।

साहित्य में भाषा का स्वरूप :

आधुनिक युग में यथार्थवादी अवधारणा और जनसंचार के व्यापक प्रभाव ने भाषा को बहुत प्रभावित किया है। आधुनिक भाषिक चेतना के आधार पर साहित्य की भाषा का विश्लेषण किया जाना आवश्यक है। रचनाकार युगीन संदर्भों और सामाजिक मूल्यों को दृष्टिगत रख, भाषा के साथ नये-नये प्रयोग कर रहा है। आज कवि भाषा की सीमा से अवगत होकर, आधुनिक जीवन की जटिलता की अभिव्यक्ति के लिए उसे अपर्याप्त मानता है। इसलिए भाषा में नये प्रयोग के साथ सम्भावित स्रोतों का प्रयोग भी रचनाओं में होने लगा है।

सामान्य भाषा व अन्य साहित्यिक विधाओं की भाषा :

सामान्य भाषा की अवधारणा को स्पष्ट करते हुए स्नेटनी फिश का कथन है 'यहाँ कुर्सी हैं'' यह उक्ति (लिखित या मौखिक) दोनों रूपों में तुरन्त बोधगम्य है।

सामान्य भाषा की यही विशेषता है सभी इसका निर्माण भी कर सकते हैं और अर्थ भी सरलता से स्पष्ट हो जाता है। यह ऐसी भाषा होती है जो हमें वस्तुस्थिति का बोध सहजता से करवाती है।

कविता की भाषा :

सामान्य भाषा में बोला गया वाक्य या कथन, भाव व विचार के सम्प्रेषण का कार्य प्रमुख रूप से करता है। वाक्य में प्रयुक्त वर्ण, शब्द, उपवाक्य का यहाँ स्वतन्त्र अस्तित्व नहीं होता किन्तु कविता की भाषा में प्रत्येक वर्ण, शब्द, उपवाक्य अलग अस्तित्व रखते हैं। संस्कृत साहित्य शास्त्र में 'वाक्यं रसात्मकं' कहा गया है। यह विशेषता कविता की भाषा में दिखाई देती है। साहित्यिक विधाओं में कविता अपनी भाषिक संरचना के कारण ही विशिष्ट है। अपनी कलात्मकता, वर्णों व शब्दों के आकर्षण, भाव गाम्भीर्य के कारण कविता की भाषा सामान्य भाषा से अलग है।

कविता के लिए कवि शिल्पगत विशेषता को ध्यान में रखकर ऐसे शब्दों का चयन करता है जो लय विधान से युक्त हो। शब्दों को आसपास बैठाने की अदा, शब्दों की रगड़, टकराहट आदि बातें कविता की भाषा के संबंध में कही गई हैं, जो ऐसे शब्दों की ओर संकेत करती हैं जिनकी टकराहट नये अर्थ व्यंजित करने में सक्षम हो। पदों का संयोजन और वाक्य विन्यास कविता की भाषा को विशेष बनाता है। यह भाषा मूलतः अभिव्यक्ति प्रधान है अर्थात् कविता में भाषा के माध्यम से कवि अपनी भावनाओं को सशक्त रूप से अभिव्यक्त करता है और 'भावाभिव्यक्ति' ही मुख्य उद्देश्य रहती है।

गद्य की भाषा :

कहानी, उपन्यास मुख्यतः वर्णन प्रधान है। इनकी भाषा किस्सागोई की भाषा होती है। कहानी का स्वरूप कथन पद्धति का है, जहाँ कहने सुनने की प्रक्रिया को दृष्टिगत रखा जाता है। इसमें रचनाकार सामान्य बोलचाल की भाषा में ही कहानी कहता है। इसलिए इसकी भाषा सहज व सरल होती है।

कहानी कहने-सुनने की विधा है अतः क्रिया-प्रतिक्रिया, संघर्ष, तनाव, संकेत भी साथ-साथ चलते हैं इसलिए कथावस्तु की रोचकता व सम्प्रेषणीयता कहानी की भाषा में आवश्यक है।

उपन्यास में चरित्र और स्थिति तथा समग्र जीवन का विस्तृत वर्णन होता है। उपन्यासकार उस परिवेश के चित्र, द्वंद्व, तनाव, घटनाक्रम व परिवेश को तद्नुरूप भाषा से ही अभिव्यक्त करता है।

आधुनिक उपन्यास लेखन में स्थानीयता व आंचलिकता के प्रयोग ने उपन्यास की भाषा को नयापन दिया है। ये अपनी कथावस्तु, विभिन्न चरित्रों, भावों के नये प्रयोगों, ध्वनियों और भंगिमाओं के कारण प्रभावित करते हैं। उपन्यास कला और आनंद का मिश्रित रूप है जो भाषा की बनावट से पैदा होता है।

नाटक की भाषा/नाट्य भाषा :

वस्तुतः नाटक भाषा से बनता भी है और भाषा को बनाता भी है। जहाँ भाषा नाटक को बनाती है वह नाटक की भाषा है जहाँ नाटक भाषा को बनाता है वह नाट्य भाषा के रूप में जानी जा सकती है। अंग्रेजी का 'Drama' शब्द 'नाटक' को और 'Play' 'नाट्य' को इंगित करता है।

नाटक की भाषा से अभिप्राय साहित्यिक विधा के रूप में नाटक में प्रयुक्त भाषिक विधा से है जो नाटक की कथावस्तु के संयोजन तथा प्राक्कथन में, माध्यम के रूप में नाटककार द्वारा प्रयुक्त होती है। नाटक की भाषा के सम्बन्ध में अलग-अलग अवधारणाएँ हैं :

भरतमुनि ने नाटक की भाषा को परिभाषित करते हुए कहा है - 'मृदुललितं पदाढ्यं गूढशब्दार्थहीनम् जनपद सुखबोध्यम् युक्तिमन्नृत्योज्यम्' अर्थात् नाटक की भाषा मृदुलित पदाढ्य, गूढ़ शब्दार्थ और जनपद सुख

बोध्य होनी चाहिए। भरत ने नाटक को शरीर माना है क्योंकि नाटक की भाषा ही नाटक के अन्य सभी अंगों के अर्थ को व्यंजित करती है। नाट्य भाषा समस्त रंगीय उद्भावनाओं को अपने में आत्मसात किए होती है और सारी क्रियाएँ, चेष्टाएँ तथा रंगीय भाषेतर माध्यम उसी से उद्भूत होते हैं। अर्थात् नाटक की भाषा में अपार मंचीय संभावनाएँ होती हैं। मुद्राराक्षस ने भी कहा है कि नाटक की भाषा काफी हाशिया छोड़ देती है। वह सम्पूर्ण उद्दिष्ट अर्थ सीधे-सीधे पाठक-दर्शक तक नहीं पहुँचाती।

एक सामान्य वाक्य भी सूक्ष्म भाव मुद्राओं और विशिष्ट कथन शैली से विशेष बन जाता है और हर अभिनेता उसमें नये अर्थ की सृष्टि कर सकता है। इसलिए नाटक की भाषा अन्य साहित्यिक (विधागत) भाषा से भिन्न स्तर की होती है।

साहित्यिक भाषा को नाटक के अनुरूप ढालने, उसे रंगमंच के निकट लाने में मोहन राकेश ने महत्त्वपूर्ण भूमिका निभाई।

साहित्यिक विधा के रूप में गद्य में संवादात्मक रूप में लिखित रचना की भाषा नाटक की भाषा है और इसी भाषा के साथ, नाटक की प्रस्तुति से जुड़े सभी उपकरण व सहायक घटक जुड़ जाते हैं तो वह नाट्य भाषा व रंगभाषा में बदल जाती है। रंगभाषा व नाट्य भाषा की विशेष पहचान ही नाटक की भाषा को कहानी, उपन्यास व कविता की भाषा से अलग करती है। हालांकि नाट्येत्तर विधाओं के मंचन ने आधुनिक रंगमंच को नई संभावनाएँ दी हैं किन्तु इसके बावजूद ये विधाएँ अपने मूल रूप में नाटक का स्थान नहीं ले सकती, क्योंकि इन्हें दृश्य रूप में प्रस्तुत तो किया जा सकता है लेकिन पढ़े जाने में इनसे कथानुभव ही होता है नाट्यानुभव नहीं। नाटक में निहित नाट्य भाषा के तत्त्व अपनी रंगमंचीय प्रस्तुति में ही नहीं अपितु पढ़े जाने में भी नाट्यानुभव देते हैं।

अन्य साहित्यिक विधाएँ अपने लिखित रूप में सम्पूर्ण होती है किन्तु नाटक का लिखित रूप एक कच्चे माल की तरह होता है। विभिन्न संकेत, लय, अर्थविशिष्टताएँ, लिखे गये और बोले गये शब्दों से भी ज्यादा अनलिखे और अनबोले अनुपस्थित शब्दों, अर्थच्छायाओं व अर्थध्वनियों की संभावना जिस नाटक में जितनी होगी वह उतना ही अच्छा नाटक माना जायेगा।

नाटक की कथावस्तु एवं शिल्पगत विशेषताएँ सफल मंचन की संभावना युक्त होती है। पात्रों, चरित्रों का संगठन, अंक, खण्ड व दृश्यों में विभाजन, कोष्ठक में मंच-निर्देश, कहीं संगीत, कहीं अंधकार व प्रकाश का संकेत, यवनिका उठाने-गिराने के निर्देश, पात्रों का प्रवेश-प्रस्थान, वेशभूषा आदि अच्छे नाटक के सूचक हैं। ये सभी विशेषताएँ लिखित नाटक में प्रत्यक्ष अप्रत्यक्ष रूप में विद्यमान रहती है। इसके बाद भी नाटक कभी अपने अंतिम रूप तक नहीं पहुँचता क्योंकि हर प्रस्तुति में अभिनेता और दर्शक के बदलने से नाटक भी बदलता रहता है और नाट्य भाषा भी बदलती रहती है।

इस प्रकार हिन्दी साहित्य में विधागत भाषिक प्रयोग को देखते हुए हम कह सकते हैं कि भाषा का प्रयोग स्वतन्त्र रूप से न होकर निश्चित विधान के अनुरूप होता है। नाटक, कहानी, उपन्यास, कविता इत्यादि विधाओं की प्रकृति का अन्तर उनके भाषिक प्रयोगों की प्रकृति में परिलक्षित होता है।

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Foreign Direct Investment

Dr. Neetu Mathur [*]

Abstract

Apart from being a critical driver of economic growth, foreign direct investment (FDI) is a major source of non-debt financial resource for the economic development of India. Foreign companies invest in India to take advantage of relatively lower wages, special investment privileges such as tax exemptions, etc. For a country where foreign investments are being made, it also means achieving technical know-how and generating employment. The Indian government's favourable policy regime and robust business environment have ensured that foreign capital keeps flowing into the country. The government has taken many initiatives in recent years such as relaxing FDI norms across sectors such as defence, PSU oil refineries, telecom, power exchanges, and stock exchanges, among others.

Keywords: Indian Economy, FDI, Employment.

Road ahead

According to United Nations Conference on Trade and Development (UNCTAD) World Investment Report 2015, India acquired ninth slot in the top 10 countries attracting highest FDI in 2014 as compared to 15th position in the year 2015.r. The report also mentioned that the FDI inflows to India are likely to exhibit an upward trend on account of economic recovery. India also jumped 16 notches to 55 among 140 countries in the World Economic Forum's Global Competitiveness Index that ranks countries on the basis of parameters such as institutions,

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macroeconomic environment, education, market size and infrastructure among others.

India will require around US$ 1 trillion in the 12th Five-Year Plan (2012–17), to fund infrastructure growth covering sectors such as highways, ports and airways. This would require support from FDI flows. During 2014, foreign investment was witnessed in sectors such as services, telecommunications, computer software and hardware, construction development, power, trading, and automobile, among others.

Exchange Rate Used: INR 1 = US$ 0.0147 as on March 01, 2016.

Foreign Direct Investment in India increased by 2473 USD Million in February of 2016. Foreign Direct Investment in India averaged 1145.82 USD Million from 1995 until 2016, reaching an all time high of 5670 USD Million in February of 2008 and a record low of -60 USD Million in February of 2014. Foreign Direct Investment in India is reported by the Reserve Bank of India.

Investments
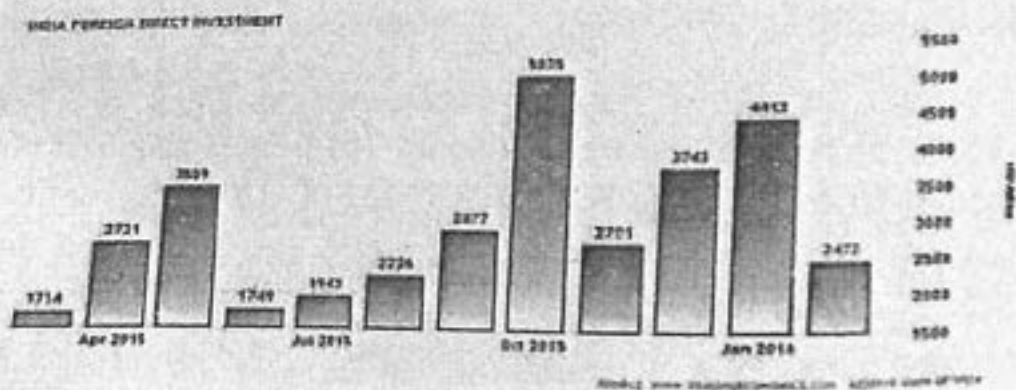
Based on the recommendations of Foreign Investment Promotion Board (FIPB) in its 231st meeting held on January 22, 2016, the Government has approved ten FDI proposals involving FDI of Rs 607 crore (US$ 89.06 million), and recommended one proposal for approval of Cabinet Committee on Economic Affairs (CCEA) involving FDI of Rs 5,856.51 crore (US$ 859 million).

Some of the recent significant FDI announcements are as follows

- E-commerce giant Amazon plans to set up its second largest global delivery centre outside the United States, in Hyderabad, which will be 2.9 million square feet in size and employ 13,500 people, compared to 1,000 Amazon employees across different offices.

- Global beverage company Pepsi plans to invest Rs 500 crore (US$ 72.84 million) to set up another unit in Maharashtra to make mango, pomegranate and orange-based citrus juices, while biotechnology giant Monsanto plans to set up a seed plant in Buldhana district of Maharashtra.

- Apple will build its first technology development centre outside the US in Hyderabad with an investment of $25 million, likely employing about 4,500 people, as per a senior Telangana state government official.

- Japan has won the right to construct India's first bullet train, while offering a loan of US$ 8.11 billion to India for the same.

- Chinese mobile handset maker, Coolpad Group Limited, has committed US$ 300 million for setting up a research and development (R&D) centre and its own assembly line in India by 2017.

- Amazon India expanded its logistics footprint three times to more than 2,100 cities and towns in 2015, as Amazon.com invested more than US$ 700 million in its India operations since July 2014.

- Indian Railways has issued a Letter of Award (LoA) to US-based General Electric (GE) for a Rs 14,656 crore (US$ 2.15 billion) diesel locomotive factory project at Marhowra, and to French transport major Alstom for Rs 20,000 crore (US$ 2.93 billion) electric locomotive project in Madhepura, Bihar.

- Kellogg Co, world's largest cereal maker, is making large investments in manufacturing and plans to set up its first Research and Development (R&D) facility in India at Taloja, near Mumbai.

- The Government of Karnataka has signed an agreement with the Taiwan Electrical and Electronic Manufacturers Association for the purpose of creating a Taiwanese electronic manufacturing cluster near the Bengaluru airport, with an investment expectation of Rs 3,200 crore (US$ 469.5 million).

- Posco Korea, the multinational Korean steel company, has signed an agreement with Shree Uttam Steel and Power (part of Uttam Galva Group) to set up a steel plant at Satarda in Maharashtra.

- Foxconn has signed a Memorandum of Understanding (MoU) with Maharashtra state government to invest US$ 5 billion over the next three years for setting up a manufacturing unit between Mumbai and Pune.

- Global giants such as Bombardier, Hyundai-ROTEM, TALGO and CAF have queued up to manufacture semi high-speed train sets in India, which will be used for faster inter-city travel.

- Germany-based ThyssenKrupp group is aiming to double its revenue from India to US$ 1 billion in next three-four years while the group's elevator unit, ThyssenKrupp Elevator, plans to invest EUR 44 million (US$ 50.5 million) to set up a manufacturing plant in Chakan, Pune.

- Swedish home furnishing brand Ikea has made a long-term plan of opening 25 stores in India by making an investment worth Rs 12,500 crore (US$ 1.83 billion).

- Google plans to invest Rs 1,500 crore (US$ 220 million) for a new campus in Hyderabad which will be focused on three key areas —

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Google Education, Google Fibre broadband services and Street view.

- Warburg Pincus, a US based Private Equity (PE) firm, has planned to invest Rs 850 crore (US$ 124 million) in Ecom Express – an India based logistics solutions provider.

Government Initiatives

Budget 2016-17 has proposed several reforms in Foreign Direct Investment (FDI) Policy in areas of insurance and pensions, asset reconstruction companies and stock exchanges, such as easier governing and fund raising norms, clarification of tax related matters and higher FDI limits.

In order to make India a more attractive foreign investment destination, the Ministry of Finance is planning to introduce the residency permit policy, which will allow key executives of foreign companies making investments worth US$ 2 billion or more in India, to avail various facilities such as special package on upscale housing, residency permits allowing long stay in the country, and cheap rates for utilities.

Government of India has amended the FDI policy regarding Construction Development Sector. The amended policy includes easing of area restriction norms, reduction of minimum capitalisation and easy exit from project.

Government of India has recently relaxed foreign direct investment (FDI) policy in 15 sectors, such as raising the foreign investment limit for some sectors, easing the conditions for others and putting many on the automatic route for approval. Sectors that benefited from the relaxation include defence, real estate, private banking, defence, civil aviation, single brand retail and news broadcasting. New rules provide for easier exit from investment in the construction sector while foreign investment limit in defence and airlines was allowed up to 49 per cent through the automatic route. Banks were allowed fungible FDI investment up to 74

per cent, which means that FII investment in private banks can rise to this limit.

Government of India recently relaxed the FDI policy norms for Non-Resident Indians (NRIs). Under this, the non-repatriable investments made by the Persons of Indian Origin (PIOs), Overseas Citizens of India (OCI) and NRIs will be treated as domestic investments and will not be subject to FDI caps.

The government has also raised FDI cap in insurance from 26 per cent to 49 per cent through a notification issued by the DIPP. The limit is composite in nature as it includes foreign investment in the form of foreign portfolio investment, foreign institutional investment, qualified foreign investment, foreign venture capital investment, and non-resident investment.

The Cabinet Committee on Economic Affairs (CCEA) has raised the threshold for foreign direct investment requiring its approval to Rs 3,000 crore (US$ 440.15 million) from the present Rs 1,200 crore (US$ 176.06 million). This decision is expected to expedite the approval process and result in increased foreign investment inflow.

India's cabinet cleared a proposal which allows 100 per cent FDI in railway infrastructure, excluding operations. Though the initiative does not allow foreign firms to operate trains, it allows them to invest in areas such as creating the network and supplying trains for bullet trains etc.

India is likely to grant most favoured nation (MFN) treatment to 15 countries that are in talks regarding an agreement on the Regional Comprehensive Economic Partnership (RCEP), which would result in significant easing of investment rules for these countries.

Government of India plans to further simplify rules for Foreign Direct Investment (FDI) such as increasing FDI investment limits in sectors and include more sectors in the automatic approval route, to attract more investments in the country.

Major Sectors for Foreign Direct Investment are:

Infrastructure

10% of India's GDP is based on construction activity. Indian government has plans to invest $1 trillion on infrastructure from 2012–2017. 40% of this $1 trillion is to be funded by private sector. 100% FDI under automatic route is permitted in construction sector for cities and townships

Automotive

FDI in automotive sector was increased by 89% between April 2014 to February 2015. India is 7th largest producer of vehicles in the world with 17.5 million vehicles annually. 100% FDI is permitted in this sector via automatic route. Automobiles shares 7% of the India's GDP.

Pharmaceuticals

Indian pharmaceutical market is 3rd largest in terms of volume and 13th largest in terms of value. Indian Pharma industry is expected to grow at 20% compound annual growth rate from 2015 to 2020. 100% FDI is permitted in this sector.

Service

FDI in service sector was increased by 46% in 2014–15. Service sector includes banking, insurance, outsourcing, research & development, courier and technology testing. FDI limit in insurance sector was raised from 26% to 49% in 2014.

Railways

100% FDI is allowed under automatic route in most of areas of railway like High speed train, railway electrification, passenger terminal, mass rapid transport systems etc. Mumbai-Hyderabad high speed corridor project is single largest railway project in India, other being CSTM-Panvel suburban corridor. Foreign investment more than ₹90000 crore (US$13 billion) is expected in these projects.

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Chemicals

Chemical industry of India earned revenue of $ 155–160 billion in 2013. 100% FDI is allowed in Chemical sector under automatic route. Except Hydrocynic acid, Phosgene, Isocynates and their derivatives, production of all other chemicals is de-licensed in India.] India's share in global specialty chemical industry is expected to rise from 2.8% in 2013 to 6–7% in 2023.

Textile

Textile is one major contributor to India's export. Nearly 11% of India's total export is textile. This sector has attracted about $ 1647 million from April 2000 to May 2015. 100% FDI is allowed under automatic route. During year 2013–14, FDI in textile sector was increased by 91%. Indian textile industry is expected reach up to $ 141 billion till 2021.

Impact of Foreign Direct Investment on Indian Economy

Investment provides the base for economic growth and development. FDI provides a win – win situation to host and the home countries. Both countries are directly interested in inviting FDI because they benefit a lot from such type of investment. There is a considerable change in the attitude of both the developing and developed countries towards FDI. They both consider FDI as the most suitable form of external finance. FDI is a predominant and vital factor in influencing the contemporary process of global economic development. It is concluded that the Government should design the FDI policy in such a way where FDI inflows can be utilised as means of enhancing domestic production, savings and exports through the equitable distribution among states so that they can attract FDI inflows at their own level. FDI can help to raise the output, production and export at the sector level of the Indian economy.

Points in Favour

Economic growth: A remarkable inflow of FDI in various industrial units in India boosts the economic life of country. It provides an opportunity for cash-deficient domestic retailers to bridge the gap between capital required and raised. In fact FDI is one of the major sources of investments for a developing country like India wherein it expects investments from Multinational companies to improve the countries growth rate, create jobs, share their expertise, back-end infrastructure and research and development in the host country. It has also been noted that foreign direct investment has helped several countries when they faced economic hardship. An example of this can be seen in some countries in the East Asian region (Indonesia and Thailand). It was observed during the 1997 Asian financial crisis that amount of foreign direct investment made in these countries was held steady while other forms of cash inflows suffered major setbacks. Similar observations have also been made in Latin America in the 1980s and in Mexico in 1994-95.

Improvement in Supply Chain: Improvement of distribution efficiencies, coupled with capacity building and introduction of modern technology helps arrest wastage. In the present situation improper storage facilities and lack of investment in logistics have been creating inefficiencies in food supply chain, leading to significant wastages.

Benefits for the Farmers: Though, India is second largest producer of fruits and vegetables, it has a very limited integrated cold-chain infrastructure. Lack of adequate storage facilities causes heavy losses to farmers, in terms of wastage in quality and quantity of produce in general, and of fruits and vegetables in particular. With FDI, there could be a complete overhaul of the currently fragmented supply chain infrastructure. Extensive backward integration by multinational retailers, coupled with their technical and operational expertise, can hopefully remedy such structural flaws. Also, farmers can benefit with the 'farm to fork' ventures with retailers which helps (a) to cut down intermediaries ;

(b) give better prices to farmers, and (c) provide stability and economics of scale which will benefit, in the ultimate analysis, both the farmers and consumers.

Improvement in Customer Satisfaction: Consumers in the organised retail have opportunity to choose between a number of internationally famous brands with pleasant shopping environment, huge space for product display, maintenance of hygiene and better customer care. There is a large segment of the population which feels that there is a difference in the quality of the products sold to foreign retailers and the same products sold in the Indian market. With increasing spending power in an emerging country, there is an increasing tendency to pay for quality and ease and access to a "one -stop shop" which has a wide range of different products. FDI definitely challenges the monopoly of certain domestic Indian companies and the ultimate benefit goes to the end-consumer.

Boost Healthy Competition and Check Inflation: Entry of many multinational corporations obviously promises intensive competition between different companies offering their brands in a particular product market (including domestic companies), thereby resulting in availability of many varieties, reduced prices, and convenient distribution of marketing offers. Products of superior quality are manufactured by various industries in India due to greater amount of FDI inflows in the country.

Improved Technology and Logistics: Improved technology in the sphere of processing, grading, handling and packaging of goods and further technical developments in areas like electronic weighing, billing, bar-code scanning etc. is a direct consequence of foreign companies opening retail shops in India. Further, transportation facilities get a boost, in the form of increased number of refrigerated vans and pre-cooling chambers which can help bring down wastage of goods.

More and Better Employment Opportunities: The entry of foreign companies into Indian Retailing not only creates employment opportunities but also ensures quality in them. This helps Indian human resource to find better quality jobs and to improve their standard of living and life styles on par with that of the citizens of developed nations.

Points against

Domination of Organised Retailers: FDI in retail definitely strengthens organised retail in the country. These organised retailers will tend to dominate entire consumer market. It leads to unfair competition and ultimately results in large-scale exit of domestic retailers, especially the small family managed outlets. It may all look good on paper now but eventually, big businesses will monopolise their respective markets in India by destroying all small competitors, and then they will be in complete control of prices. Also, after monopolizing, product quality will stop mattering, since all small businesses whose products competed in quality would be destroyed. Also, vegetables and fruits that will be imported from outside India will be not fresh and stale due to long distance transportation and constant refrigeration.

Loss of Jobs: Retail in India has tremendous growth potential and it is the second largest employer in India. Any changes by bringing major foreign retailers who will be directly procuring from main supplier will not only create unemployment on front end retail but also the middleman who have been working in this industry will be thrown out of their jobs. Jobs in manufacturing sector will be lost because foreign giants will purchase their goods from the international market and not from domestic sources. This has been the experience of most countries which have allowed FDI in retail. Although, India had made a condition that they must source a minimum of 30% of their goods from Indian micro and small industries, but as per WTO Laws, country can't stop them from purchasing goods from international markets.

Loss of Self Competitive Strength: The Indian retail sector, particularly organized retail, is still underdeveloped and in a nascent stage and that, therefore the companies may not be able to compete with big global giants. If the existing firms collaborate with the global biggies they might have to give up at the global front by losing their self-competitive strength.

Distortion of Culture: Though, FDI in Indian retail will indirectly or directly contribute for enhancement of Tourism, Hospitality and few other industries, the culture of people in India will slowly be changed. Youth will easily imbibe certain negative aspects of foreign culture and lifestyles and develop inappropriate consumption patterns, not suited to Indian cultural environment.

Farmers' Woes: Because of FDI, there is a negative impact on farming, since large corporations will push farmers to work for them and get involved in single-crop farming and the use of artificial means of farming. Due to monopolisation, farmers will have to sell their products to corporations at the offered price. The farmers will have to bear the cost of reduced MRPs eventually.

Rise in Unethical Practises: Due to lack of transparency and proper regulation norms in country, FDI would act as another source of increasing corruption and red tape in country. In fact, Unethical behaviours like corruption, red-tapism and selfishness is increasing day by day because of huge potential of money making, which is their ultimate aim and not quality or providing jobs or reviving the economy.

Conclusion

Foreign Direct Investment (FDI) in India is major monetary source for economic development in India. Foreign companies invest directly in fast growing private Indian businesses to take benefits of cheaper wages and changing business environment of India. Co-operation is the key to success. FDI would lead to a more comprehensive integration of India

into the world market where India can also make a strong position in global market by exporting their quality products and services. According to the World Bank, opening the retail sector to FDI would be beneficial for India in terms of price and availability of products. While FDI in India has been opposed by several in the past citing fears of loss of employment, adverse impact on traditional retail and rise in imports from cheaper sources like China, adherents of the same indicate increased transfer of technology, enhanced supply chain efficiencies and increased employment opportunities as the perceived benefits. Considering the inflation rise and economic recession in India, FDI looks like something that can put a check on this and provide some relief to the ailing economy.

CADMIUM INDUCED TOXICITY IN PLANTS: IMPACT ON GROWTH, DEVELOPMENT AND BIOCHEMICAL ATTRIBUTES.

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ABSTRACT

This review emphasises cadmium toxicity on plants with regards to ecological, physiological and biochemical aspects. Cadmium toxicity in plants and problems concerning tolerance and ecological performance are discussed briefly. Heavy metals are important environment pollutants and their toxicity is a problem of increasing significance for ecological, evolutionary, nutritional and environmental reasons. Plants possess homeostatic cellular mechanisms to regulate the concentration of metal ions inside the cell to minimize potential damage that could result from the exposure to non-essential metal ions.

Key words: cadmium toxicity, effects, plants, growth.

INTRODUCTION

The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Examples of heavy metal include mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (Tl),

and lead (Pb). Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed. Heavy metals are dangerous because they tend to bio accumulate. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted.

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Cadmium (Cd) is a naturally occurring metal situated in the Periodic Table of the Elements between zinc (Zn) and mercury (Hg), with chemical behavior similar to Zn. It generally exists as a divalent cation, complexed with other elements (e.g., $CdCl_2$). Cd exists in the earth's crust at about 0.1 part per million, usually being found as an impurity in Zn or lead (Pb) deposits, and therefore being produced primarily as a byproduct of Zn or Pb smelting.

Cadmium is a heavy metal of considerable environmental and occupational concern. It is widely distributed in the earths' crust. The highest level of cadmium compounds in the environment is accumulated in sedimentary rocks, and marine phosphates. Effects of cadmium toxicity in plants are as follows:

- Cadmium decreases leaf conductance
- Cadmium affects CO_2 uptake
- Cadmium chloride induces stomatal closure in the nanomolar range of concentration
- Cadmium chloride induces stomatal closure via a calcium channel inhibitor sensitive pathway

Cadmium toxicity in crops has become in a serious problem, especially in developed countries. Cadmium accumulation in soils may come from different sources, including air pollutants and soil applications of commercial fertilizers, sewage sludge, manure and lime (McGrath et al., 1994). Also, industrial effluents may contain a wide variety of pollutants depending on the industries involved, and in many cases high concentrations of heavy metals have been reported (Iribar et al., 2000). In polluted soils, Cd is generally present as free ions or different soluble forms, and its mobility depends on pH and on the presence of chelating substances and other cations. Plants can accumulate Cd during plant growth, and the accumulation often occurs in edible parts, thus endangering crop yield and quality and becoming a potential hazard for human and animal health. Cadmium is suggested to cause damage even at very low concentrations, and healthy plants may contain Cd levels that are toxic for mammals (Chen et al., 2007). Moreover, it is widely recognized that Cd taken up by plants is the main source of Cd accumulation in food (Pinot et al., 2000). Most of the information available about Cd physiology in plants comes from studies with the Cd-hyperaccumulator *Thlapsi caerulescens* (Lombi et al., 2002) and Cd-tolerant plants such as *Arabidopsis halleri* (Weber et al., 2006), whereas less information is available in commercial crops such as tomato. It is commonly assumed that Cd, as well as other heavy metals, are

taken up by transporters of essential elements, because of the lack of specificity of these proteins. There is evidence that metal transporters from different families such as ZIP and Nramp are able to transport several divalent cations, including Cd (Korshunova et al., 1999). Also, it has been described that a Ca transport pathway could be involved in Cd uptake (Clemens et al., 1998). Cadmium tolerance in plants is thought to involve internal metal detoxification processes, which may be achieved through both cellular and subcellular compartmentation (Küpper et al., 2007) and/or complications with cellular ligands such as phytochelatins, organic acids, cisteine and other low molecular weight thiols (Cobbett and Goldsbrough, 2002). Although long distance Cd transport also contributes to Cd distribution and accumulation throughout the plant (Chen et al., 2007), little is known about the chemical form(s) in which this heavy metal is present in xylem and phloem saps. Data available suggest that Cd may be associated in the xylem sap with small molecules such as organic acids. Physiological effects of Cd toxicity in plants include inhibition of seed germination, major reductions in growth rates, changes in photosynthetic efficiency, respiration and transpiration (Greger and Ögren, 1991) and alterations in nutrient homeostasis, including a Cd induced, Fe deficiency and changes in Mn, K, Mg and Ca uptake rates. At the cellular level, Cd toxicity is known to cause alterations such as membrane damage, disruption of electron transport, inhibition/activation of enzymes and interaction with nucleic acids (Chen et al., 2003a). Possible mechanisms by which these disorders are generated are induction of oxidative stress and replacement of elements such as Zn, Fe, and Mn, which are essential cofactors of many enzymes. Accordingly, there are several reports documenting oxidative stress following exposure to high concentrations of Cd (Smeets et al., 2005).

SOURCES OF CONTAMINATION

There are different sources of heavy metals in the environment such as: natural, agricultural, industrial, domestic effluents, atmospheric sources and other sources. Cadmium has been widely dispersed into the environment through the air by its mining and smelting as well as by other man-made routes:

- usage of phosphate fertilizers,

- presence in sewage sludge, and

- various industrial uses such as NiCd batteries, plating, pigments and plastics

The most important sources of airborne cadmium are smelters. Other sources of airborne cadmium include burning fossil fuels such as coal or oil and incineration of municipal waste

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such as plastics and nickel-cadmium batteries (which can be deposited as solid waste). Cadmium may also escape into the air from iron and steel production facilities.

Cadmium is used mainly:

- in metal plating,

- in producing pigments,

- in NiCd batteries,

- as stabilizers in plastics, and

- as a neutron absorbent in nuclear reactors.

When released into the atmosphere by smelting or mining or some other processes, cadmium compounds can be associated with respirable-sized airborne particles and can be carried long distances. It is deposited onto the earth below by rain or falling out of the air. Once on the ground, cadmium moves easily through soil layers and is taken up into the food chain by uptake by plants such as leafy vegetables, root crops, cereals and grains.

Cadmium concentrations in drinking water supplies are typically less than 1 microgram per litre (μg/L) or 1 part per billion (ppb). Groundwater seldom contains high levels of cadmium unless it is contaminated by mining or industrial wastewater, or seepage from hazardous waste sites. Soft or acidic water tends to dissolve cadmium and lead from water lines; cadmium levels are increased in water stagnating in household pipes. These sources have not been reported to cause clinical cadmium poisoning, but even low levels of contamination add to the body's accumulation of cadmium.

Cadmium oxide also exists as small particles in air (fume) which are the result of smelting, soldering, or other high-temperature industrial processes. A certain percentage of these particles are respirable. From the soil, certain plants (tobacco, rice, other cereal grains, potatoes, and other vegetables) take up cadmium more avidly than they do other heavy metals such as lead and mercury. Cadmium is also found in meat, especially sweetmeats such as liver and kidney. In certain areas, cadmium concentrations are elevated in shellfish and mushrooms.

Cadmium can also enter the food chain from water. In Japan, zinc mining operations contaminated the local water supplies with cadmium. Local farmers used that water for

irrigation of their fields. The soil became contaminated with cadmium which led to the uptake of cadmium into their rice.

EFFECTS OF CADMIUM IN PLANTS

Cadmium is a non-essential element that negatively affects plant growth and development. It is released into the environment by power stations, heating systems, metal-working industries or urban traffic. It is widely used in electroplating, pigments, plastic stabilizers and nickel-cadmium batteries (Sanitá di Toppi and Gabrielli, 1999). It is recognized as an extremely significant pollutant due to its high toxicity and large solubility in water (Pinto et al., 2004). Genotoxicity and ecotoxicity of cadmium in animals have been also reported. Important sources of cadmium input to the marine environment include atmospheric deposition, domestic waste water and industrial discharges. Regarding its potential toxicity for soil organisms and soil microbial processes, Duxbury (1985) classified Cd as an element of "intermediate" toxicity. Although the toxic effects of cadmium on biological systems have been reported by several authors (Das et al., 1997; Sanitá di Toppi and Gabrielli, 1999), the mechanisms of Cd toxicity are not completely understood yet. Cadmium can alter the uptake of minerals by plants through its effects on the availability of minerals from the soil, or through a reduction in the population of soil microbes (Moreno et al., 1999). Stomatal opening, transpiration, and photosynthesis have been reported to be affected by cadmium in nutrient solutions, but the metal is taken up into plants more readily from nutrient solutions than from soil. (Sanitá di Toppi and Gabrielli, 1999). Chlorosis, leaf rolls and stunting are the main and easily visible symptoms of cadmium toxicity in plants. Chlorosis may appear to be Fe deficiency, phosphorous deficiency or reduce Mn transport. The inhibition of root Fe(III) reductase induced by Cd led to Fe(II) deficiency, and it seriously affected photosynthesis (Alcantara et al., 1994). In general, Cd has been shown to interfere with the uptake, transport and use of several elements (Ca, Mg, P and K) and water by plants. Cd also reduced the absorption of nitrate and its transport from roots to shoots, by inhibiting the nitrate reductase activity in the shoots (Hernandez et al., 1996). Appreciable inhibition of the nitrate reductase activity was also found in plants of Silene cucubalus. Nitrogen fixation and primary ammonia assimilation decreased in nodules of soybean plants during Cd treatments (Balestrasse et al., 2001). Metal toxicity can affect the plasma membrane permeability, causing a reduction in water content; in particular Cd has been reported to interact with the water balance. Cadmium treatments have been shown to reduce ATPase activity of the plasma membrane fraction of wheat and sunflower roots. Cadmium

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produces alterations in the functionality of membranes by inducing lipid peroxidation (Fodor et al., 1995), and disturbances in chloroplast metabolism by inhibiting chlorophyll biosynthesis and reducing the activity of enzymes involved in CO_2 fixation.

Cadmium homeostasis

The sensitivity of plants to heavy metals depends on an interrelated network of physiological and molecular mechanisms that includes uptake and accumulation of metals through binding to extracellular exudates and cell wall, complexation of ions inside the cell by various substances, for example, organic acids, amino acids, ferritins, phytochelatins, and metallothioneins; general biochemical stress defense responses such as the induction of antioxidative enzymes and activation or modification of plant metabolism to allow adequate functioning of metabolic pathways and rapid repair of damaged cell structures (Sanita di Toppi and Gabrielli, 1999; Hall, 2002).

Effect of Cd on growth and development

Cd toxicity causes inhibition and abnormalities of general growth in many plant species. After long-term exposure to Cd, roots are mucilaginous, browning, and decomposing; reduction of shoots and root elongation, rolling of leaves, and chlorosis can occur. Cd was found to inhibit lateral root formation while the main root became brown, rigid, and twisted (Krantev et al., 2008; Rascio and Navari-Izzo, 2011). The main reason indicated is disordered division and abnormal enlargement of epiderma and cortical cell layers in the apical region. The changes in the leaf included alterations in chloroplast ultra structure, low contents of chlorophylls, which caused chlorosis, and restricted activity of photosynthesis (He et al., 2008). In pea plants, the Cd stress also caused disorders in root elongation and the mitotic process and caused chromosomal aberrations of root tips. The observation showed that in these abnormalities as lagands, bridges, stickiness, precocious separation, and fragments were most common (Siddiqui et al., 2009). At high Cd concentration (250 µM), the disorder of mitosis of roots in pea happens rapidly, even after 24 h of treatment. An unusual number of nucleus populations in the differentiated roots were found

Effects of Cd on photosynthesis

In many species, such as oilseed rape (*Brassica napus*) (Baryla et al., 2001), sunflower (*Helianthus annuus*) (Di Cagno et al., 2001), *Thlaspi caerulescens* (Küpper et al., 2007), maize, pea, barley (Popova et al., 2009), mungbean (*Vigna radiate*) (Wahid et al., 2008), and wheat (Moussa and El-Gamal, 2010), the evidence showed that photosynthesis was inhibited

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after both long-term and short-term Cd exposure. A large number of studies have demonstrated that the primary sites of action of Cd are photosynthetic pigments, especially the biosynthesis of chlorophyll and carotenoids. According to Baryla et al. (2001), the observed chlorosis in oilseed rape was not due to a direct interaction of Cd with the chlorophyll biosynthesis pathway and most probably it was caused by decreasing of chloroplast density. the Cd-induced decrease in pigment content was more powerful at the leaf surface (stomatal guard cells) than it was in the mesophyll. In addition, the change of cell size, and the reducing of stomata density in the epidermis in Cd-treated leaves were observed. Thus, Cd might interfere directly with chloroplast replication and cell division in the leaf. This research also revealed that stomatal conductance was strongly reduced by Cd. Cd ions are known to affect the structure and function of chloroplasts in many plant species such as *Triticum aestivum* (Atal et al., 1991), *Beta vulgaris* (Greger and Ögren, 1991), *Vigna radiata* (Keshan and Mukherji, 1992), *Spinacea oleracea* (Sersen and Kral'ova, 2001), and *Phaseolus vulgaris*

Effect of Cd on mineral nutrition

It has been reported that uptake, transport, and subsequent distribution of nutrient elements by the plants can be affected by the presence of Cd ions. In general, Cd has been shown to interfere with the uptake, transport, and use of several elements (Ca, Mg, P, and K) and water by plants. In sugar beet, deficiency of Fe in roots induced by Cd was observed (Chang et al., 2003). In pea plants, the uptake of P, K, S, Ca, Zn, Mn, and B was inhibited strongly after Cd exposure (Metwally et al., 2005). Treatment of barley plants with 1.0 μM Cd decreased the concentrations of P, K, Ca, Mg, Cu, Fe, Mn, Zn, Mo, and B in roots, whereas the concentrations of these elements in shoots were not decreased in comparison with the control (Guo et al., 2007). A decrease in uptake of Ca and K by Cd has been found in a Cd-hyperaccumulator, *Atriplex halimus* subsp. schweinfurthii (Nedjimi and Daoud, 2009). Cd also reduced the absorption of nitrate and its transport from roots to shoots, by inhibiting nitrate reductase activity in the shoots (Hernandez et al., 1996). Appreciable inhibition of the nitrate reductase activity was also found in plants of *Silene cucubalus*. Nitrogen fixation and primary ammonia assimilation decreased in nodules of soybean plants during Cd treatments (Karina et al., 2003). The observation of Cd-treated soybean seedlings showed that there was an increase in laccase activity (laccases are responsible for lignin biosynthesis), during the early stage of Cd treatment, whereby Cd induced the lignin synthesis in early stage of root growth and as a result might cause inhibition of root elongation (Yang et al., 2007).

Defence mechanisms against Cd in plants:

The mechanisms leading to heavy metal tolerance can be divided into avoidance strategies and tolerance strategies. Avoidance leads to limitation of Cd uptake. Plant tolerance mechanisms include accumulation and storing of Cd by binding it to amino acids, proteins, and peptides. Other mechanisms that plants have developed to cope with damage caused by Cd are related to some stress signalling molecules, such as salicylic acid, jasmonic acid, nitric oxide, and ethylene. All these compounds were induced by Cd treatment, which suggests that they are involved in cell response to Cd toxicity (Rodríguez Serrano et al., 2009). Many plants survive, grow, and develop in Cd-polluted soils even in high concentrations of Cd. Investigations showed that some of these plants exhibit a hypertolerant capacity of their organelles and tissues. Strategies to cope with Cd toxicity involve the uptake and the distribution of Cd, defined as "hyperaccumulation". On the other hand, some plants increased cleaning up of the ROS by antioxidants to protect cells and tissues from destruction. Thus, the mechanism of Cd tolerance in plants can include both antioxidant defence and/or hyperaccumulation defence (Rascio and Navari-Izzo, 2011).

CONCLUSION

In conclusion, Cd affects photosynthesis either directly or indirectly thus decreasing the crop yield. We reviewed its inhibitory effect on pigments, lipids, photosystems proteins and chloroplasts. Summing up all we investigated net loss in photosynthesis. It can be said that much has been known about Cd toxicity to plants but numerous mechanisms remains debatable about its interaction with photosynthetic proteins i.e. D1 and D2 and oxygen evolving complexes. In particular, we should extend our knowledge towards PSI measurements to get an intricate knowledge on effect of Cd on photosynthesis. Strategies must be evolved on understanding the mechanism of Cd hyperaccumulation to uphold various phytoremediation strategies.

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DRIVING FORCES OF INVESTMENT DECISIONS IN MUTUAL FUNDS

Dr. Priyanka Khurana[*]

Abstract

Investment is a commitment of funds in real assets or financial assets that involves risk and gain. In the present dynamic global environment, exploring investment avenues are of great relevance. The success of an investment activity depends on the knowledge and ability of investors to invest, the right amount, in the right type of investment, at the right time. Small investors face a lot of problems in the share market, limited resources, lack of professional advice, lack of information on different investment options, etc. Thus, people began opting for portfolio managers with expertise in stock markets who would invest on their behalf. As mutual funds are managed by professionals, they are considered to have a better knowledge of market behaviors. Thus, investors choose mutual funds as their primary means of investing, as they provide professional management, diversification, convenience and liquidity that leads to high returns with low risk.

Keywords: Global Environment, Stock Market, Market Behavior, Mutual Fund, Diversification.

Introduction

Financial service is a segment of financial system that facilitates the transformation of savings of individuals, Government as well as business into investment and consumption. The investment in the financial system interacts in two financial markets i.e. Money Market and Capital Market. Money Market deals in financial assets with a short-term which is regulated by RBI. Capital Market is where financial assets have long tenure. Capital market for corporate sector has been growing in strength and diversity and is being regulated by SEBI. An average Indian Investor is like ignorant child when it comes to financial markets, the cause may be lack of knowledge and conceptual understanding or the influence of a fixed income orientation in the Indian culture. The market potential can be tapped by scrutinizing investor behavior to identify their expectation and articulate investor's own situation and risk preference and then apply to an investment strategy.

Investment Avenues & Investment Decisions

In choosing specific investments, investors will need definite ideas regarding features, which their investment avenue should possess. These features should be consistent with the investors' general objectives and in addition, should afford them all the incidental conveniences and advantages, which are possible under the circumstances. The following are the suggested features as the ingredients from which many successful investors compound their selection policies:

- **Safety of Principal**

    The investor, to be certain of the safety of principal, should carefully review the economic and industry trends before choosing the types of investment.

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- **Liquidity**

Every investor requires a minimum liquidity in his investment to meet emergencies. Liquidity will be ensured if the investor buys a proportion of readily saleable securities out of his total portfolio.

- **Income Stability**

Regularity of income at a consistent rate is necessary in any investment pattern. Not only stability, it is also important to see that income is adequate after taxes.

- **Appreciation and Purchasing Power Stability**

Investors should balance their portfolios to fight against any purchasing power stability. Investors should judge price level inflation, explore their possibility of gain and loss in the investments available to them, limitations of personal and family considerations.

- **Legality and Freedom from Care**

All investments should be approved by law. Law relating to minors, estates, trusts, shares and insurance not studied will bring out many problems for the investor.

- **Tangibility**

Intangible securities have many times lost their values due to price level inflation, confiscatory laws or social collapse. Some investor prefers to keep a part of their wealth invested in tangible properties like building, machinery and land.

Mutual Funds: A Financial Instrument

Mutual Fund Industry is growing at a faster pace. Mutual Funds are the most appropriate and preferred investment avenue for individual investors as it offers an opportunity to invest in a diversified, professionally managed basket of securities at a relatively low cost. A fund is "mutual" as all of its returns, minus its expenses, are shared by the investors of the fund. To state simply, a mutual fund collects the savings from small investors, invest them in Government and other corporate securities and earn income through interest and dividends, besides capital gain. It works on the principle of 'small drop of water makes a big ocean'. The factors which can be largely attributed to impressive growth in the Indian Mutual fund industry are increased household savings, advantageous tax policies, and introduction of several new products, investor education and the role of distributors. A Mutual Fund Industry is undoubtedly a must for future growth of the economy as they are the most preferred investment avenue for variety of small as well as big investors.

Driving Forces

The performances of Mutual funds are influenced by the performance of the stock market as well as the economy as a whole. Equity Funds are influenced to a large extent by the stock market. The stock market in turn is influenced by the performance of the companies as well as the economy as a whole. The performance of the sector funds depends to a large extent on the companies within that sector. Bond-funds are influenced by interest rates and credit quality. As interest rates rise, bond prices fall, and vice versa. Similarly, bond funds with higher credit ratings are less influenced by changes in the economy.

Net Assets Value (NAV)

NAV is the actual value of one unit of a given scheme on any given business day. The NAV reflects the liquidation value of the fund's investments on that particular day after accounting for all expense.

$$\text{Net Asset Value (NAV)} = \frac{\text{Assets- Debts}}{\text{Number of Outstanding Units}}$$

where Assets = Market value of the fund's Investments + Receivables + Accrued Income Debts = Liabilities + Accrued Expenses

Expense Ratio

The Expense Ratio of a fund indicates the efficiency and cost effectiveness of the fund. The expenses are incurred to meet the general running expenses of the fund. Mutual funds charge fees, sometimes high fees. A mutual fund's Expense Ratio is the most important fee to understand, and is made up of the investment advisory fee or management fee and administrative costs.

$$\text{Expense Ratio} = \text{Total Expenses / Average Net Assets of the Fund}$$

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Risk

Risk can be a great ally when trying to estimate the reward potential of a stock investment. The greater the stock volatility or risk, the greater also is the reward. There are several new risk measurements that give guidance for selecting mutual stocks that provide higher returns for lower risk.

Time Horizon

The time horizon of an individual will also influence the performance measures he/she will look at more closely. If you are investing for less than four years, you need a fund with consistent performance, so all your money will be there when you need it. Conversely, if you plan to invest your money for 30 years, neither consistency nor load is very important: you have plenty of time for the market to recover. With a long-term horizon, your biggest enemies are poor performance and high annual expenses, both of which can erode that all-important compounding.

Risk Tolerance & Attitude of Investors

Investors always look for safer investment avenues. Investors wish to maximize their returns in accordance with their risk tolerance. Return is the motivating force and the principal reward in the investment process. To measure the risk, two appropriate quantitative risk surrogates that can be used are: Standard Deviation of rate of return and Beta Coefficient of the portfolio. In financial markets, "expectations" of the investors play a vital role. They influence the price of the securities; the volume traded and determines quite a lot of things in actual practice. These 'expectations' of the investors are influenced by their "perception" and humans generally relate perception to action.

- **Annual Investments & Percentage of Investments in Mutual Funds**

The stepping stone for investing is savings itself. The saving and investment behaviour of the respondents was found to be as follows:

Table 1: Annual Investments & Percentage of Investments in Mutual Funds

% Invested in MFs	Annual Investment				
	< 1 Lakh	1-2Lakh	2-3 Lakh	>3 Lakh	Total
10-25%	35	24	3	1	63
30-50%	8	9	6	6	29
55-80%	1	3	1	3	8
100%	-	-	-	-	-
Total	44	36	10	10	100

The above table shows that 44% of the investors invest less than one lakh rupees out of their total income and only 10% investors invest more than 3 lakh rupees annually. This shows that most of the investors are investing more than 25% of their savings towards other investment options available to them. Only 8% of the investors are there who invests three-fourth of their savings towards the Mutual Funds.

- **Period of Investment**

The following table shows that 35% of the investors have invested in Mutual Funds for a longer period of 2-5 years and 28% have invested for more than 5 years. Only 13% have made investment for a shorter span of less than one year. This shows that people are willing to take moderate risk by investing in these funds for a long period.

Table 2: Period of Investment in Mutual Funds

Period	No. of Investors	Percentage
< 1 year	13	13
1-2 years	24	24
2-5 years	35	35
> 5 years	28	28
Total	100	100

- **Level of Satisfaction**

In the present study, the investors were asked to rank their level of satisfaction from 1 to 4, Rank 1 for Extremely Satisfied, Rank 2 for Neutral, Rank 3 for Unsatisfied and Rank 4 for Extremely Unsatisfied.
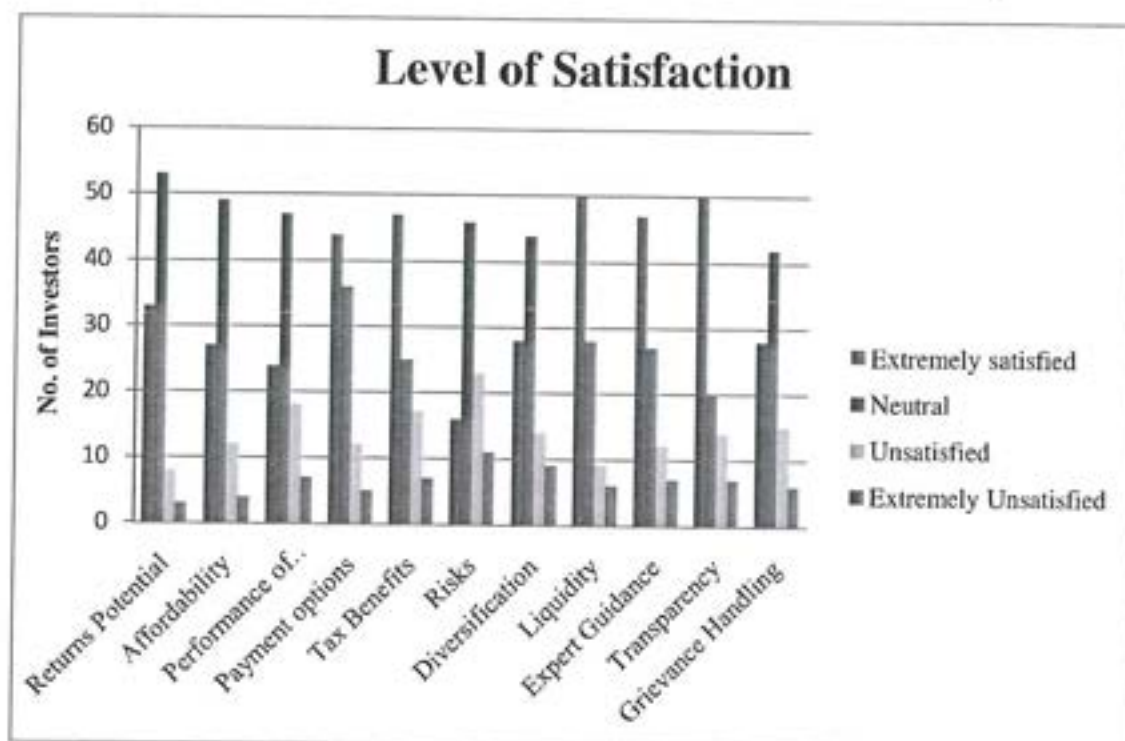
The above table shows that the satisfaction level for the Liquidity is highest for the investors. Transparency, Expert Guidance and various payment options provides good level of satisfaction to them. But, they were not extremely satisfied with the potential returns generated by the Mutual Funds. They believe that funds with higher performance in respect to return are better funds. The analysis shows that the investors are dissatisfied with the risks attached to Mutual Funds. They perceive that fluctuations in NAV do not encourage them to invest in Mutual Fund. Hence, the investors were not satisfied with the level of satisfaction they achieved as compared to the level of satisfaction they perceived from Mutual Funds

Conclusion

Indian Mutual Funds have emerged as strong financial intermediaries and they play a significant role in bringing stability into the financial system and efficiency in resource allocation. These are suitable for all types of investors from risk adverse to risk bearer. Mutual Funds have many options of return, risk free return, constant return, market associated return, etc. They are suitable to all age of investors, businessmen, salary person, etc. Investors need not be expert in equity market; Mutual Funds can satisfy their need. In today's world, investors are showing more trust in Mutual Fund than any other financial product. There is no need of a financial consultant, if you have good knowledge of Mutual Funds and their type to invest. Mutual Fund is subject to market risk, despite of that it have low risk than stock market.

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BANKING SECTOR REFORMS IN INDIA : AN OVERVIEW

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Abstract

Since nationalization of banks in 1969, the banking sector had been dominated by the public sector. There was financial subjugation, role of technology was narrow, no risk management etc. It resulted in little profitability and pitiable asset quality. The nation was caught in profound economic crises. The Government contemplated to announce wide-ranging economic reforms. Banking sector reforms were part of this predicament. In August 1991, the Government employed a committee on banking system under the chairmanship of M. Narasimham. This paper seeks to address the issue of banking sector reforms in India and the impact of the reforms in India.

Keywords: Nationalization, Subjugation, Pitiable Asset Quality, Profitability, Economic Reforms.

Introduction

The main aim of the banking sector reforms in India begun in the early 1990s was to create a well-organized, competitive and steady financial sector that can contribute to induce growth. Concurrently, the monetary policy made a systematic transition from direct instruments of monetary management to an increasing dependence on indirect instruments. However, as appropriate monetary transmission cannot take place without efficient price discovery of interest rates and exchange rates in the overall functioning of financial markets, the corresponding development of the money market, Government securities market and the foreign exchange market became necessary. Reforms in the various segments, therefore, had to be coordinated. This paper seeks to address the issue of banking sector reforms in India and the impact of the reforms in India.

Objectives

The main objectives of the research are as given under:

- To understand the banking sector reforms in India.
- To understand the impact of banking sector reforms in India.

Methodology

- Research Type: Exploratory Research
- Type of Data/Data Source used: Secondary Data/Data source.

The present study is based on secondary data. The requisite information has been derived from various books, articles from Newspapers, Magazines and Journals, and from several web-sites which deal directly or indirectly with the topics related to banking sector reforms in India. Pertinent information was then analysed to address the objectives of present study.

Main Text and Finding

First Phase of Banking Sector Reforms / Narasimham Committee Report, 1991

To promote healthy development of financial sector, the Narasimham committee made recommendations.

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Recommendations of Narasimham Committee

- Establishment of 4 tier hierarchy for banking structure with 3 to 4 large banks (including SBI) at top and at bottom rural banks engaged in agricultural activities.
- The supervisory functions over banks and financial institutions can be assigned to a quasi-autonomous body sponsored by RBI.
- Phased reduction in statutory liquidity ratio.
- Phased achievement of 8% capital adequacy ratio.
- Abolition of branch licensing policy.
- Proper classification of assets and full disclosure of accounts of banks and financial institutions.
- Deregulation of Interest rates.
- Delegation of direct lending activity of IDBI to a separate corporate body.
- Competition among financial institutions on participating approach.
- Setting up asset Reconstruction fund to take over a portion of loan portfolio of banks whose recovery has become difficult.

Banking Reform Measures of Government

On the recommendations of Narasimham Committee, following measures were undertaken by government since 1991:-

Lowering SLR and CRR

The high SLR and CRR reduced the profits of the banks. The SLR has been reduced from 38.5% in 1991 to 25% in 1997. This has left more funds with banks for allocation to agriculture, industry, trade etc. The Cash Reserve Ratio (CRR) is the cash ratio of banks total deposits to be maintained with RBI. The CRR has been brought down from 15% in 1991 to 4.1% in June 2003. The purpose is to release the funds locked up with RBI.

Prudential Norms

Prudential norms have been started by RBI in order to impart professionalism in commercial banks. The purpose of prudential norms include proper disclosure of income, classification of assets and provision for Bad debts so as to ensure that the books of commercial banks reflect the accurate and correct picture of financial position. Prudential norms required banks to make 100% provision for all Non-performing Assets (NPAs). Funding for this purpose was placed at Rs. 10,000 crores phased over 2 years.

Capital Adequacy Norms (CAN)

Capital Adequacy ratio is the ratio of minimum capital to risk asset ratio. In April 1992 RBI fixed CAN at 8%. By March 1996, all public sector banks had attained the ratio of 8%. It was also attained by foreign banks.

Deregulation of Interest Rates

The Narasimham Committee advocated that interest rates should be allowed to be determined by market forces. Since 1992, interest rates has become much simpler and freer.

- Scheduled Commercial banks have now the freedom to set interest rates on their deposits subject to minimum floor rates and maximum ceiling rates.
- Interest rate on domestic term deposits has been decontrolled.
- The prime lending rate of SBI and other banks on general advances of over Rs. 2 lakhs has been reduced.
- Rate of Interest on bank loans above Rs. 2 lakhs has been fully decontrolled.
- The interest rates on deposits and advances of all Co-operative banks have been deregulated subject to a minimum lending rate of 13%.

Recovery of Debts

The Government of India passed the "Recovery of debts due to Banks and Financial Institutions Act 1993" in order to facilitate and speed up the recovery of debts due to banks and financial institutions. Six Special Recovery Tribunals have been set up. An Appellate Tribunal has also been set up in Mumbai.

Competition from New Private Sector Banks

Now banking is open to private sector. New private sector banks have already started functioning. These new private sector banks are allowed to raise capital contribution from foreign institutional investors up to 20% and from NRIs up to 40%. This has led to increased competition.

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Phasing Out of Directed Credit

The committee suggested phasing out of the directed credit programme. It suggested that credit target for priority sector should be reduced to 10% from 40%. It would not be easy for government as farmers, small industrialists and transporters have powerful lobbies.

Access to Capital Market

The Banking Companies (Acquisition and Transfer of Undertakings) Act was amended to enable the banks to raise capital through public issues. This is subject to provision that the holding of Central Government would not fall below 51% of paid-up-capital. SBI has already raised substantial amount of funds through equity and bonds.

Freedom of Operation

Scheduled Commercial Banks are given freedom to open new branches and upgrade extension counters, after attaining capital adequacy ratio and prudential accounting norms. The banks are also permitted to close non-viable branches other than in rural areas.

Local Area Banks (LABs)

In 1996, RBI issued guidelines for setting up of Local Area Banks and it gave its approval for setting up of 7 LABs in private sector. LABs will help in mobilizing rural savings and in channeling them in to investment in local areas.

Supervision of Commercial Banks

The RBI has set up a Board of financial Supervision with an advisory Council to strengthen the supervision of banks and financial institutions. In 1993, RBI established a new department known as Department of Supervision as an independent unit for supervision of commercial banks.

Second Phase of Reforms of Banking Sector (1998) / Narasimhan Committee Report 1988

To make banking sector stronger the government appointed Committee on banking sector Reforms under the Chairmanship of M. Narasimhan. It submitted its report in April 1998. The Committee placed greater importance on structural measures and improvement in standards of disclosure and levels of transparency.

Following are the recommendations of Narasimhan Committee:

- Committee suggested a strong banking system especially in the context of capital Account Convertibility (CAC). The committee cautioned the merger of strong banks with weak ones as this may have negative effect on stronger banks.
- It suggested that 2 or 3 large banks should be given international orientation and global character.
- There should be 8 to10 national banks and large number of local banks.
- It suggested new and higher norms for capital adequacy.
- To take over the bad debts of banks committee suggested setting up of Asset Reconstruction Fund.
- A board for Financial Regulation and supervision (BFRS) can be set up to supervise the activities of banks and financial institutions.
- There is urgent need to review and amend the provisions of RBI Act, Banking Regulation Act, etc. to bring them in line with current needs of industry.
- Net Non-performing Assets for all banks was to be brought down to 3% by 2002.
- Rationalization of bank branches and staff was emphasized. Licensing policy for new private banks can be continued.
- Foreign banks may be allowed to set up subsidiaries and joint ventures.

On the recommendations of committee following reforms have been taken:

New Areas

New areas for bank financing have been opened up, such as: - Insurance, credit cards, asset management, leasing, gold banking, investment banking etc.

New Instruments

For greater flexibility and better risk management new instruments have been introduced such as: -Interest rate swaps, cross currency forward contracts, forward rate agreements, and liquidity adjustment facility for meeting day-to-day liquidity mismatch.

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Risk Management

Banks have started specialized committees to measure and monitor various risks. They are regularly upgrading their skills and systems.

Strengthening Technology

For payment and settlement system technology infrastructure has been strengthened with electronic funds transfer, centralized fund management system, etc.

Increase Inflow of Credit

Measures are taken to increase the flow of credit to priority sector through focus on Micro Credit and Self Help Groups.

Increase in FDI Limit

In private banks the limit for FDI has been increased from 49% to 74%.

Universal Banking

Universal banking refers to combination of commercial banking and investment banking. For evolution of universal banking guidelines have been given.

Adoption of Global Standards

RBI has introduced Risk Based Supervision of banks. Best international practices in accounting systems, corporate governance, payment and settlement systems etc. are being adopted.

Information Technology

Banks have introduced online banking, E-banking, internet banking, telephone banking etc. Measures have been taken facilitate delivery of banking services through electronic channels.

Management of NPAs

RBI and central government have taken measures for management of non-performing assets (NPAs), such as corporate Debt Restructuring (CDR), Debt Recovery Tribunals (DRTs) and Lok Adalts.

Mergers and Amalgamation

In May 2005, RBI has issued guidelines for merger and Amalgamation of private sector banks.

Guidelines for Anti-Money Laundering

In recent times, prevention of money laundering has been given importance in international financial relationships. In 2004, RBI revised the guidelines on know your customer (KYC) principles.

Managerial Autonomy

In February. 2005, the Government of India has issued a managerial autonomy package for public sector banks to provide them a level playing field with private sector banks in India.

Customer Service

In recent years, to improve customer service, RBI has taken many steps such as Credit Card Facilities, banking ombudsman, settlement of claims of deceased depositors etc.

Base Rate System of Interest Rates

In 2003 the system of Benchmark Prime Lending Rate (BPLR) was introduced to serve as a benchmark rate for banks pricing of their loan products so as to ensure that it truly reflected the actual cost. However the BPLR system tell short of its objective. RBI introduced the system of Base Rate since 1st July, 2010. The base rate is the minimum rate for all loans. For banking system as a whole, the base rates were in the range of 5.50% - 9.00% as on 13th October, 2010.

Performance of Public Sector Banks, New Private Sector Banks & Foreign Banks in India

After the introduction of reforms the performance of all banks in India have improved. The comparative performance of public sector banks, new private sector banks and foreign banks is given below:-

Productivity of Commercial Banks

Productivity is related to profitability. Productivity is analysed in terms of business per employee, profit per employee and business per branch. Let us Explain:-

Business Per Employee

In public sector banks the business per Employee has increased from Rs. 324.1 lakh in 2005-06. The business per employee in the new private sector banks was Rs. 728.9 lakhs in 2005-06 and it was Rs. 1012.8 lakh in foreign banks in 2005-06.

Business Per Employee

(Rs. in lakh)

Year	Public Sector Banks	New Private Sector Banks	Foreign Banks
1997-98	88.5	785.9	529.4
2005-06	324.1	728.9	1012.8

Source: New Century Publications, 2008

From above we can see that as compared to new private sector banks and foreign banks the performance of public sector banks is very low.

Profit Per Employee

In public sector banks the business per employee has increased from Rs. 88.5 lakh in 1997-98 to 2.9 lakh in 2005-06. In new private sector banks it was Rs. 6.3 lakhs and in foreign banks profit was Rs. 26.5 lakh in 2005-06. The profits per employee is the highest in foreign banks followed by new private sector banks.

Profits Per Employee

(Rs. in lakh)

Year	Public Sector Banks	New Private Sector Banks	Foreign Banks
1997-98	0.7	11.4	4.5
2005-06	2.9	6.3	26.5

Source: New Century Publications, 2008

Business Per Branch

In India, business per branch has been increasing. In 2004-05 per branch business was Rs. 4,242 lakh in nationalized banks, Rs. 7,454 lakh in SBI and its associates, Rs. 21,656 lakh in new private sector banks and Rs.1, 14,768 lakh in foreign banks.

Business Per Branch

(Rs. in lakh)

Year	Nationalized Banks	SBI and its Associates	New Sector Pvt. Banks	Foreign Banks
1999-2000	2,152	2,860	14,989	54,800
2004-2005	4,242	7,454	21,656	1,14,768

Source: New Century Publications, 2008

The per branch business is lower in public sector banks as compared to new private sector banks and foreign banks. After the introduction of reforms the productivity of public sector Banks have started to rise.

Profitability of Commercial Banks

Profitability of commercial Banks has been shown by following indicators:-

Interest Income Ratio

Interest Income Ratio (as percentage of total assets) of public sector banks has fallen from 8.8% in 2000-01 to 6.90% in 2009-10 and of foreign banks from 9.3%, in 2000-01 to 6.09% in 2009-10. New private banks has fallen marginally from 8.2% in 2000-01 to 7.07% in 2009-10.

Interest Expanded Ratio

Interest expanded Ratio (as percentage of total assets) has fallen for all groups. It has fallen for foreign banks from 5.6% in 2000-01 to 2.06% in 2009-10. For Public sector banks it has fallen from 6% to 4.77% and new private sector banks from 6% to 4.21% during same period.

Intermediation Cost to Asset Ratio (ICAR)

The ICAR of public sector banks has fallen from 2.7% in 2000-01 to 1.49% in 2009-10. For new private sector banks it has risen from 1.7% to 2.04% and for foreign banks again it has fallen from 3% to 2.56% for same period.

Return on Assets

It is rate of net profit to total assets. The ROA of all banks has risen. For public sector banks it has risen from 0.4% in 2000-01 to 0.88 in 2009-10. For new private sector banks it has risen from 0.8% to 1.22%, and foreign banks from 0.9% to 1.09% for the same period.

Net / Spread interest Margin

Spread is an important indicator of efficiency. In 2000-01 the spread interest margin of public sector banks was 2.9%, new private sector Banks was 2.1% and foreign banks was 3.6%. In the year 2009-10the public sector banks spread is of 2.13%, new private sector banks is 2.86% and the highest spread is of foreign banks 4.035.

Asset Quality

Asset quality of banks is shown by the level of non-performing assets (NPAs).

Gross and Net NPAs of Commercial Banks

(As at end of March)

Banks	Total NPAs as % to Total Advances		Net NPAs as % to Net Advances	
	2009	2010	2009	2010
Public Sector	1.97	2.19	0.94	1.10
New private Sector	3.05	2.87	1.40	1.09
Foreign Banks	3.80	4.29	1.81	1.82

Source: - RBI Website

The gross NPAs as percent of total advances and net NPAs as percent of net advances of public sector banks have declined marginally in 2010 and that of new private banks and foreign banks have increased. In case of public sector banks the gross NPA ratio was 2.19% and net NPA ratio was 1.10% in 2010. For new private sector banks the gross NPA ratio decreased from 3.05% to 2.87% and net NPA ratio decreased from 1.40% to 1.09% during 2009 and 2010. The gross NPA ratio of foreign banks rose to 4.29% in 2010 and net NPAs rose to 1.82% in 2010.

Financial Soundness

The Capital Adequacy ratio (CAR) is the most important indicator of financial soundness of banks. As on 31st March, 2009, all commercial banks in India have become Basel II complaint. Under Basel II Indian Banks have to maintain a stipulated minimum capital to Risk Weighted Assets Ratio (CRAR) of 9%. The CRAR of Indian banks has risen from 14% at end March 2009 to 14.5% at end March 2010.

Customer Services

Indian banks have begun to offer many financial services to clients / customers. Core banking Solutions (CBS) is increasing very fast. Under CBS, a number of services are provided like: - anywhere banking, 'everywhere access' and quick transfer of funds in an efficient manner and at reasonable cost. The no. of branches of PSBs that have implemented CBS increased from 79.4% in March 2009 to 90% at the end of March 2010.

New Technology in Banking

The IT (Information Technology) has changed the Indian structure of Indian Banking. Technology has been identified by banks as an important element in their strategy to improve productivity and render sufficient customer service. In banking computerization has taken place all over the world. The purpose is to bring technology to the counter and to enable Employees to have information at their fingertips. The New technologies that are being used in banks are:-

Electronic Fund Transfer (EFT)

It is easy transfer of funds from one place to another. It enables the beneficiary to receive money on same day or next day. The customer can transfer money instantly from one bank to another, from one bank account to another or from one branch to other or a different bank not only within the country but also anywhere else in t5hre world through electronic message.

Credit Card

Credit Card (post Card) is a convenient medium of exchange. With the help of credit card a customer can purchase goods and services from authorized outlets without making immediate cash payments but, within the prescribed limit.

Debit Card

Debit Card is a prepaid card and it allows customers anytime anywhere access to his saving or current account. For using debit card a PIN (Personal Identification Number) is issued to customers. Any transaction taking place is directly debited to the customer's bank account.

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Phone Banking

In phone banking a customer can do entire non-cash related banking services on telephone, anywhere at any time. He can talk to a phone banking officer for transacting a banking business.

Tele Banking

Tele banking is a 24 hour banking facility based on the voice processing facility available on bank computers. Here banking services or products are rendered through telephone to its customers.

Internet Banking

Internet banking is on-line banking. It is a product of E-commerce. Internet banking enables customers to open accounts, pay bills, know account balances, view and print copies of cheques, stop payments etc.

Mobile Banking

Everybody with a mobile phone can access banking services, irrespective of their location. It is an extension of Internet banking. It provides services like account balance, mobile alerts about credit card or debit card transactions, mini account statement etc.

Door Step Banking

Here, there is no need for customer to visit the branch for getting services or products from the bank. This means banking services and products are made available to a customer at his place of residence or work.

Point of Sale (POS)

In an online environment the POS terminal is a machine that facilities transactions through swipe of a card.

ATMs

ATMs are emerging as the most useful tool to ensure 'any time banking' and 'anywhere banking' or 'anytime money'. ATMs are self-service vendor machines that help the banks to provide round the clock banking services to their customers at convenient places without visiting bank premises. The customers are provided with ATM card.

Virtual Banking

It means rendering banking and its related services through use of IT. Some of the most important types of virtual banking are:-ATMs, electronic fund transfer phone – banking, credit card, debit card, internet banking etc.

Electronic Clearing Services (ECS)

It is non – paper based movement of funds. It consists of Electronic Credit Clearing and Electronic Debit Clearing.

Conclusions

The banking sector reforms, which were implemented as a part of overall economic reforms, witnessed the most effective and impressive changes, resulting in significant improvements within a short span. The distinctive features of the reform process may be stated thus: (a) The process of reforms has all along been pre-designed with a long-term vision. The two Committees on financial sector reforms (Narasimham Committee-I and II) have outlined a clear long-term vision for the banking segment particularly in terms of ownership of PSBs, level of competition, etc. (b) Reform measures have been all pervasive in terms of coverage of almost all problem areas. In fact, it can be said that, it is difficult to find an area of concern in the banking sector on which there has not been a Committee or a group. (c) Most of the reform measures before finalization or implementation were passed through a process of extensive consultation and discussion with the concerned parties. (d) Most of the reform measures have targeted and achieved international best practices and standards in a systematic and phased manner. (e) All the reform measures and changes have been systematically recorded and are found in the annual reports as well as in the annual publications of RBI on "Trend and Progress of Banking in India". To satisfy the growing demands from customers for high quality service, commercial banks will have to find out new ways and method to face new challenges. As banks are expanding in to virtual banking, supervision and audit will have to be strengthened. Banks will have to pay greater attention to fool proof security arrangements and systems to safeguard against frauds.

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ASCENT INTERNATIONAL JOURNAL FOR RESEARCH ANALYSIS

(A Bi-lingual Multi Disciplinary Peer Reviewed International Quarterly Journal)

NAVBHARAT MEMORIAL FOUNDATION
(A tribute to Late Shri Narendra Singh Kothari)

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M — Commerce (Mobile Commerce) in India

*Dr. Mrinali Kankar
**Dr. Vishal Gauttam

Abstract: India has a huge opportunity for mobile commerce. This is the first time a majority of Indians are getting connected to the internet. They are discovering products at costs that are lower than they've never seen before, and they are getting products that were not available in their market before. As 2016 begins, Mobile Commerce in India is undergoing an exciting transition. The country has seen an impressive rise in everyday commerce conducted via mobile devices. The Mobile Commerce market in India is witnessing increasing collaboration between service providers and banks. Most of the mobile service operators are having tie-ups with leading banking service providers to provide mobile payment facilities. The ubiquity, reach-ability, mobility and flexibility features of M-Commerce have increased the mobile users and mobile internet subscribers in India. M-Commerce is implemented through mobile applications. People are using mobile applications instead of web application for utility bill payment, ticket booking, fund transfer, email and so on. Thus M-Commerce is replacing E-commerce. With these advantages M-Commerce have disadvantages such as tiny screen of device, weak processors, limited memory, poor resolutions, poor data entry, and lack of WAP-enabled devices, expensive data speed, and shortage of bandwidth. This paper sheds light on the M-Commerce, its applications, advantages, disadvantages and the growth of M-Commerce in India.

Introduction

Development of M-Commerce in India has seen a great upturn in these recent years. The major reason for the same can be contributed to fast adoption of the new technology, fast internet service and ease of access on one tap, tabs and smart mobile phone based applications. Mobile Commerce refers to wireless electronic commerce used for conducting commerce or business through a handy device like cellular phone or tablets. It is also said that it is the next generation wireless e-commerce that needs no wire and plug-in devices. Mobile commerce is usually called as 'm-Commerce' in which user can do any sort of transaction including buying and selling of the goods, asking any services, transferring the ownership or rights, transacting and transferring the money by accessing wireless internet service on the mobile handset itself. Presuming its wide potential reach all major mobile handset manufacturing companies are making WAP enabled smart phones and providing the maximum wireless internet and web facilities covering personal, official and commerce requirement to pave the way of m-commerce that would later be very fruitful for them. The major reason for the growth of M-commerce is the age bracket of young generation which is tech savvy, have money to spend and want everything done in some seconds. M-Commerce is E-

commerce on mobile phones. E-Commerce introduced Anytime online transactions and M. Commerce introduced Anytime Anywhere online transactions. Different types of on-line transactions are carried out using mobile phones, mobile applications and internet. People can carry and access mobile phones with preserving the privacy anytime anywhere. Thus, ubiquity, mobility, flexibility, reach ability features of M-Commerce make people possible to do shopping, search various products, transfer funds, ticket booking, utility bill payment anytime anywhere. Mobile money transfer, Mobile ticketing, Mobile vouchers, coupons and loyalty cards, Mobile vouchers, coupons and loyalty cards, Location-based services, Information services are the M. Commerce services which the mobile subscribers can use through different mobile applications using internet.

M-commerce can be a huge success for the Indian market but this requires a complete ecosystem, partners must be synchronized so that the best benefits go to consumers and their confidence is assured. Although m-commerce market in India is in nascent stage, m-payment and m-banking segments have shown significant growth over the last few years.

Currently, users of m-commerce perform a wide variety of transactions via mobile from paying for utility bill and movie tickets to shopping and holidays. While the uptake of mobile payments is still gathering pace, services that are more accessible and easier to use are finding favor. For instance, Bharti Airtel and Axis Bank have a partnership for providing banking services through the Airtel Money platform. Similarly, Vodafone India has signed agreements with ICICI bank to launch mobile payment services. Such collaborations and partnerships are expected to grow and will support the market to grow.

M-commerce has several major advantages over its fixed counterparts because of its specific inbuilt characteristics such as personalization, flexibility, and distribution. Mobile commerce promises exceptional business, market potential and greater efficiency. In the current commerce industry, M-Commerce has been entered in finance, services, retails, tele-communication and information technology services. M-commerce seems attractive and convenient at first glance however, everything comes with several advantages and disadvantages, both. It is important to analyze advantages and disadvantages of m-commerce for consumers as well as companies. Some of the major advantages of m-commerce include convenience of use, reduce costs and increases personalization. On the other hand some of the major disadvantages of technology include small screen size of phones; apps are to be developed for each platform.

Advantages Of M-commerce

- **Convenience:** With just a few clicks on mobile devices, customers can already do shopping, banking; download media files and more than that. M-commerce also benefits retailers by many of their outstanding features compared with responsive website and mobile site. There is a large proportion of population using smart phones daily, especially in developed and developing countries. People are able to use mobile phones at every place to

use the services of e-commerce websites through the application provided by them. Majority of e-commerce giants have launched their mobile applications for the convenience of users. The small size and ease of use of mobile receivers, coupled with freedom from problems caused by infrastructure, makes for a higher degree of user convenience.

Flexible Accessibility: User can be accessible via mobile devices and at the same time be accessible online too through logging on to various mobile messengers and other networking platforms. On the other hand, the user may also choose not to be accessible by shutting down his mobile device, which at times can be a good thing.

Easy Connectivity: As long as the network signal is available, mobile devices can connect and do commerce transactions not only mobile to mobile but also mobile to other devices. No need for modem or WI-FI connectivity set up.

Personalization: Each mobile device is usually dedicated to a specific user so that it is personal. Users can do whatever they want with their handheld devices: modify the wallpaper, change view settings or modify contact information as you send emails or e-payments. It also increases personalization of shopping as generally people are able to use their own phone to utilize m-commerce facility. Like usage of Facebook and Gmail, users are able to shop through their own mobile phones.

Time Efficient: Doing M-commerce transactions do not require the users to plug anything like personal computer or wait for laptop to load.

Completely Customization: The service provider has access to data about the user's preferences and status which facilitates better, personalized service. In addition, the service provider can be constantly updated about the current status and location of the customer so that the service can be customized; for instance, a request for a certain product can be met with the nearest possible source.

Quicker access: Connecting through a mobile is faster than dial-up connections using wire line modems.

Electronic wallet: Analysts believe that easy mobile payment is one of the main prerequisites for the success of M-commerce, when the mobile phone can function as an electronic wallet for mobile payments, including micropayments, application developers and service providers will find it attractive to introduce new mobile communication services to the market.

Cost Friendly: M-commerce is also cost friendly for users because of the fact that mobile internet is generally cheaper as compared to internet services being used at laptops or computer through Wi-Fi connectivity or dongles etc.

Disadvantages of M-Commerce

Every invention has its own merits and demerits. It is applicable in this M-commerce business also.

- **Smartphone limitation:** Mobile has no big screen like desktop or laptops, so sometimes users tired to navigate more and more to choose just one item from thousands. It affects shopping rates. Smaller screen size and security concern generally lead consumers to opt for e-commerce over m-commerce. Screen size of smart phones is being increased by makers but it is sometimes inconvenient for users to analyze products on the basis of photos seen on small screens.

- **Habituate:** Every new technology has some problem at the starting phase. Here m-commerce is a new application, so sometimes people avoid changing which are rapidly changed. As they are habituated to buy products from ecommerce.

- **Risk factor:** Each business has its own risk. Same Mobile commerce is the growing field and a lot of investment in this field becomes risky. Because technology changes day by day. Moreover, there less security in the wireless network, so in data transfer hacking chances are more.

- **Connectivity:** Mobile commerce needs high-speed connectivity of 3G. Otherwise, it is become hectic for the user to go through entire product purchase process.

- **Wide range of Applications:** Disadvantage or the extra burden to be handled by companies includes the fact that there is a wide range of platforms in smart phones. Companies have to develop applications for all the platforms to cover market properly.

- **Probability of Fraud:** Another major issue for consumers is high probability of fraud. "Any one, good or bad, can easily start a business. And there are many bad sites which eat up customers' money. There is no guarantee of product quality. Mechanical failures can cause unpredictable effects on the total processes. As there is minimum chance of direct customer to company interactions, customer loyalty is always on a check."

Challenges To M-commerce In India

India is a developing country and there is huge potential for all sorts of businesses whether it is offline, ecommerce and m-commerce business. There are various factors that are in favour of M-commerce business in India such as there is a large proportion of young generation in the country that are interested in innovative ways of business like m-commerce, popularity of smart phones among people is rising and various domestic e-retailers are working hard to make consumers use mobile applications for placing orders from their portal. Despite of various factors working in favour of M-commerce in India, there are many challenges to be faced by business organizations.

...is a big feature in consumers' mind while shopping online through mobile applications. ...are risks associated with business whether it is offline or online, concepts of economics like ...demand, supply, market supply and competition etc. are always applicable on all sorts of ...businesses. Therefore, M-commerce is not a sure way of being successful in business activities.

Security: Increased number of cases of frauds due to hacking and theft of credentials of a user ...consumers to be concerned about security in m-commerce. Cash on delivery is a good option ...provided by portals to make consumers feel secure. However, cash on delivery especially for ...orders of significantly large amount leads to increase in risk for the service provider. Therefore, it ...important for companies to ensure that consumers trust on their transaction system and feel free ...carry out transaction. There are various security techniques and encryptions available to ...companies to ensure security. "GSM provides a relatively secure connection through the PIN ...(Personal Identification Number) when turning on the handset. An authentication protocol ...between handset and the network through SSL encryption of voice and data is what the ...technology can do today and what the consumer has been led to expect."

Business Risks: Despite of huge potential for businesses in Indian market, it is important for ...companies to note that people are looking for innovative ideas and better deals over internet. ...Another factor against m-commerce is that, consumers are ambiguous about quality of products ...especially the products in groceries, cloths and footwear segment. One major factor behind this is ...the quality of product, people are able to check for quality of products at store, as per their wisdom ...and knowledge and then decide if they should buy product or not. Because of this reason, ...customers do not find shopping groceries online as a convenient way. Size of smart phones is ...increasing rapidly but still there are times when people are not able to observe and analyze ...products easily on mobile screen. Therefore, it is difficult for companies to convince consumers ...that they are going to get high quality products with lower prices as compared to deals provided at ...brick and mortar stores. Domestic e-commerce giants of India such as Flipkart and Snapdeal have ...launched their mobile applications to enable consumers get services through smart phones. ...Paytm is another leading company in m-commerce field. Companies are providing discounts and ...other types of offers for consumers ordering using mobile applications.

Future Perspectives Of M-commerce

After looking at various aspects regarding m-commerce and analyzing various pros and cons of M-commerce, it is important to see future perspectives of m-commerce. Advantages of m-commerce are expected to surpass the disadvantages and it is expected that m-commerce will be widely used for shopping, mobile recharges and DTH recharges etc. Technology is in initial phase and work is in progress to make transactions more secure. Smarts phones are very popular and are gaining much more popularity day by day. Convenience of "any time anywhere use" is greatest strength of M-commerce and people are accepting this innovative way of shopping.

Conclusion

M-commerce is the latest way of shopping being popular among large population. Day by day E-commerce and M-commerce playing very good role in online retail marketing and peoples using this technology day by day increasing all over the world. Mobile commerce involves all kind of electronic transactions by the use of mobile phone. M-commerce is the term for making business transactions using mobile devices. There are already several existing M-commerce applications and services nowadays that have been very helpful to us. Some are mobile banking, location maps, and variety of news, mobile shopping, ticketing and mobile file sharing. There are various advantages of M-commerce that are helping companies to adopt this route; also the convenience of its usage is attracting consumers. However, there are certain challenges to be faced by companies in convincing consumers about M-commerce's advantages and convenience. Overall, convenience of M-commerce is expected to surpass its little disadvantages and in future,M-commerce is expected to become much more popular.

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Impact of GST on the Economic Growth of India

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Abstract

GST system has already been implemented world wide around 150 countries and now India will catch up with global trends. The aim of this paper is to find out the impact of the introduction of such a tax in Indian economy. The GST is a long pending indirect tax reform which India has been waiting for, and which is hope to iron out the wrinkles in the existing system. GST is most logical steps towards comprehensive indirect tax reform therefore all sections of economy viz. big, medium, small scale units, intermediaries, importers, exporters, professionals and consumers shall be directly affected by GST. It will not only make the text system simpler, but will also help in increase compliance, boost text revenue, reduce tax outflow in the hands of the consumer and make export competitive. The challenges in the path of GST are critical but considering the features benefits and differences, the GST encompasses as compared to the present regime.

Key words: GST, IGST, CGST, SGST.

Introduction

The reference of GST was first made in the Indian Budget in 2006-07 by the then Finance Minister Mr. P. Chidambaram as a single centralized Indirect tax. The GST constitution Bill, 2014 was introduced on December 19, 2014 and Passed on May 6, 2015 in the Lok Sabha and yet to be passed in Rajya Sabha.

The introduction of such a tax in Indian Economy is a concrete step of Government of India as one of the biggest taxation reforms and is all set to integrate state economies and boost overall growth. It will also help in increasing the GDP of the country by 1-1.5%. Such a tax system has already been implemented world wide around 150 countries and India is catching up with the global trends. Introduction of a GST to replace the existing multiple tax structures of central and state taxes is very desirable by imperative in the emerging economic environment. The article gives power to legislature of every state and parliament to make laws with respect to goods and services tax where the supply of goods or of services take place.

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Objectives of the Study

Presently, the tax structure of India is very complex. Looking to the global developments and tax structure of developed countries, GST is the need of the hour. The need of GST can further be explained as India needs comprehensive levy and collection of both goods and services at the same rate with the benefit of input credit. A simple tax structure can bring greater compliance, thus increasing number of tax payers and in turn tax revenues of Government. The current state of Indian Economy demands fiscal consolidation and reduction in fiscal deficit. A recent report by CRISIL, states that GST is the country's best bet to achieve fiscal consolidation.

Research Methodology

The research is an attempt of the exploratory research based on the secondary data sourced from journals, magazines, articles and media reports.

Concept of GST

GST is a tax on goods and services with comprehensive and continuous chain of setoff benefits from the producer's point and service provider's point up to the retailer level. The proposed tax will be levied on all transactions involving supply of goods and services, except those which are kept out of its purview. These are two important purpose of GST.

- Single Umbrella Tax Rate: GST shall replace a number of indirect taxes being levied by Union and State Governments.

- Removing Cascading Effects: GST is intended to remove "Tax on Tax Effects" and provide for common national market for Goods and Services.

Salient Features of GST: Inspite of basic purpose there are some more silent features of GST.

1   Subsuming of Central Taxes:
    It is provided that GST shall subsume various Central indirect taxes and levies such as Central Excise Duty, Customs Duty.

2   Subsuming of State and other Taxes:
    It is provided that GST shall also subsume Taxes such as State Value Added Tax/Sales Tax, Entertainment Tax, Central Sales Tax, Octori and Entry Tax, Purchases Tax, Luxury tax, State cesses and surcharges in so far as they relate to supply of goods and services.

3   Integrated Goods and Services Tax [IGST] :
    Clause 269A of the Bill provides for levy of Goods and Services Tax on supplies in the course of inter-state trade of commerce. Such Tax shall be levied and collected by Government of India and thereafter shall be apportioned between the Union and the States in the manner as may be provided by parliament by low on the recommendations of the GST council.

4   No Surcharge levy on GST:
    Clause 271 of the Bill which empowers the Parliament to increase any duties or taxes by surcharge for the purpose of Union has been amended in the bill by providing, an exception to GST under Clause 246A.

5 **Scope of GST:**

GST shall cover all goods and services, except alcoholic liquor for human consumption, for the levy of goods and services tax.

6 **Working of GST Council:**

- It is further provided that every decision of the council shall be taken by a majority of not less than three-fourths of the weighted votes of the members present and voting. This has been illustrated in the Bill.

- One half of the total number of Members of the Council shall constitute the quorum as its meetings.

- While discharging the functions conferred by Article 279A, the GST Council Shall be guided by the need for a harmonized structure of goods and services tax and for the development of a harmonized national market for goods and services.

- The Council is also vested with some recommendatory powers in Article 279A (4).

7 **Dispute Resolution Mechanism:**

The present bill empowers the GST Council to decide the modalities of resolving disputes arising out of its recommendations. This is a clear departure from previous proposal of having a separate GST Dispute Settlement Authority.

8 **Compensation to States:**

It is provided that the Parliament may, by law, on the recommendation of the Goods and Services Tax Council, provide for compensation to the States for loss of revenue arising on account of implementation of the goods and services tax for such period which may extend to five years.

Expected Scheme of GST: It can be understood in following points:

- **Dual Model:** GST shall have two components Central GST and State GST. The rates of which will be prescribed separately keeping in view revenue considerations, tax burden and acceptability of the tax.

- **Cross Utilization:** Input from CGST and SGST can be utilized for payment of CGST and SGST. Cross Utilization between these two will not be allowed except in case of Inter-state supply of goods and services.

- **Carry Forwards of CENVAT and VAT Credit:** It is expected that in transition phase, the credit is allowed to be carried forward.

- **Common Threshold Limit:** This shall apply to both CGST and SGST. Dealers with a turnover below its, would be exempt from tax. A compounding option (i.e. to pay tax at a flat rate without credits) would be available to small dealers below a certain threshold. The exemption and compounding provision would be optional.

Impact of GST on the Economic Growth of India

GST Registration: It is expected that each taxpayer would be allotted PAN-linked taxpayer identification number with a total of 13 to 15 digits. Thus, a combination of PAN being 10 digit number, two digits for state code and one or two check number for disallowing of fake numbers may be used.

GST Invoice: Invoice is essential part of imposing and enforcing GST Regime. It should be standardized across all state so as contain a minimum of information about the supply being invoiced.

Return: The taxpayer would need to submit common format for periodical returns, to both the Central and to the concerned State GST authorities.

GST Payment: Collection of GST being dominant source of revenue therefore it should be designed in such a periodic manner that it ensures proper flow of revenue to both Centre and State and at the same time minimize the burden on the taxpayer.

GST Rate: Combined GST rate is being discussed by the Government. The Revenue neutral rate is expected around 16%. After the total GST rate is arrived the centre and state will decide on the CGST and SGST rate.

GST Refund: Refund of unutilized CGST and SGST is to be completed in time bound manner. The procedure and timeline are yet to be clarified.

Assessment etc. : The function of assessment, enforcement, scrutiny and audit would be undertaken by the authority collecting the tax with information sharing between Centre and State.

Challenges for Success of GST in India

GST will be the biggest reform in Indian taxation since 1947, but there are many challenges for its successful implementation. These are as under:

- **Passing of Bill in Rajya Sabha:** Since Central Government is not having sufficient majority in the Rajya Sabha. Thus, it will have to ensure safe passage as it will not be cake-walk for the Union government to pass the Bill in the Upper House of Parliament.
- **Consent of States:** For implementing it is critical that GST bill is passed by the respective state Governments in state assemblies so as to bring majority. This is a herculean task.
- **Revenue Neutral Rate (RNR):** It is one of Prominent Factor for its success. It is well know that in GST regime, the government revenue would not be the same as compared to the current system. Hence, through RNR Government is to ensure that its revenue remains the same despite of giving tax credits.
- **Threshold Limit in GST:** While achieving broad based tax structure under GST, Both empowered committee and Central Government must ensure that lowering of threshold limit should not be a "taxing" burden on small businessmen in the country.
- **Robust IT Network:** Government has already incorporated Goods and service tax network (GSTN). GSTN has to develop GST portal which

ensure technology support for registration, return filing, tax payments IGST settlements etc. Thus there should be a robust IT backbone.

- **Extensive Training to Tax Administration Staff:** GST is absolutely different from existing system. It, therefore, requires that tax administration staff at both Centre and state to be trained properly in terms of concepts, legislation and Procedure.

Present Regime vs GST Regime.

S. No.	Issues	Present Regime	GST Regime
1.	Broad scheme	There are separate laws for separate levy. For e.g. Central Excise Act, 1944, respective State VAT laws.	There will be only one such law because GST shall subsume various taxes as specified above.
2.	Tax rates	There are separate rates. For e.g. Excise 12.36% and Service Tax 14%	There will be one CGST rate and a uniform rate of SGST across all states.
3.	Cascading effect	This Problem arises because credit of CST and many other taxes not allowed.	This situation will not arise as CST concept is being eliminated with introduction of IGST.
4.	Tax burden	Under present scenario, tax burden on tax payer is high.	Under this, tax burden is expected to reduce since all taxes are integrated which make it possible the burden to be split equitably between manufacturing and services.
5.	Cost Burden on Consumers	Due to presence of cascading effect certain taxes become part of cost.	As GST mechanism removes such effect by providing credit, cost burden is reduced.
6.	Concurrent Power	At present, there is no such power to both Centre and State on same subject tax matter.	Both Centre and Sate are vested with the power to make law on GST by virtue of proposed Article 246A of the Constitution.
7.	Compliance	Tax compliance is complex because of multiplicity of laws and their provision to be followed.	Tax Compliance would be easier as only one law subsuming other taxes need to be followed.
8.	Transparent Tax Administration	Presently, tax is levied at two stages in broad manner i.e. 1. When product moves out of factory. 2. At retail outlet.	GST is to be levied only at final destination of consumption and not at various points. This brings more transparency and corruption free tax administration.

Conclusions

GST is most logical steps towards comprehensive indirect tax reform therefore all sections units, intermediaries, importers, exporters, professional and consumers shall be directly affected by GST.

It will not only make the tax system simpler, but will also help in increased compliance, boost tax revenue, reduce tax outflow in the hands of the consumer and make export competitive.

We note that the challenges in the path of GST are critical but considering the features, benefits and differences, the GST encompasses as compared to the present regime, it can be concluded that GST will prove to be a success for India.

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(A Bi-lingual Multi Disciplinary Peer Reviewed International Quarterly Journal)

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NAVBHARAT MEMORIAL FOUNDATION

(A tribute to Late Shri Narendra Singh Kothari)

IV

parative Study of The Public and Private Sector Bank
cial Reference to Punjab National Bank and ICICI Bank

**Dr. Vishal Gauttam
*Dr. Mrinali Kankar

Abstract

economic development of a country mostly depends upon the efficient banking system they play significant role in the effort to attain stable prices, high level of employment and economic growth. Hence, banking can better be described as the kingpin of the chariot of omic progress. In recent years, there have been considerable pressures on the profitability of nks. Profitability is considered to be an index of financial strength. Profitability is a key performance parameter in banking sector, which reflect efficient utilization of all resources in an organization. The present research paper is an effort to make a comparative study between the growth rate in Punjab National Bank and ICICI Bank as both the banks are giant banks in public and private sector. As a study of Growth analysis of both the banks for a period of 5 years, i.e., from 20011 to 2016 is made. The main parameters of growth in banks are Net profit growth, Net assets growth, and NPA.

Keywords: Growth, Compound Annual Growth Rate (CAGR), Net Assets, Net Profit, Non Performing Assets (NPA)

Introduction

Banking sector plays an important role in economic development of a country because it is one of the major financial pillars of the financial sector, which plays a vital role in the functioning of the economy. The banking sector's performance is seen as the replica of economic activities of the nation as a healthy banking system acts as the bedrock of social, economic and industrial growth of a nation. Banks are considered to be very important financial mediators or institutions because they result into wellbeing of saver as well as investors. In modern economy banks play the role of leaders of development. They play an important role in mobilization of deposits and disbursement of credit to various sectors of economy. Hence, banking can better be described as the kingpin of the chariot of economic progress. The banking system of India is featured by a large network of bank branches, serving many kinds of financial services of the people. As regards Punjab National Bank, it was established in 1895 and it holds the distinction of being the first Indian bank to have been started exclusively with Indian capital. Bank has strong capital base with capital adequacy ratio 11.28% as in march 2016. The bank has paid up capital of 392.72 crore as on march 2016. As regards ICICI Bank, it was originally promoted in 1994 by ICICI limited, an Indian financial institution, and was its wholly- owned subsidiary. The paid up share capital as on march 2016 is 1162.95 crore its capital adequacy ratio as on march 2016 is 16.64%.

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29.1

Net Profit/loss Growth Rate

Net profit is another base for comparing the growth of these two banks Punjab National Bank and ICICI Bank. Net profit growth in respect of Punjab National Bank and ICICI Bank has been calculated by taking Net profit after tax, so as to adjudge the absolute growth of net profit after tax.

Table 2: Net Profit/ (loss) Growth

Year	Punjab National Bank		ICICI Bank	
	Net Profit in lac	% Increase/Decrease Profit over previous years	Net Profit in lac	% Increase/Decrease Profit over previous years
2011-12	488420	-	646526	-
2012-13	474767	-2.7	832547	28.7
2013-14	334258	-29.5	981048	17.83
2014-15	306158	-8.4	1117535	13.9
2015-16	-397440	-229.8	972629	-12.9

Net profit growth rate of Punjab National Bank is -195% and the ICICI Bank is 8.51%. This implies that performance of ICICI Bank is better times as Punjab National Bank in corresponding years.

In 2012-16 Punjab National Bank has shown a negative growth in the profit which is -2.7, -29.5, -8.4 and -229.8 respectively, as compared to ICICI it is very low. The net profit of both the banks ICICI Bank indicate annual compound growth rate of 8.51% where as Punjab National Bank shows -195% (graph 2)

Graph 2 Net Profit of Punjab National Bank and ICICI Bank

NPA (Non Performing Assets)

NPA (non-performing assets) is related to banking and finance term. When bank or finance company is unable to recover its lent money from borrower in 90 days than that amount which have not been recovered will be treated as NPA. It represents bad loans, the borrowers of which failed to satisfy their repayment obligations.

Types of NPA

Gross NPA: Gross NPA are the sum total of all loan assets that are classified as NPA as per RBI Guidelines as on Balance Sheet date. Gross NPA reflects the quality of the loans made by banks.

Gross NPA Ratio = Gross NPA / Gross Advances

Net NPA: Net NPA shows the actual burden on banks. Net NPA are those type of NPA in which the bank has deducted the provision regarding NPA. Net NPA is obtained by deducting items like interest due but not recovered, part payment received and kept in suspense account from Gross NPA.

From table 3, in Punjab National Bank highest Gross NPA is 12.9% in 2015-16 where as lowest is 2.93% in 2011-12 and same data in ICICI Bank are 5.82% in 2015-16 and 3.03% in 2013-14 respectively.

From table 3, in Punjab National Bank highest Net NPA is 8.61% in 2015-16 where as lowest is 1.52% in 2011-12 and same data in ICICI Bank are 2.98% in 2015-16 and 0.73% in 2011-12 respectively. From the observation ICICI Bank performance better than Punjab National Bank.

Year	Punjab National Bank		ICICI Bank	
	Gross NPA %	NET NPA %	Gross NPA %	NET NPA %
2011-12	2.93	1.52	3.62	0.73
2012-13	4.27	2.35	3.22	0.77
2013-14	5.25	2.85	3.03	0.97
2014-15	6.55	4.06	3.78	1.61
2015-16	12.90	8.61	5.82	2.98

Table 3: Ratio of Gross & Net NPA to Total Advances
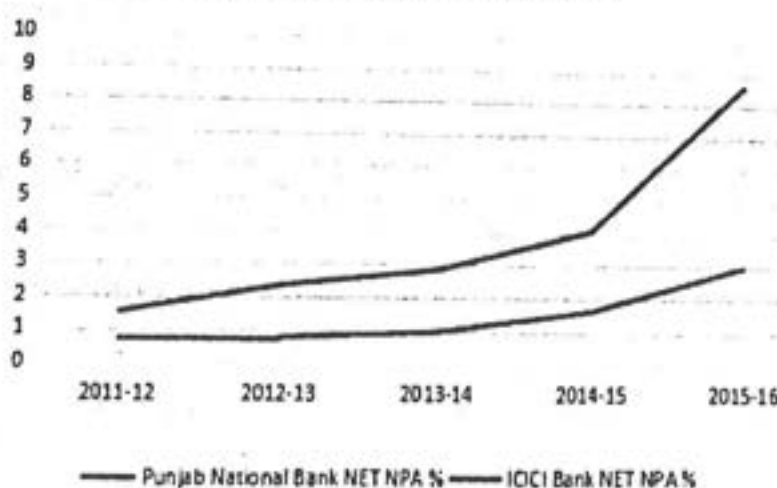
Graph 3 Net NPA of Punjab National Bank & ICICI Bank

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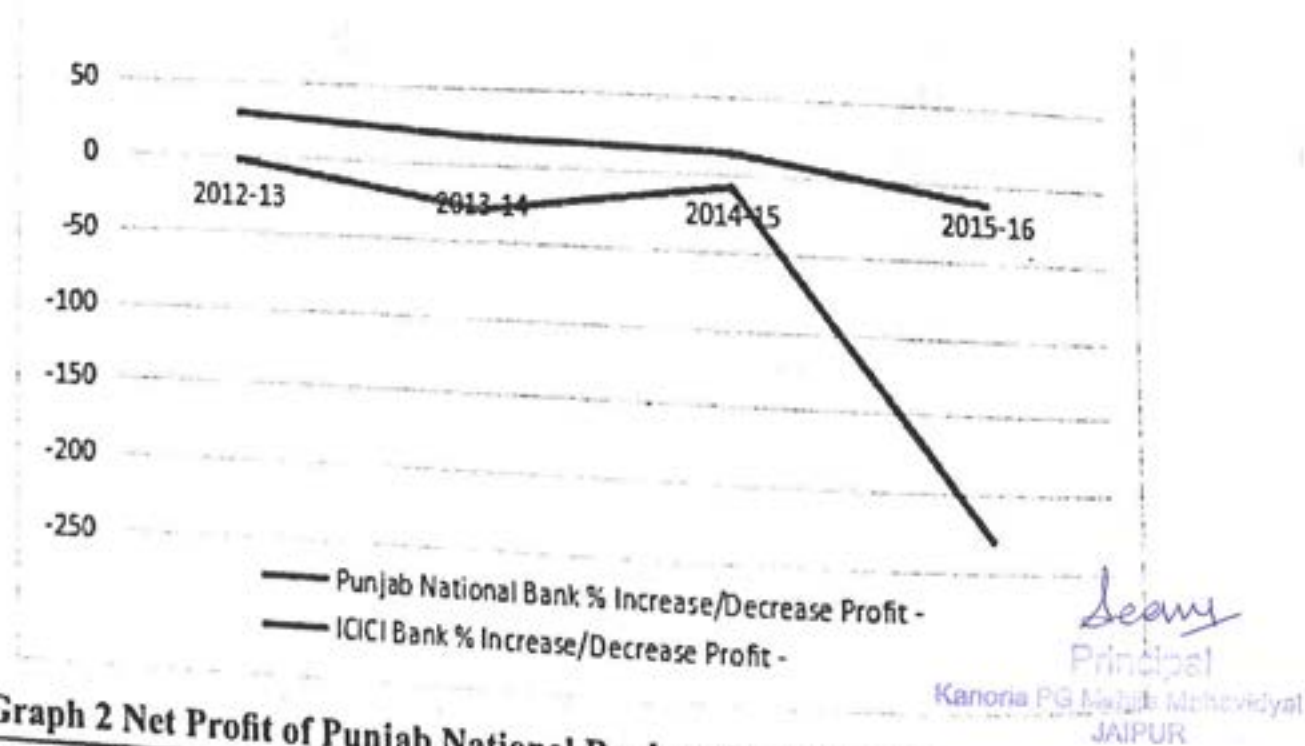
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Findings

(a) Compound annual growth rate of net assets indicated that net assets of ICICI Bank increased quicker than that of Punjab National Bank.

(b) CAGR reveals that the Net Profit of Punjab National Bank had negative growth rate during corresponding years.

(C) Gross NPA & Net NPA of Punjab National Bank had increased every year. It causes an adverse effect on the liquidity of Bank.

Conclusion and Suggestions

Net Assets of ICICI Bank show annual compound growth rate of 7.55% which is higher than Punjab National Bank that is 6.11%. While comparing the net profit of both the banks, ICICI Bank indicate annual compound growth rate of 8.51% whereas Punjab National Bank shows -195%. There is huge difference between profit of both banks, as the net profit of Punjab National Bank from 2013 to 2016 and ICICI Bank for 2015-16 indicates negative growth rate.

Net NPA ratio of both the banks indicate the true story of the banks that how much loan are bad and how much is recovered, who is managing its NPA more efficiently to lower it down to maximize the true profit shown in table 3. Punjab National Bank has higher net NPA ratio that is 8.61% whereas ICICI Bank has 2.98% having large gap. So every basic of data establishes that ICICI as compared to Punjab National bank. Therefore, it can easily be concluded that growth in ICICI Bank is better than Punjab National Bank.

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29.7

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Comparing Stress Levels in Female Doctors of Selected Public and Private Sector Hospitals

Dr. Surabhi sharma[*]
Manish Kumar Sharma[**]

Abstract

The health care industries have experienced profound changes, during the past several decades. Doctors in health care profession and a major component of health care delivery system is significantly affected by changes in health care industry. Thus, they undergo tremendous stress in their occupational life as well as their personal life. The present study was aimed to focus to measure level of stress in female doctors of public and private sector hospitals. For the present study, total sample was taken as 300 female doctors from public and private sector hospitals. Convenient sampling technique was used to collect data through standardised self-made questionnaire. The result indicates that female doctors were working in private sector hospitals are more stressed than female doctors were working in public sector hospitals.

Keywords: Health, Stress, Hospital, Behaviour

Introduction

Concept of stress was first introduced in the life sciences by Selye Hans in 1936. It was derived from the Latin word 'stringere'; it meant the experience of physical hardship, starvation, torture

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and pain. Selye Hans, 1936 defined stress as "the non-specific response of body to any demand placed upon it".

Stress affects not only physical health but mental well-being, too. To successfully manage stress in everyday lives, individual can learn to relax and enjoy life. The best way to manage stress is to prevent it. This may not be always possible. So, the next best things are to reduce stress and make life easier.

Stress refers to any environmental, organisational and individual or internal demands, which require the individual to readjust the usual behaviour pattern. Degree of stress results from events or situations that have potential to cause change. Stimuli or situations that can result in the experience of stress are called stressors. There are three major sources of stress- environmental, individual and organisational. Environmental stress is not only caused by the factors intrinsic to job, but also influenced by the environmental or extra organisational factors. Stress results because of the individual's interaction with environmental stimuli or factors such as societal or technological changes, political and economic uncertainties, financial condition, community conditions etc. The stress which an individual experiences in an environment is carried with him in another environment also, therefore, increasing the stress and causing stress to others also. There are many factors at the level of individual which may be generated in the context of organisational life or his personal life like life and career change, personality types, role characteristics. Any change in career life of an individual puts him in disequilibrium state of affairs and he is required to bring equilibrium. In this process individual experiences stress. Personality type/ characteristic such as authoritarianism, rigidity, masculinity, femininity, extroversion, spontaneity, locus of control are particularly relevant to individual stress. When people become members of several system like family, voluntary organisation, work organisation etc., they are expected to fulfill certain obligations to each system and to fit into defined places

in the system. These various roles may have conflicting demands and people experiences role stress as they are not able to fulfill the conflicting demands or requirements.

Stress has been considered as one of the major factors in work organisation (Agarwal et al., 1979). Sources of stressors in the employment organisation identified by Pestonjee (1992) are work, role, personal development, interpersonal relations and organisation climate.

It is interesting to note that, stress has two faces. It is a good servant, but a bad master. In other words, it can be one's best friend or worst enemy. A certain amount of stress is necessary to achieve success, but undue stress causes distress. Although, people tend to think of stress as caused by external events, events in themselves are not stressful. Rather, it is the way in which an individual interpret and react to events that makes them stressful. Stress is received by different people differently. If two people experience the same amount stress or pressure, one may take it as positive or healthy types or the other may accept it as negative. Stress is often referred to as having negative connotation. The calamitous consequences of stress can affect an individual in three ways i.e. physiological, psychological and behavioural. Mental stress may be accompanied by anger, anxiety, depression, nervousness, irritability, tension and boredom. Physical stress is accompanied by high blood pressure, digestive problem, ulcers and indigestion, palpitation, chest pain, skin disorder muscle tension, head ache, loss of appetite, restlessness, ulcers, shut down of menstrual cycle, impairment of fertility among male and depletion of vitamin C,B and D in the body. Behavioural Stress may be symptomised in the behaviour such a overeating or under eating, loneliness, sleeplessness, absenteeism, alcohol consumption, increased smoking and drug abuse.

Further the stress can affect either positively or negatively to employee performance. Positive qualities are those in which the individual may feel

more excited and agitated and perceive the situation positively as a form of challenge (Selye, 1956). Stress is also described as posing threat to the quality of work life as well as physical and psychological well-being (Cox, 1978). A high level of occupational stress, not only detrimentally influence the quality, productivity and creativity of the employees but also employee's health, well- being and morale (Cohen and Williamson, 1991) Job related stress tends to decrease general job satisfaction. Stress can be either temporary or long term, mild or severe, depending mostly on how long it continues, how powerful they are and how strong the employee's recovery powers are. But major stress problems are sustained for long period. If one does not react to the stress, it may create some other Trauma. It is another severe form of stress. The nature of loss may have an effect on the individual's perception of the stressful events as well as the avoidance, intrusion and hyper arousal symptoms of post-traumatic stress. The specific stress experienced by people, often depends on nature and demands of setting in which people live. Thus, teachers, engineers, doctors, managers and people in other professions experience different types of stresses to different degrees. The professional role is extremely demanding because they serve to the society.

It is clearly understood that, though everyone faced stress at least once in life, it is still difficult to define the term of —stress. Through the centuries the concept of the stress was changing, obtaining new meaning or returning to the old definitions. Although, there were always two ways of stress and disease relation: from psychological to physiological problems and from the biological illnesses to mental disorder. So, at different periods of time —conditions like hysteria, passions, vapors, nerves, neurasthenia, worry, mental strain, and tension have been put forward as significant contributors of or explanations for disease. The life brings a lot of surprises and put in difficult condition every day, succumbing to great stress which leads to a disease, and it does not matter what century

it is. Stress is biological factor, describing the outcomes of disability to react appropriately to physical or emotional dangers to the organism, whether actual or imagined. Stress sets off an alarm in brain, which should respond by preparing the organism for defensive action. Signs of stress are divided into four types: physical, emotional, cognitive and behaviour. The most often met stress characteristics: general negative outlook, poor judgment, exaggerated worrying, continuous unhappiness, irritability, aggressiveness, inability to relax, feeling lonely or isolated, depressed. There are also some physical signs, for example aches and pains, dizziness, chest pain, rapid heartbeat. And finally changing habits: eating too much or not enough, sleeping too much or not enough, procrastinating or neglecting responsibilities, using alcohol, cigarettes, or drugs to relax, and nervous habits like nail biting or pacing.

Review of Literature

Roohafza, et al., (2012) explained job stress as the harmful physical and emotional responses which occurred when the requirements of the job do not match the capabilities, resources, or needs of the worker. Additionally, it has also been referred to as non-specific negative response of the body to demand in work place. Stress can be generally defined as undue, inappropriate or exaggerated response to a situation. According to Cardoso & Fernandes (2011) stress is a holistic concept and so is difficult to be specifically defined. From birth till death, individuals are subjected to the stressful circumstances .

Schwarzer (2009) stated that stress cannot result from any opportunity/challenge/constraint/demand, whatsoever, unless its outcome is perceived to be both important and uncertain at the same time.

Mehta, Sharma and Sharma (2014) in their paper explored the role stress level present in the doctors working in public hospitals in Jaipur city. Sample of the study consisted of 38 female doctors and 37 male doctors.

ORS scale by Udai Pareek was used. Results indicate that inter role distance stressor contribute to a great extent to the TORS scale.

Their results revealed that the overall level of role stress among doctors in public hospitals is quite high (ORS= 75), may be due to the nature of their work. As it was found in the study that stress was found to be higher in female doctors as compared to male doctors, it is been concluded here that female doctors experience more stress than male doctors working in public hospitals. Except in case of RS, REC and RE female doctors experience more stress than male doctors.

Irfana Baba (May 2012), he investigated causes of role stress in doctors working in government hospitals and to examined the levels of stress among Male and Female doctors. He employed (Organisational Role Stress) ORS instrument developed by Prof. UdaiPareek to collect the data from the respondents. Convenient sampling method was used to select the sampled units within the hospitals for the study. His study concluded that the overall level of stress among doctors in government hospitals is quite high (ORS= 71.20), pointing towards the fact that the nature of the job of doctors is stressful.

Wong, D. J. (2008), identified in his study that stress and its types depend on the medical practice that the practitioners execute. Public hospital doctors may face different type of stress as compared to the private hospital doctors.

Sharma (2005) reported on role stress of doctors, small amount of stress can have positive effects by energising people towards goals and excessive stress may seriously and negatively affect a person's health and job performance .hospitals are no exception; doctors ,nurses, and other paramedical staff work under stress. The study was done in two private and government hospitals of Jaipur. The following 10 role stresses were measured and analysed (IRD) Inter Role Distance, (RS) Role Stagnation, (REC) Role Expectation Conflict, (RE) Role Erosion, (RO) Role Overload,

(RI) Role Isolation, (PI) Personal Inadequacy, (SRD) Self Role Distance, (RA) Role Ambiguity, (RIn) Resource Inadequacy .his study concludes that doctors, esp. govt. doctors experience various types of role stress.

Al-Aameri (2005), examined that Hospital staff in particular is subject to work related stress simply because they are severely challenged by their rapidly changing environment.

A British Medical Association (BMA) report (2000) suggests that many senior doctors suffer high levels of stress as a result of their work which directly hampers their ability to provide high quality care to patients.

Racquel Singh (2000),in his observations found that hospital doctors reported work productivity and idealists traits as the highest sources of work stress.

Research Methodology

Objectives

- To identify the differences in stress level among female doctors working in public sector and private sector hospitals.
- To suggest measures to combat with stress to female doctors.

Hypothesis

There is no significant difference between the stress among female doctors working in the public sector hospitals and female doctors working in the private sector hospitals.

Tools Used

A self-made standardised tool was administered based on 5 point likert scale i.e. Never, Sometimes, Occasionally, Frequently and Always. These 5 point likert scales were coded as:-

Never = 1

Sometimes = 2

Occasionally = 3

Frequently = 4

Always = 5

Discussions and Results

Table No. 1 is depicting Mean Scores, Standard Deviations ,SEM, Mean Difference and obtained t- values of Female Doctors Working in Public Sector Hospitals and Female Doctors Working in Private Sector Hospitals.

Table.1

Groups	N	Mean	STD. Deviation	STD. Error Mean	Mean Difference	t-value
Female doctors of Public sector	150	131.69	14.998	1.225		
					33.16	21.399
Female doctors of private sector	150	164.85	11.636	.950		

In case of overall stress, the above table confirms that the Mean, S.D. & SEM obtained for Female Doctors Working in Public Sector Hospitals is M = 131.69 S.D =14.998 & SEM =1.225 while the Mean, S.D. &SEM obtained for Female Doctors Working in Private Sector Hospitals is M =164.85, S.D =11.636 & SEM = .950 and the difference of their mean scores is 33.16.

It is also confirmed in above table in which the significance of t-test, to test the equality of their mean scores, is applied and it is found that the obtained t-value is (21.399) is higher than the tabulated t-value (2.00) required for t- test to be significant at 0.05 level of significance. Hence, the t-Value is considered to be statistically significant .The t-Value with respect to stress illustrates that the mean scores cannot be considered equal on the basis of responses. Consequently, the null hypothesis is rejected.

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Conclusions and Suggestions

The null hypothesis is rejected and looking at the mean scores clearly depicts that mean scores of female doctors working in private sector hospitals is greater than the mean scores of female doctors working in public sector hospitals (164.85>131.69). Therefore, it is concluded that female doctors were working in private sector hospitals are more stressed than female doctors who were working in public sector hospitals.

Female doctors may plan their diet, like taking food in small quantity at regular intervals may keep them intact for the whole working day. This also controls the life style diseases/stress like diabetic problems. Female doctors should spend more time with their family in the events like social gathering and develop positive thoughts towards the society and others. In the fast moving world, female doctors should update themselves to survive in the competitive world of medical profession. So, doctors should go for training programmes like orientation programme, refresher courses etc., though they are experienced. Doctors have to prepare themselves to 'say no' even when they are assigned too much of work to them related to their profession. If the above said suggestions are implemented by female doctors and working them and will create a stress free doctors society. Moreover, it will help safeguard doctors' own well-being, help them to maintain high standards of performance and patient care reduce the risk of errors and concomitantly reduce the risk of patient harm.

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Social Networking Creating Gap In Interpersonal Communication

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Experienced Constraints of Bt cotton Technology Learners

SOCIAL NETWORKING CREATING GAP IN INTERPERSONAL COMMUNICATION

Preeti Agarwal

The cheap technology has made mobile phones, laptops, tabs etc. accessible to all which has given rise to net surfing and searching and updating on SN. Through this paper an attempt has been made to bring to light the harmful effect of being net addict and that too in Indian context. Some real life incidences have been included to explain the situation of increasing gap in interpersonal communication in the form of cases.

Key words: Interpersonal communication, Social Networking sites (SNS), Social media, Social Networking (SN)

Social media riding on the front seat of internet has given immense power to individual. At one end individual gathers the knowledge and on the other hand he disseminate the knowledge. This media is really superb in which many people are sending messages and at the same time many persons are receiving messages, beautiful coordination and off course communication. But they actually do not know in what kind of spout they are caught in. No doubt mobile technology and internet have opened new doors of success but on the other have posed many challenges and problems.

India is regarded as the land of values, culture, traditions and family system. The country where every festival, occasion and ceremony is regarded as a social gathering, where interpersonal communication has always been the symbol of being social, but if the interpersonal communication takes back seat and communication on SN takes driving seat, no doubt that we won't be called as social beings because everything is virtual. We have long list of friends on face book, watts app but actually we do not hold authentic communication. Susan Tardanico (2012) has said that "as human being, our real method of connection is through authentic communication". And so, here we need to understand the key terms.

Social Media: It is best understood as a group of new kind of online media, which share most or all of the features like openness, conversation, community, and connectedness. According to Walter and Riviera, (2004) social media "is the relationship that exists between networks of people". It is a system that disseminates information.

Social Networking: According to Drussell (2012), "Social networking consist of both web based communication with internet users through websites and interaction with others via cell phones. Text messaging is also included in social networking".

Social Networking Sites: These sites are web based sites on which the user creates his/her individual profile and then he creates a list of the persons to whom he

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wants to interact eg. facebook, twitter, instagram, myspace. Firstly we choose media and if the media is social media then we choose social networking site.

Interpersonal Communication: It is one of the types of communication in which communication between small groups of people is held, usually in a face to face setting. And it breaks down the barriers which we put up to protect our self. Some authors regard it as direct or face to face communication also.

Objective:-

1. To examine the increasing gap in interpersonal communication due to social networking

2. To depict the results of increasing gap in interpersonal communication through some cases.

MATERIALS AND METHODS :

To carry out the research personal interview method has been used, as it is impossible to study the entire population, a small sample has been taken to know whether there is interpersonal communication gap or not due to the use of social networking. So the researcher has taken sample which incorporated characteristics of whole population. As a source of information, both primary and secondary sources have been adopted. For secondary source books, journals, yearbooks and websites have been used. Study has been done using sample of 50 individuals. A questionnaire consisting 8 questions was given. The questionnaire was structured and included open ended questions. Sample consisted of respondents who use mobile phones/smart phone, laptops, tabs etc for social networking. Thus, the researcher has used non probability sampling technique and convenience method has been used under this.

Literature review

Lot of work has been done in this area of research. Literature is available where communication ,interpersonal communication, effect of mobiles on students and their performance ,impact of communication on households and even effect of social media on interpersonal communication and other such related aspects have been highlighted. Longjam Meena Devi (2014), "Data suggest that participants use social media to fulfil perceived social needs, but are often disappointed .Lonely individuals are drawn to the internet for emotional support. This causes problems as it interferes with the 'real life socializing'.According to Siobhan Mcgrath, (2012) "The technological revolution that has occurred in recent years has impacted on daily life within a household in a variety of different ways .New media technologies have become embedded in today's society and have resulted in major societal changes ".Lenhart and Madden,(2007) "in adolescent social networking have reinforced the fact that within the past five years social networking has shown phenomenal shoot up from being a niche activity to a mania that engages millions and billions of internet users."Smith (2007), "A study conducted in UK revealed the fact that even though teenagers have lots of friends ranging in hundreds in numbers on social networking sites, the actual number of close friends was same as the number of friends in their real life. .The study reported that the contact of 90% teenagers in social networking sites are people whom they have already met and only 10%contacts were strangers.

FINDINGS AND DISCUSSION :

Cases

The author is not against the use of social media or social networking sites but a careful step can be taken while using it. There are certain cases which can define that how the gap in impersonal communication affected life. These stories were in news last year (2015). Every news channel and print media were highlighting such cases from India.

1) 13 year old boy, committed suicide, leaving a note behind on whatsapp (September 2015) that he thinks that whole world is materialistic. Had he talked to someone he would have come to know that it was not so, hope he would have involved in interpersonal communication, he would have got relieved from his negative thoughts.

2) In Bangalore a 26 year old fashion designer cum wellness consultant alleged suicide and before doing so she scored 89 websites for 48 hours, surprising. Why she did so what was her problem, hope she would have involved herself with interpersonal communication and someone would have suggested her importance of life and stopped her from searching such websites (aug2015).

3) An Indian female who was from Chennai and was 25 years old jumped from a high rise apartment building in Singapore. She left a text message to her sister in which she indirectly blamed her husband. Instead of that message if she would have shared the problem she would have got some other solution (2015).

4) 27 years old software engineer in one of the IT major jumps from building under construction. Before doing so he made his video and posted that on facebook. What was going in his mind so that he made such video?

5) A very well known case of 2014 of a 31 year old senior resident doctor in the department of anaesthesia at AIIMS attracted everyone's attention because before committing suicide she posted her suicide note at facebook which was shared 3500 times yearly. No doubt she was having a big personal problem, but believe all problems could be solved through interpersonal communication and taking such step can be avoided.

6) Pratyusha Banerjee a well known TV actress commits suicide on 2 April 2016 and before doing so leaves messages on Instagram. Her last whatsapp status also revealed that she was quite disturbed, "Mar Ke bhi munh na tujhse modna". Why she did so, might be she was in great pain but ...suicide is no solution. Hoped she would have shared it with someone rather than just updating her whatsapp status and posting messages on Instagram.

1. As the researcher selected all those individuals only who were using social networking for communication, so all the 50 respondents replied regarding different uses of mobile, laptop, tab etc. They replied that these gazettes are used for communication, entertainment, study, shopping, show off, to maintain privacy etc. And 48 out of 50 had the communication as their main objective.

2. Then when asked what method they use for communication through these gazettes? they said text messaging, calling including video calling, through social networking sites e.g. Facebook, Instagram, myspace, twitter, using different apps e.g. Watsapp. So 45 out of 50 were actually taking help of social networking for communication more frequently.

And were spending all their leisure time in/out of home on social networking and even some of them were spending more than 5 hours per day on that.

3. Their answers regarding effectiveness of social networking in helping them resolve their conflicts, communicate effectively and share feelings was not satisfactory. Few individuals have the bitter experience of being part of social networking, as the conflict that aroused was not resolved and the relationship ruined.

4. Individuals answered that they involve in interpersonal communication when their gazettes do not work, when they do not have data connection, when they have some kind of force on them (e.g. in the classroom, during festivals, on particular occasion) when they get bored with their social networking gazettes and that too for very small time.

5. According to respondents social networking creates gap in interpersonal communication, as they involve in more of interpersonal communication only when it is compulsory for them to do so.

6. They admitted that no doubt interpersonal communication is better because through this we cannot hide our actual feelings, we cannot fake, resolve disputes in better way, and can know the real intentions of other individual.

7. All individuals noticed some change in their life after the use of social networking. Parents said that they do not give time to children, and to each other, students said that when they get time they start checking their status and making updates, they use to send messages to each other during classes also, they have become more careless. They are not bothered if they miss class as their friend forward them the notes. All individuals said that they have lost their rest time and sleep time. They feel that they have become more arrogant and introvert as they do not involve in interpersonal communication. Their creativity, originality and concentration are lost. They do not enjoy the moments rather are busy taking photos and selfie, making videos so that they can update status through social networking.

CONCLUSIONS :

The individuals are not using social networking merely for relaxation rather they want to show-off. They want to be the part of this new virtual world; they felt if they do not use this they would be regarded as backward. In this new era of technology, individual want more privacy and this new technology provide them privacy of chatting, sharing their feelings without disclosing their identity. Individuals in today's time are losing the interpersonal skills. Lack of interpersonal communication not only bring individual under stress but affects everyone associated to such person and this depression and stress situation are the outcome of more social networking. The two cases discussed above clear the whole picture. It is not so that lack of interpersonal communication will always lead to worst situation, but can generate situation where we do not want to see ourselves and also any close one.

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Journal of Indian Dietetic Association

CONTENTS

METABOLICALLY HEALTHY BUT OBESE OR METABOLLICALLY OBESE BUT NORMAL WEIGHT : DEBATE ON HEALTH

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ABSTRACT: Obesity has been associated with increased morbidity and mortality. The indicators used for assessment of nutritional status and risk of metabolic syndrome are body mass index and central obesity by waist circumference and waist to hip ratio. Subtypes of obesity have been a recent topic of debate in field of obesity research. Among these subtypes one is metabolically healthy obese (MHO) characterized by high BMI and normal WHR and the other is defined by normal BMI(< 25kg/m^{2}) and high WHR i.e.metabolically obese normal weight (MONW). The present study was conducted to assess prevalence of MHO and metabolically obese normal weight MONW individuals among those visiting weight reduction centers for losing weight. Among the 624 participants visiting such centers, 19.9% males and 13.9% females were MONW. On the contrary, 54% males and 78% females were MHO. Overall females had a higher BMI than males whereas males had greater central adiposity.

Key Words:

INTRODUCTION :

The risk functions for obesity, (defined as the quantitative relation between degree of obesity throughout its range and the risk of health problems) have been used to define 'obesity' as an excess storage of fat in the body to such an extent that it causes health problems leading to increased mortality . Obesity has become one of the major contributors to the global burden of disease, increasing the risk of metabolic syndrome and risk of morbidity and mortality from cardiovascular diseases, type 2 diabetes and some cancers . Body Mass index (BMI), Waist Circumference (WC) and Waist Hip Ratio(WHR) have been used for assessment of nutritional status and risk factors of metabolic syndrome.

BMI is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^{2}). WHO classifies BMI over 25 as overweight and BMI over 30 as obese . For Asian populations, additional trigger points for public health action were identified as 23kg/m^{2} or higher, representing increased risk and 27.5kg/m^{2} or higher as representing high risk.

According to , Waist circumference and Waist-to-hip ratio are both related risk of all-cause mortality, throughout the range of adult BMIs; waist circumference and waist-to-hip ratio are strongly predictive in young and middle-aged adults compared to older people and those with low BMI; waist circumference alone could replace waist-hip ratio and BMI as single risk factor for all –cause mortality.

PURPOSE: The present study was conducted to assess prevalence of MHO and MONW individuals among those visiting weight reduction centers, in Jaipur city.

METHODOLOGY: All the individuals visiting commercial weight reduction and fitness center with the purpose of weight loss in the age group of 20-60 years and willing to participate in the study were included in the study. Anthropometric indices such as height (m), weight (kg), waist circumference (cm) and hip circumference (cm) were assessed for all subjects. These indicators were used to calculate body mass index (kg/m^{2}) and waist –to-hip ratio which indicate the grade of obesity and central adiposity for subjects.

Height was measured using height-o-meter and weight was measured using a digital weighing scale. Waist and hip circumference were measured using non-elastic, non-stretchable, flexible measuring tape. Standard procedures as described by were used. BMI was calculated using height and weight; waist-to-hip ratio was calculated using waist and hip circumference. Statistical tests of mean, standard deviation, percentage, t-test and correlation were applied.

RESULTS AND DISCUSSIONS: A total of 624 subjects were enrolled for the study, comprising 310 males and 314 females. These subjects were trying to lose weight with help of structured weight loss programs.

Table 1 depicts the age and gender wise profile of the patients. Approximately, 49.7% participants were males and 50.3% participants were females. They were categorized into two age categories: 20-40 years and 40–60 years. In the age group of 20-40 years 39.9 % were males and 60.1 % were females. In the age group of 40-60 years 60.1% were males and 39.9 % were females. Higher numbers of subjects were in the age group of 20-40 years as compared to 40-60 years.

Table 1: Age and Gender Wise Percent Distribution of Subjects

Age in Years	Males (n = 310)	Females (n = 314)	N= 624
20-40(n= 323)	39.93 (129)	60.06 (194)	51.76 (323)
40-60 (n= 301)	60.13 (181)	39.86 (120)	48.24 (301)
N=624	49.68 (310)	50.32 (314)	100 (624)

*Figures in parenthesis denote numbers

Table 2 presents mean ± SD for different variables for males and females. Females had a significantly lower age, height, weight; waist circumference and waist-to-hip ratio than males. BMI for females was significantly higher as compared to BMI for males.

Figure 1 illustrates that females had a higher BMI than males in both the age groups and there was a steep increase in the BMI of females with age. Males did not show such a rise in their BMI values with age. In a study of 23,627 UK adults aged 18–99 (99% ≤ 70) years, of which 11,582

Table 2: Age and Gender Wise Mean Variables

Variable	Gender	20-40 yrs (n=323)	40-60 yrs (n=301)	t
Age (yrs.)	Male	30.99± 5.08	49.69± 6.21	7.75**
	Female	28.86 ± 5.80	48.03 ± 5.72	
Height (m)	Male	1.73± 0.06	1.69± 0.14	19.47**
	Female	1.58 ± 0.06	1.54 ± 0.16	
Weight (kgs)	Male	79.84± 17.02	78.39± 13.65	6.04**
	Female	70.79 ± 13.20	73.19 ± 14.63	
BMI	Male	27.04± 4.25	27.31± 3.86	5.95**
	Female	28.31 ± 5.27	30.54 ± 4.91	
WC (cm)	Male	94.20 ± 7.04	99.12 ± 8.35	16.09**
	Female	86.10 ± 9.71	93.11 ± 10.30	
HC (cm)	Male	104.32 ±8.76	104.50 ± 7.25	1.75^NS
	Female	105.21 ± 10.08	108.46 ± 11.05	
WHR	Male	0.90 ± 0.06	0.94 ± 0.10	12.01**
	Female	0.82 ± 0.10	0.86 ± 0.12	

*Significant at 5% level **Significant at 1% level NS Not significant
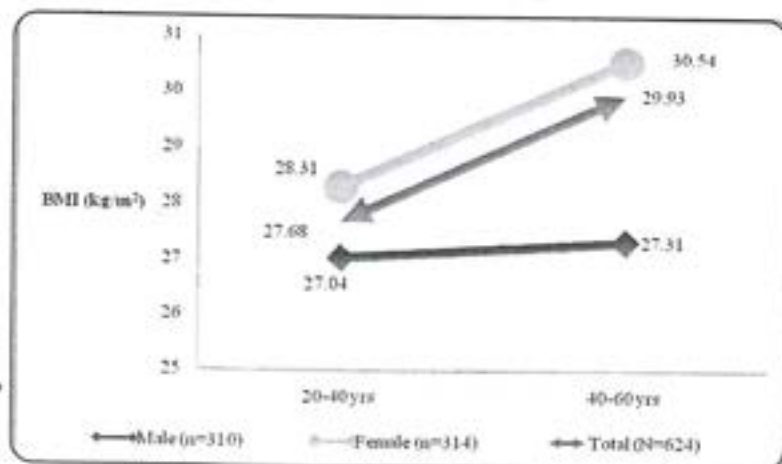
Figure 1: Age and Gender-Wise Mean BMI (kg/m^2) of Subjects

were males with a mean BMI of 26.3 ± 4.7 kg/m^2 and 12,044 females, with a mean BMI of 25.7 ± 5.1 kg/m^2; it was found that BMI progressively increased with age in women and plateaued between 40 and 70 years in men (Meeuwsen et al., 2010).

Figure 2 presents percent distribution of subjects on basis of increased risk of co-morbidities on basis of WHO cut off for global population and Asians. BMI cut off values for increased risk of comorbidities have long been identified as BMI value above 25 kg/m^2. Early in this decade, WHO identified Asians to be at an increased risk of degenerative diseases at a lower BMI (≥ 23 kg/m^2) . When analyzed on the basis of WHO global cut off value (25 kg/m^2) males in the 'increased risk' category for the two age group categories were 68.2 % and 73.5 %, respectively. Similarly, 76.8 % and 86.7 % females were at increased risk of comorbidities in the two age groups in respective order. When assessed on basis of WHO cut off for Asians 85.3 % and 88.4 % males were above the cut-off point

of 23 kg/m^{2}in the two age groups.For females these values were 88.1 % and 95.8 %, indicating a high risk for Indians.

Grades of Obesity: Table 3 represents age-wise and gender-wise distribution of participants as per their BMI cut off points.In the age group of 20-40 years 31.8 % males had normal BMI, 47.3 % males were pre-obese followed by 14 % obese grade I and 7 % obese grade II. Females in the age group of 20-40 years had the following per cent distribution – 23.20 % (normal), 50 % (obese), 17% (obese class I), 6.2 % (obese class II) and 3.6 % (obese class III). In the age group of 40-60 years, 26.5 % males and 13.3 % females had normal BMI, followed by 50.8 % males and 35.8 % females in pre-obese grade. Obese grade I comprised of 18.2 % males and 30.8 % females. Seven per cent males and 17.5 % females were falling in obese grade –II. Obese grade III comprised of 0.6 % males and 2.5 % females.

Majority of the subjects were thus falling in the 'pre-obese' category which is an indication of future burden of obesity as these participants
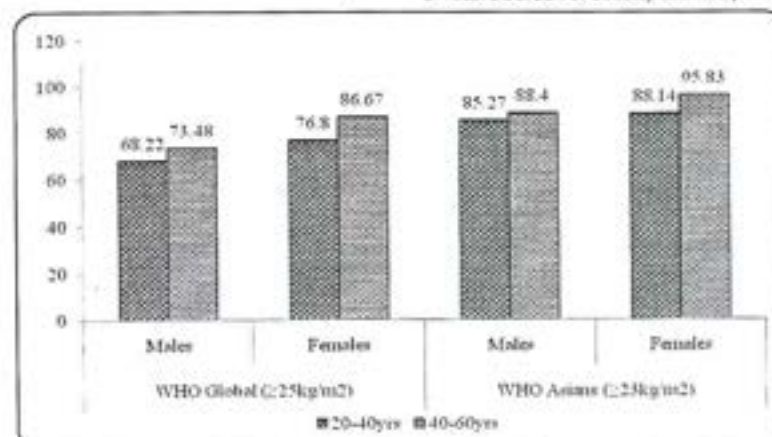
Figure 2: Per Cent Distribution of Subjects on Basis of BMI Cut off Points (Global and Asians)

may swiftly transit to higher obesity grades. A cohort of 1169 Norwegian adults revealed that of the individuals who were already classified as overweight or obese in 1990, 68% had gained additional weight 10 years later, indicating an average increase of 2.6 BMI units. The greatest amount of weight gain occurred for the youngest adults, aged 20–29 years (Reas et al., 2007).

Waist Hip Ratio: Greater tendency for central obesity (mean WHR) was shown among males than females in all age groups. Overall mean WHR values for males were higher than the WHR cut off of 0.90 . Mean WHR for males was 0.93 ± 0.08 and 0.84 ± 0.11 for females and the difference was significant at 1% significance level (t=12.01) as seen from **Figure 3**. A

Table 3: Age and Gender Wise Distribution of Subjects on Basis of BMI Categories

Age in years		20-40 (n=323)		40-60 (n=301)		Total (N=624)	
Grades of Obesity	BMI Cut-off Points (kg/m2)	Male (n=129)	Female (n=194)	Male (n=181)	Female (n=120)	Male (n= 310)	Female (n=314)
Normal	18.00-24.99	31.78 (41)	23.20 (45)	26.52 (48)	13.34 (16)	37.44 (149)	19.43 (61)
Pre-obese	25.00 - 29.99	47.29 (61)	50.00 (97)	50.83 (92)	35.83 (43)	43.72 (174)	44.59 (140)
Obese class I	30.00-34.99	13.95 (18)	17.01 (33)	18.23 (33)	30.83 (37)	14.32 (57)	22.29 (70)
Obese class II	35.00-39.99	6.98 (9)	6.19 (12)	3.87 (7)	17.50 (21)	4.52 (18)	10.51 (33)
Obese class III	≥ 40.00	0.00 (0)	3.61 (7)	0.55 (1)	2.5 (3)	0.75 (3)	3.18 (10)

*Figures in parenthesis denote frequencies.
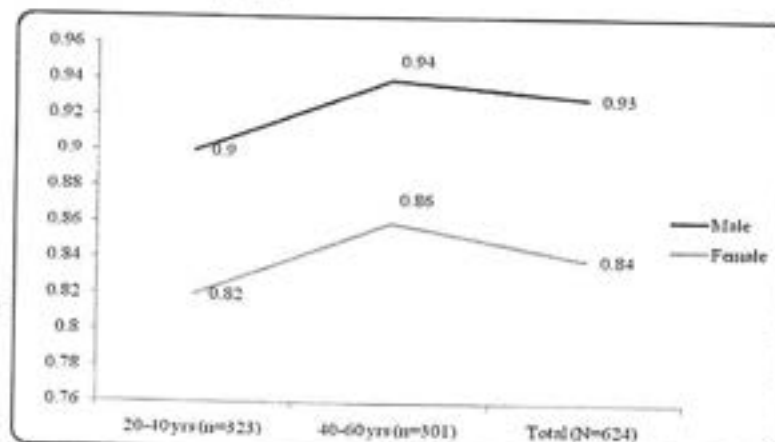
Figure 3: Age and Gender Wise Comparison of Participants on Basis of WHR Cut Off Points

randomized control trial of 130 subjects (58 males and 72 females; BMI 32.5 ± 0.5 kg/m²) reported that compared to women, men carried an extra 7.0 ±0.9 % of their total body fat in the trunk (p<0.01) at baseline (Evans et al., 2012).

Figure 4 depicts distribution of participants on basis of their WHR cut off values for being 'at risk' of co-morbidities. Approximately, 50 %

males in the age group of 20-40 years had WHR higher than the cut off values as compared to only 28.4 % females having WHR above the cut off. In the age group of 40-60 years 77.9 % males and 50 % females had WHR higher than the cut off values. Overall, 66.5 % males and 36.6 % females were falling in 'at-risk' category based on WHR cut off values.
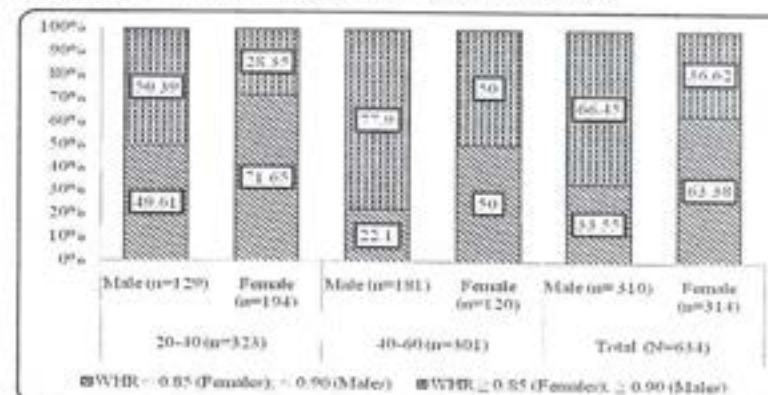
Figure 4: Age Wise and Gender Wise Distribution of Subjects on Basis of Central Adiposity (WHR Cut Off)
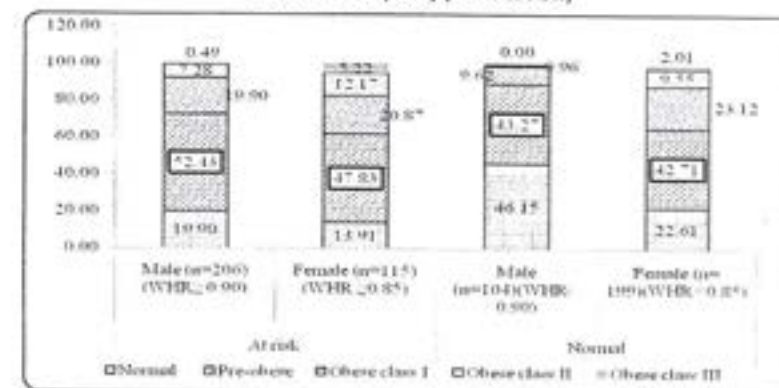
Figure 5: Percent Distribution of Subjects on Basis of BMI and WHR Categories

The results presented in **figure 5** underline one of the most recent debates in obesity-**subtypes of obesity.** Among the subjects with waist-hip ratio above the cut-off values, 19.9% males and 13.9% females had normal BMI (normal weight metabolically obese). On the contrary, among subjects with normal WHR 54% males and 78% females were falling in different grades of overweight and obesity (metabolically healthy obese).

In their recent review concluded that MHO (metabolically healthy obese) is an important, emerging phenotype with risks somewhere intermediate between healthy, normal weight and unhealthy, obese individuals.

First of all identified four subtypes of obesity – (1) Metabolically Healthy Obese (MHO); (2) "At Risk" Obese; (3) Metabolically Obese Normal Weight (MONW) and (4) Metabolically Healthy Normal Weight (MHNW).

males than females. From the above and association it is evident that women were more prone to obesity but men were at more risk due to higher central obesity.

A study revealed that in women categorized in 3 different age groups: 21–29 years; 30 – 39 years and 40 – 55 years; WHR and BMI were strongly correlated r =0.65, r=0.79 and r=0.91. In another study it was found that men were classified as obese more often than women by WHR (92% v. 82%). The relative risk of being obese as determined by WHR (waist-to-hip ratio) if classified as obese by the BMI criteria was 1.04 (95% confidence interval [CI] 0.91–1.18) for men and 1.23 (95% CI 1.03–1.46) for women.

SUMMARY :

Among the 624 participants visiting the center with the purpose of weight reduction 19.9%

Table 5: Association among Various Parameters (Correlation coefficient)

	MALE (n =310)	FEMALE (n=314)
AGE and BMI	0.037^{NS}	0.196^{**}
AGE and WHR	0.244^{**}	0.175^{*}
AGE and WEIGHT	0.056^{NS}	0.065^{NS}
BMI and WHR	0.272^{**}	0.153^{*}

*Significant at 5% level **Significant at 1% level NS Not significant

Correlations among various parameters were investigated in the study and have been shown in **Table 5**. Age was found to be significantly correlated with BMI only for females and not for males. Progression in age results in increment in WHR but the relationship was stronger for males than females. Body weight was found not to be affected by age for both the genders. BMI and WHR were closely associated but the relationship was stronger for

males and 13.9% females were normal weight status (BMI< 25kg/m²) but had higher waist-to hip ratio (central adiposity) (MONW-Metabolically obese normal weight). On the other hand 54% males and 78% females were overweight or obese but had normal WHR (metabolically healthy obese). Overall females had a higher BMI than males whereas males had greater central adiposity.

CONCLUSION :

Recent researches have demonstrated that central obesity defined by waist-to-hip ratio is a better predictor of metabolic syndrome and other degenerative diseases. Body mass index alone is not able to predict the visceral fat deposition which is a risk factor for metabolic syndrome. Therefore, in past decade many experts have advocated concept of obesity subtypes of which normal weight metabolically obese (normal BMI, high WHR) is of great concern as it often goes unnoticed. One study on Jordanian men and women showed that BMI tended to be the weakest index for identifying metabolic syndrome risk factors in both sexes. Waist-to hip ratio exhibited the best predictive index for metabolic syndrome .

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Talent Management: A Solution to Brain Drain

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Divya Pareek[**]

Abstract

Over the years, India has become a major supplier of skilled and talented young people to the developed countries the skilled Indians prefer US Green Cards and EU Blue Cards over the not-so-attractive pay checks and average living conditions of a developing country like India Talent Management is a strategy which serves as a solution to Brain Drain, that a company employs to attract, retain and develop employees in order to achieve objectives of the organization .Most of the organizations are planning ahead to handle an inevitable talent crisis, to ensure that they have the right people to do the right jobs, when needed. Many challenges are associated with the changing and competitive nature of work and the workplace environment are very real for every organization. Rapid changes require a skilled, knowledgeable and talented workforce with employees who are adaptive, flexible and focused on the future.

***Key Words:** Brain Drain, Talented Workforce, Workplace Environment.*

Introduction

In a competitive marketplace, talent management is a initial driver for organizational success. Broadly, talent management is the implementation of integrated strategies or systems designed to increase workplace productivity by developing better processes for attracting, developing, retaining and utilizing people with the required skills and aptitude to meet present and future business requirements. But from where does this talent pool come from? Quiet obvious, the source is prestigious academic institutes such as IIT's and

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IIM's, but a major constraint for a student to get admission in these prestigious institutes is high cut off rates of these universities.

The two most significant issues to ponder are:

- Main concern of the developing countries like, India is "Brain drain".
- Will Pioneering Organizations with their Talent Management practices be able to prevent excessive brain drain.

In recent years, the cut-offs for admissions became close to 100% in the best Indian Universities. While the institutes are in the race of getting the finest students in the country, the ambitious youth who fail to meet the cut off demands, had to compromise on their dream of occupying a seat in any of the prominent Indian universities. This leads them to explore the scope of higher education abroad as they don't get the best chances, resources and facilities for education and research in India due to high cut off.

Opportunities Abroad

Most of the students prefer staying back in the host country due to better work prospects and heavy pay packages. After getting global exposure and getting introduced to the high quality life and facilities, the students become reluctant to go back to the native land. These days, most of the developed countries attract the highly skilled and qualified people from other countries.

Time for a Reality Check

The term Brain drain was emerged in 1960s when the skilled workforce started emigrating from the poor countries to the rich countries to seek better job opportunities and living conditions. India has been losing its foremost skilled workforce that consist of doctors, engineers, scientists and technicians. Over the years, India has become a major supplier of skilled and talented young people to the developed countries. In a competitive marketplace, talent management is considered as tool to prevent excessive brain drain, as at Organizational level the biggest challenge lies in retaining the talented pool. A recent study shows that 85% of HR executives considered "single greatest challenge in workforce management is creating or maintaining their companies' ability to compete for talent."Undoubtedly, effective talent management provides one of the most critical points of strategic leverage today.

Table:1 Country-wise Data on the Number of Students Going Abroad for Higher Studies

Country	Students going abroad (per year)
China	421,000
India	153,300
Germany	77,500
Japan	54,500

Source: UNESCO's Report-Global Education Digest, 2009

Research shows that organizations increasingly focus on talent management. Moving from reactive to proactive, companies is working hard to harness talent.

According to SHRM's 2006 Talent Management Survey Report, 53% of organizations have specific talent management initiatives in place. Of these companies, 76% consider talent management a top priority. In addition, 85% of HR professionals in these companies work directly with management to implement talent management strategies.

Key findings of SHRM's Research Spotlight: Employee Job Satisfaction and Engagement 2015.Shows that around 86% percent of employees reported overall satisfaction with their current job. 72% of employees reported respectful treatment as a very important job satisfaction contributor; only 33% were very satisfied with it. Compensation/ pay had the second largest gap, at 37 percentage points.

For example: *Proctor and Gamble*, feels that getting the right mix of people is a major part of talent management and they hires many of its leaders from universities or Business School campus recruits.

Key business strategies also drive talent management. *For* example, with the growing need for global technical expertise, *Ford Motor Company* links competency development and corporate branding, to its organizational strategic goals, as a business strategy that drives talent management.

Increasingly, firms are linking their brand to employees and corporate behavior. At *JPMorgan Chase*, the concept of leadership for all employees is part of its corporate branding: "One Firm, One Team, Be a Leader."

Talent Management

Every person has a unique talent that suits a particular job profile. Talent is the vehicle to move the organization where it wants to be. It is the task of Human Resource (HR) department of an organization to choose the right candidate for the right job. A wrong fit results in further hiring, retraining and other wasteful activities. Talent management implies recognizing a person's inherent skills, traits, personality and offering the matching job.

Reasons to have a Plan to Stop Brain Drain

- More opportunities for high potential
- A road map for employee development
- More talent ready sooner
- More support for diverse workforce
- Better moral
- Low labour turnover
- Lower stress
- Job content tied to business plan
- More focus on vision and direction

There are several drivers fueling emphasis on Talent Management. There is a demonstrated relationship between better talent and better business performance and greater job satisfaction level (which to an extent prevent brain drain). Increasingly, organizations seek to quantify the return on their investment in talent.

A research study from *Mc Bassi & Company,*2013 revealed that high scorers in five categories of human capital management (leadership practices, employee engagement, knowledge accountability, workforce organization, and learning capacity) resulted into higher stock market returns and better safety records—two common business goals that are top of mind for today's senior leadership.

As employee expectations are also changing, so they do not mind mobility if given an opportunity. This forces organizations to place a greater emphasis on talent management strategies and practices to retain talented pool.

Employees today are:

- Increasingly interested in having challenging and meaningful work.
- More loyal to their profession than to the organization.
- Less accommodating of traditional structures and authority.
- More concerned about work-life balance.
- Prepared to take ownership of their careers and development.

Key components of a highly effective talent management process include:

- A clear understanding of the organization's current and future business strategies.
- Identification of the key gaps between the talent in place and the talent required to drive business success.
- A sound talent management plan designed to close the talent gaps. It should also be integrated with strategic and business plans.
- Accurate hiring and promotion decisions.
- Connection of individual and team goals to corporate goals, and providing clear expectations and feedback to manage performance.
- Development of talent to enhance performance in current positions as well as readiness for transition to the next level.
- A focus not just on the talent strategy itself, but the elements required for successful execution.
- Business impact and workforce effectiveness measurement during and after implementation.

Global Companies for Leadership focus on the "Big Six"

- CEO and senior leaders make leadership development a top priority.
- Leaders at all levels are accountable for creating a work climate that motivates employees to perform at their best.
- Leadership teams receive training and coaching to help them work together more effectively.

- Mid-career managers receive job-shadowing opportunities.
- High-potentials receive objective 360-degree assessments and feedback on their leadership ability early on.
- Mid-level managers get enough time to take part in leadership development activities early in their careers

What to do, to Fix up

- External MBA programs
- External coaches for senior executives
- Internal coaches for mid-level managers
- Specific skill building for lower-level managers
- Externally run development programs
- Job rotations

Conclusion (A wake up call) Talent is precious and it has to be taken care, it is inherent, unique and cannot be measured. It has to be groomed and managed well. The increasing trend of brain drain of the skilled workers finally persuaded the organization's to take corrective action and formulated strategies. For the success of Talent management strategies the educational institute must keep go hand in hand with corporate changing Human resource requirement, which on one hand, will enhance the employability of the students and on other hand help the organization to manage and retain the talented people easily. For this purpose the companies are striving hard by adopting the latest changes from the global environment and designing number of possible strategies to manage the talent of the employees and putting the best foot forward to curb brain drain, with better economic policies and the human capital to execute them, there is still hope for today's business, because the talent is the only mantra of managers today. So the Multi-National Corporations and the domestic companies should adopt the strategies designed for the talent management and implement these strategies as a part of the business strategy for the long – run success of the business and prevent brain drain.

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CORPORATE SOCIAL RESPONSIBILITY : AN OVERVIEW

Dr. Ranjula Jain*

Abstract

The last half decade has witnessed a remarkable resurgence of attention among practitioners and scholars to understanding the ability of corporate social responsibility to address environmental and social problems. While significant advances have been made, assessing the forms, types and impacts on intended objectives is impeded by the conflation of distinct phenomena, which has created misunderstandings about why firms support corporate social responsibility, and the implications of this support, or lack thereof, for the potential effectiveness of innovative policy options. As a corrective, we offer seven categories that distinguish efforts promoting learning and stakeholder engagement from those requiring direct on-the-ground behavior changes. Better accounting for these differences is critical for promoting a research agenda that focuses on the evolutionary nature of corporate social responsibility innovations including whether specific forms are likely to yield marginal or transformative results.

Keywords: Codes of Conduct, NSMD, Governance, Environmental Standards, Legitimacy.

Introduction

The evolution of corporate social responsibility in India refers to changes over time in India of the cultural norms of corporation's engagement in corporate social responsibility (CSR) with CSR referring to way that businesses are managed to bring about an overall change in communities, cultures, societies and environments in which they separate. The -fundamentals of CSR rest on the fact that not only public policy but even corporate should be responsible enough to address social issues. Thus companies should deal with the challenges and issues looked after to a certain extend by the states. CSR is a form of corporate self-regulation integrated into a business model. It functions as a self-regulatory mechanism whereby a business monitors and ensures its active compliance with the spirit of the law, ethical standards and international norms. CSR aims to embrace responsibility for corporate actions and to encourage a positive impact on the environment, and stakeholders including consumers, employees, investors, communities and others. The term "corporate social responsibility" become popular in 1960's and has remained a term used indiscriminately by many to cover legal and moral responsibility more narrowly construed. There is no single universally accepted definitions of CSR, but each definition that currently exists, underpins the impact that business have on society at large and the societal expectations of them. Some of the definitions given by some institutions are :

- European commission defines CSR as "the responsibility of enterprises for their impacts on society". to meet their social responsibility completely, enterprises should have in place a

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process to integrate social, environmental, ethical human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders.
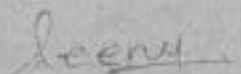
- The world business council for sustainable development (wbcsd) defines CSR the continuing commitment by business to contribute t.,000tomic development while improving the quality of life of the -workforce and their families as well as of the community and society at large.
- From these definitions, it is clear that
- The CSR approach is holistic and integrated with the core business strategy for addressing social and environmental impacts of businesses.
- CSR needs to address the meet being of all stakeholders and not just the company's shareholder.
- Philanthropic activities are only a part of CSR, which otherwise constitutes a much larger set of activities entailing strategic business benefits.
- There are various benefits the company's can enjoy by adopting good CSR practices. these are :
    Communities provide the license to operate governments, investors and customers are some of the key stakeholders that influence the corporate behaviour. Apart from these, an increasingly important stakeholder is the community, and many companies hat started realizing that the 'license to operate' is no longer given by govt. Alone, but communities that all impacted by a company's business operations. Attracting and Retaining Customers/Employees : several human resource studies have linked a company's ability to attract, retain and motivate employees with their CSR commitments. interventions that encourage and enable employees to participate are shown. To increase' employees' morale and a sense of belonging to the company. Communities as Suppliers : There are certain CSR initiatives emerging, wherein companies have invested in enhancing community livelihood by incorporating them into their supply chain. This has benefitted communities and increased their income levels, while providing these companies with an additional and secure supply chain. Enhancing Corporate Reputation : The traditional benefit of generating goodwill, creating a positive image, benefits continue to exist for companies that operate effective CSR programmes. This allows companies to position themselves as responsible corporate citizens.

The Compan4s Act, 2013

In India the concept of CSR is governed by clause n5 of" the companies Act 2013, which was passed by both Houses of the parliament of India on 29th August; 2013.

- These provisions are applicable to companies with an annual turnover of INR 1,000 crore and more, or a net worth of INR 500 crore and more, or a net profit of TNR 5 crore and more.
- The new rules also require companies to set up a CSR Committee consisting of their board members, including atleast one independent Director.
- The Act encourages companies to spend atleast 2% of their average net profit in the previous three years on CSR activities.
- The indicative activities which can be undertaken by a company under CSR IIPAT been specified under schedule VII of the Act. These are :
    - Promotion of Education
    - Eradication of extreme hunger and poverty
    - Gender Equity and women empowerment.
    - -Reducing child mortality and improving maternal health.

- Combating HIV-AIDS, malaria and other diseases
- Environmental sustainability
- Social business projects.
- Contribution to Prime Minister's relief : No and other state and central funds. Employment enhancing vocational skills.
- And such other matters as may be prescribed.

For the past 1,1my years, there have been number of companies participating in CSR activities. Reliance Industrial Limited has been one among them. Reliance Industries Limited has made significant contributions & measurable progress towards a vision of inclusive development in India. The group has been involved in venous social responsibility initiatives over the last many years. These efforts have substantially improved the lives of same of the most marginalised communities across India. In order to strengthen Reliance's Commitment and enrich the lives of the marginalised, Reliance Foundation was set up in the year 2010 as the umbrella organisation for all the social sector initiatives of the group.

Reliance's Contribution Towards CSR Activities During The Last Four Years.

	2013-14	2012-13	2011-12	2010-11
Education	80.76	66.71	75.06	91.01
Health	416.69	140.72	91.03	46.99
Rural Development	165.72	73.10	21.69	28.38
Environment	0.52	1.20	2.15	0.76
Others	48.03	69.27	61.34	34.23
Total	711.72	351.00	251.27	201.34

- In the year 2011-12 RIL contributed Rs. 251.27 Cr. towards CSR activities, which was 1.25% of its profit (after tax) during the years.
- In the year 2012-13, RIL contributed Rs. 351 Cr. towards CSR activities which was 1.67% of its profit (after tax) during the years.
- In the year 2012-14, this contribution rose to 123% of its profit (after tax) for the year.

Conclusion

Among other countries-, India has one of the oldest traditions of CSR. But CSR practices are regularly not practiced or done only in namesake especially by MNC's with no cultural or emotional attachments to India. Much has been done in recent years to make Indian entrepreneur aware of social responsibility as an important segment of their business activity but CSR in Indiais yet to receive widespread recognition. If this goal has to be realised then the CSR approach of the corporate has to be in line with their attitudes towards mainstream business companies setting clear objectives, undertakings, potential investments, measuring and reporting performance publicly.

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TECHNOLOGY AND INNOVATION MANAGEMENT (Technology & Innovation Management Key to Growth in a Knowledge Based Economy)

Dr. Ranjula Jain

The current competitive imperative is the development of a science and innovation culture. This identifies that the real engines of competitiveness and economic success remain science, innovation, technology, education and entrepreneurship. An essential part of developing the science and technology base for sustained competitive advantage is to build the organizations capacity to manage innovation successfully. Technology & Innovation Management is at the intersection of strategy, technology and operations. It provides executives with the understanding of how technology works in the innovation process and enables them to make sound business decisions. Successful innovation is inherently multi-functional and matches a profound understanding of user needs and wants to a distinctive technical competence.

Technology Management and Innovation is an interdisciplinary group that studies various aspects of technology and innovation – strategic, behavioral, organizational and social. We live and work in an increasingly knowledge-intensive age. Today and tomorrow's managers need to understand how technology nad innovation are essential for delivering value to organizations and the marketplace.

INNOVATION MANAGEMENT

"Innovation is : production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems, It is both a process and an outcome."

Innovation management is the management of innovation processes. It refers both to product and organizational innovation.

Innovation Management includes a set of tools that allow managers and engineers to cooperate with a common understanding of processes and goals. Innovation management allows the organization to respond to external or internal opportunities, and use its creativity to introduce new ideas, processes or products.

Innovation, although not sufficient, is a necessary prerequisite for the continued survival and development of enterprises. The most direct way of business innovation is technological innovation and institutional innovation. Management innovation, however, plays a significant role in promoting technological and institutional innovation.

Innovation is a change that outperforms a previous practice. To lead or sustain with innovations, managers need to concentrate heavily on the innovation network, which requires deep understanding of the complexity of innovation. Collaboration is an important source of innovation. Innovations are increasingly brought to the market by networks of firms, selected according to their comparative advantages, and operating in a coordinated manner.

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When a technology goes through a major transformation phase and yields a successful innovation, it becomes a great learning experience, not only for the parent industry but other industries as well. Big innovations are generally the outcome of intra and interdisciplinary networking among technological sectors, along with combination of implicit and explicit knowledge. Networking is required, but network integration is the key to success for complex innovation. Social economic zones, technology corridors, free trade agreements, and technology clusters are some of the ways to encourage organizational networking and cross-functional innovations.

TECHNOLOGY MANAGEMENT

Technology management can also be defined as the integrated planning, design, optimization, operation and control of technological products, processes and services, a better definition would be the management of the use of technology for human advantage.

The Association of Technology, Management and Applied Engineering defines technology management as the field concerned with the supervision of personnel across the technical spectrum and a wide variety of complex technological systems. Technology management programs typically include instruction in production and operations management, project management, computer applications, quality control, safety and health issues, statistics, and general management principles.

Perhaps the most authoritative input to our understanding of technology is the diffusion of innovations theory developed in the first half of the twentieth century. It suggests that all innovations follow a similar diffusion pattern – best known today in the form of an "s" curve though originally based upon the concept of a standard distribution of adopters. In broad terms the "s" curve suggests four phases of a technology life cycle – emerging, growth, mature and aging.

These four phases are coupled to increasing levels of acceptance of an innovation or, in our case a new technology. In recent times for many technologies an inverse curve – which corresponds to a declining cost per unit – has been postulated. This may not prove to be universally true though for information technology where much of the cost is in the initial phase it has been a reasonable expectation.

The role of the technology management function in an organization is to understand the value of certain technology for the organization. Continuous development of technology is valuable as long as there is a value for the customer and therefore the technology management function in an organization should be able to argue when to invest on technology development and when to withdraw.

CONCLUSION

This specialized management concentration offers an understanding of the nature of innovation, the relationship between strategic leadership and innovation, and how organizations use technology and new product development processes to successfully manage change. Students examine the intersection of technology and innovation within the context of the firm and its industry. Students have the opportunity to –

- Acquire the necessary skills to critically analyze the potential impact of upcoming technologies on various industrial sectors.
- Study local high-technology companies and meet their decision-makers and innovators
- Make more informed investment decisions.
- Target new business opportunities.
- Position themselves to work in high-technology companies in areas such as product/project management, strategic planning, and technology development.

After graduation, students apply their knowledge in industries such as telecommunications, computing, engineering, and biotechnology.

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<mark>Single-Molecule FRET Studies of the Hybridization Mechanism during Noncovalent Adsorption and Desorption of DNA on Graphene Oxide</mark>

Tapas Paul, Subhas Chandra Bera, <mark>Nidhi Agnihotri</mark>, and Padmaja P. Mishra*

📄 Abstract   📄 Full text   📄 PDF

∨ ABSTRACT

Effect of Pulse Shaping on Observing Coherent Energy Transfer in Single Light-Harvesting Complexes

Kai Song, Shuming Bai, and Qiang Shi*

📄 Abstract   📄 Full text   📄 PDF

∨ ABSTRACT

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Single-Molecule FRET Studies of the Hybridization Mechanism during Noncovalent Adsorption and Desorption of DNA on Graphene Oxide

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⑤ *Supporting Information*

ABSTRACT: Remarkable observations on the adsorption and desorption mechanisms of single-stranded oligonucleotides and the hybridization of double-stranded DNA (ds-DNA) on a graphene oxide (GO) surface have been made using ensemble and single-molecule fluorescence methods. Probe and target DNAs labeled individually with fluorescence resonance energy transfer (FRET) pairs and having similar adsorption affinities toward the GO surface are used to provide detailed insights into the hybridization mechanism. Single-molecule FRET results reveal an "in situ" DNA hybridization mechanism, i.e., hybridization between the probe and target DNAs to form a ds-DNA, and simultaneous desorption from the GO surface thereafter. These results also demonstrate that the electrostatic interaction between DNA and GO is of little importance to the overall theory of interaction and the largest effects are from solvation forces, specifically the hydrophobic effect. This investigation improves the fundamental understanding of the DNA hybridization dynamics on the GO surface, opening new windows in the field of biophysics as well as in sensing and therapeutic applications.
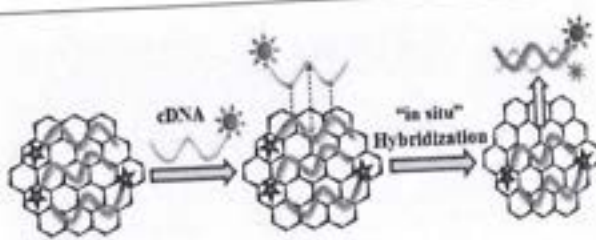
1. INTRODUCTION

Large multiprotein machines are known to typically use cooperative interactions to promote and modulate DNA transactions that are responsible for a variety of fundamental procedures.[1] Besides DNA bending and/or wrapping, hybridization of single-stranded DNA (ss-DNA) to double-stranded DNA (ds-DNA) and dissociation back to ss-DNA plays an important role in several life processes.[2] For a long time, cooperative hydrogen bonding-based DNA hybridization assays of base pairs have been used in medicine, molecular biology, and other DNA-related technologies.[3,4]

Sensing of DNA is a tedious process that requires multistep amplification due to the negligible concentration of DNA under physiological conditions.[5,6] Traditionally, DNA is detected by exploitation of nucleic acid probes grafted on a transducer surface that is used as a molecular recognition element,[5] by targeting through Watson–Crick interactions. This type of DNA sensor needs to be precise enough in terms of its manifestation to distinguish between ss-DNA and ds-DNA at the interface, and this can be achieved either using hybridization indicators or through changes in the physicochemical behavior of the sensing layer.[7–10] Hence, it is very important to understand the behavior of DNA at the interfaces, as the interactions between the substrate with DNA and the environment have substantial contributions in tuning the hybridization processes at the interface.[2,11,12] Moreover, the structural and functional stabilities of the biomolecules in the environment play a crucial role in the practical viability of the biomolecule–material hybrid. It is known that noncovalent

interactions of biochemical functional groups with a mesoporous structure can significantly disrupt the biomolecular structure and function and hence affect nucleotide bioavailability in solution.[13] Thus, insight into the detailed mechanism of this interaction is required to monitor it as well as the structural deformation that the biomolecules undergo during such an interaction.[14]

Since its discovery in 2004, graphene[15] and its derivatives,[16] especially graphene oxide (GO), have been used as an immobilization platform for biosensors due to their unique electronic, mechanical, and optical properties as well as their high surface area and fluorescence quenching ability.[17–19] Being a low-dimensional system and due to its increased hydrophobicity and processability, the study of the interaction of GO with DNA has accumulated great research interest in the recent past.[20–23] Irrespective of the negative charge on both DNA and GO, DNA still adsorb reversibly onto the surface of GO in the solution phase, and this can be tuned by the concentration of salts in the medium.[24,25] It has also been seen that the adsorption affinity of purine bases or purine-based DNA toward a GO surface is stronger than that of pyrimidine bases or pyrimidine-based DNA.[26] The driving force for the adsorption could be an effective combination of either two or all three phenomena, namely, the shielded electrostatic force, the dehydration effect, and the intermolecular hydrogen bonding.

Scheme 1. Three Possible Reaction Mechanisms for Hybridization of Surface-Adsorbed Bimolecules: (A) Displacement Mechanism, (B) Eley–Rideal Mechanism, and (C) Langmuir–Hinshelwood Mechanism[a]

(A) Displacement mechanism

(B) Eley-Rideal mechanism

(C) Langmuir-Hinshelwood mechanism
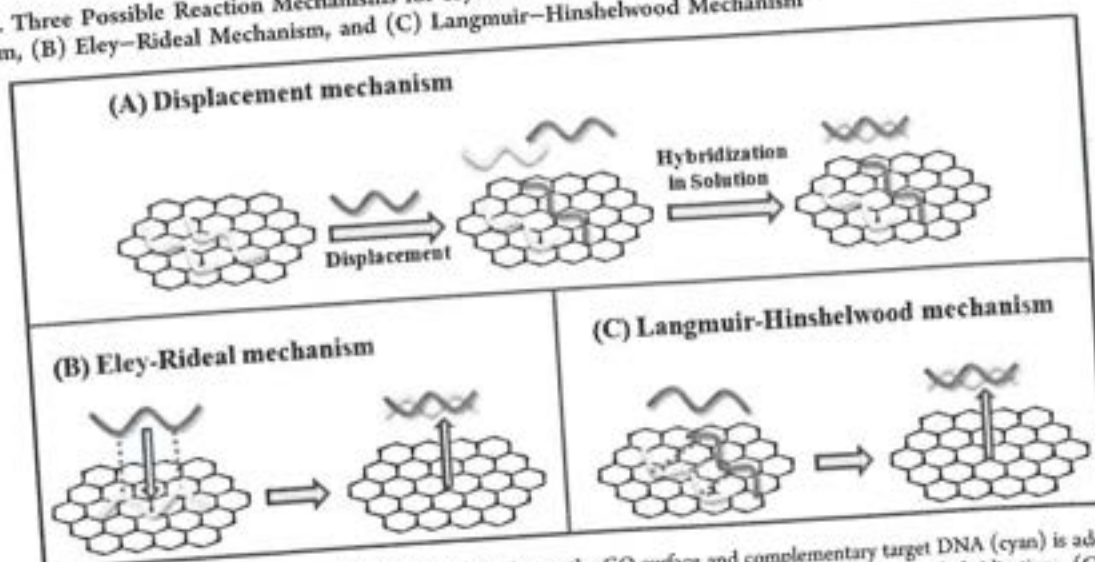
[a]In all of these cases, the probe DNA (yellow) is initially adsorbed onto the GO surface and complementary target DNA (cyan) is added to it later. (A) Displacement mechanism: displacement, followed by hybridization; (B) Eley–Rideal mechanism: direct hybridization; (C) Langmuir–Hinshelwood mechanism: hybridization on the surface, followed by diffusion. The surface functional groups and conjugated bonds of GO have been excluded for simplicity.

Table 1. Sequence of the Oligonucleotides with Modification

Name of the oligo	Sequence and Modification (5' to 3', unless specified)	% of purine & pyrimidine
D1	Biotin-TGGCCAAAAAAGCATTGCTTATCAATTTGTTGCACCGACCCTAA-Cy3	47.7 & 52.3
D2	Cy5-TCGGTGCAACAAATTGATAAGCAATGCTTTTTTGGCCA	50 & 50
D3	TTAGGGTCGGTGCAACAAATTGATAAGCAATGCTTTTTTGGCCA	52.3 & 47.7
D4	TGGCCAAAAAAGCATTGCTTATCAATTTGTTGCACCGA	50 & 50
D5	CAGGAATTCCATATGGAATTCCTGATGAGCGAAGCACTTAATTCTG	52.2 & 47.8
D6 (D3+D4)	5'-TTAGGGTCGGTGCAACAAATTGATAAGCAATGCTTTTTTGGCCA-3' 3'-AGCCACGTTGTTTAACTATTCGTTACGAAAAAACCGGT-5'	51.1 & 48.9
D7 (D1+D2)	5'-Biotin-TGGCCAAAAAAGCATTGCTTATCAATTTGTTGCACCGACCCTAA-Cy3-3' 3'-ACCGGTTTTTTCGTAACGAATAGTTAAACAACGTGGCT-Cy5-5'	51.1 & 48.9

As GO is also a competent fluorescence quencher,[21,27] fluorophore-labeled DNA and aptamers have been extensively coupled with GO as an analytical tool for nucleic acid detection;[28] sensing of metal ions,[29] small molecules,[18,30,31] proteins,[32–34] viruses,[35–37] cells,[16,38] and drug delivery.[39,40]

The dynamic nature of GO, to be used as a sensor, is based on its ability to bind to ss-DNA with a greater affinity compared to that of binding to ds-DNA or well-folded ss-DNA.[21] Despite the valuable functionalities of GO-loaded ss-DNAs in DNA biosensors,[41] little information is available about the role of GO in the mechanistic pathway of the hybridization of its DNA cargo. The majority of work carried out so far in this field is based on mixing of a fluorophore-labeled ss-DNA with GO, leading to DNA adsorption onto the GO surface, with successive quenching of the fluorescence. Upon addition of target DNA, the probe DNA desorbs from the GO surface and hybridizes to form a ds-DNA in solution, restoring the fluorescence. Two possible mechanisms have been proposed earlier by Liu et al. and Kim et al. to explain these phenomena,

as represented in Scheme 1. Out of the three possible surface reaction mechanisms (Scheme 1), namely, (A) displacement,[26] (B) the Eley–Rideal mechanism, and (C) the Langmuir–Hinshelwood mechanism,[42] Liu et al. proposed that hybridization follows nonspecific probe displacement in the solution phase, i.e., the displacement mechanism.[26] On the other hand, according to Kim et al., desorption of the DNA adsorbed onto GO is followed by hybridization with the complementary DNA (cDNA) on the GO surface, i.e., the Langmuir–Hinshelwood mechanism.[43] However, it has been quite challenging to define the analyte-induced desorption reaction or duplex formation mechanism on a molecular scale due to the lack of substantial experimental evidence.

Our work demonstrates the mechanistic aspects underlying the adsorption of DNA onto or its desorption from the GO surface in aqueous solution using both ensemble and single-molecule fluorescence resonance energy transfer (sm-FRET) methods.[44] The experiments were carried out by fluorophore-labeling both of the probe and target DNAs with a donor and

B

acceptor FRET pair to get the accurate distance-dependent interaction between them. The results depict the fundamental mechanism during the interaction and set the stage for formulating GOs as carriers of nucleic acids. The outcomes obtained emphasize the postulation of a parallel mechanism that can serve as the basis for further design and optimization of GO-based DNA sensors.

2. MATERIALS AND METHODS

2.1. Chemicals and Materials. Analytical-grade chemicals from Sigma-Aldrich, without further purification, were used to carry out all of the experiments. Graphite flakes were purchased from Fishier Scientific. The experimental buffer was made using salts from Merck (India). Milli-Q water was used to prepare all solutions, including buffers, which were either sterilized or filtered through 0.22 μm membrane filters. Labeled and unlabeled oligonucleotides that were purified using high-performance liquid chromatography were purchased from IDT and used without further purification (Table 1). Buffer containing 10 mM Tris–HCl and 50 mM Mg^{2+}, pH 7.5, was used to make ds-DNA by annealing equimolar amounts ss-DNA. The mixture was heated at 90 °C for 4 min, followed by slow cooling to room temperature; it was then stored at −20 °C before further use. Oligonucleotide D1 is biotin-tagged at the 5′ end, which helps in surface immobilization during the sm-FRET experiments.

2.2. Synthesis of GO. GO was synthesized following a marginally modified Hummers' procedure.[45] A 9:1 mixture of concentrated H_2SO_4/H_3PO_4 was added to a mixture of graphite flakes (1 wt equiv) and $KMnO_4$ (6 wt equiv), producing a slight exotherm to 35–40 °C. The reaction mixture was then heated to 50 °C and stirred for 12 h. It was then cooled to room temperature and poured onto ice (~400 mL) with 30% H_2O_2. The filtrate was centrifuged (at 4000 rpm for 2 h), and the supernatant was decanted away. The remaining solid material was then washed in succession with 200 mL of water, 200 mL of 30% HCl, and 200 mL of ethanol (two times). The material remaining after this extended multiple-washing process was coagulated with 200 mL of ether and properly centrifuged at 4000 rpm for an hour. The solid obtained on the filter was vacuum-dried overnight at room temperature to obtain the desired product.

2.3. Fluorescence Measurement of DNA Adsorption/Desorption. Adsorption of ss-DNA was carried out initially using 100 nM D1 (Table 1) oligonucleotide in buffer A, containing 50 mM Tris–HCl of pH 7.2, 100 mM NaCl, and 10 mM $MgCl_2$. For complete adsorption, 40 μg/mL GO was added in four subsequent steps (Figure S1). In every step, 10 μg/mL GO was added and incubated for 3 min at room temperature; then, fluorescence was measured using a Fluoromax-3 spectrofluorimeter from Jobin Yvon Horiba. Desorption was carried out after complete fluorescence quenching of Cy3 on D1. Either D2, D3, D4, D5, or D6 (an unlabeled duplex made using D3 and D4) (100 nM) was added in different experiments (Figure 1). After each addition, the reaction was incubated for 3 min. To monitor Cy3 and Cy5 emissions, the sample was excited at 530 and 635 nm, respectively.

To monitor the complete quenching of Cy5-labeled DNA (D2), 100 nM D2 DNA was taken in buffer A and incubated with 40 μg/mL GO for 30 min at room temperature. There was no fluorescence signal on monitoring through ensemble measurement, indicating that it was completely quenched.

For adsorption of only D2 onto GO, the above-mentioned DNA/GO complex mixture was centrifuged at 13 000 rpm for 15 min and the free DNA was removed by discarding the supernatant, followed by washing with the same buffer. The washing was carried out two times, and this mixture was used in the sm-FRET experiment for further analysis. It was checked whether the adsorbed probe DNA was relatively stable without further addition of DNA and the background fluorescence remained unchanged, which are well supported by the previous report.[26] Similarly, samples of unlabeled complementary (D3) and noncomplementary (D5) oligonucleotides adsorbed onto GO are prepared following the same protocol.

2.4. sm-FRET Measurements. We followed an already established procedure to execute the sm-FRET experiments.[46] In brief, predrilled quartz microscope slides were cleaned thoroughly and poly (ethylene glycol) (PEG)/biotin−PEG was coated onto their surfaces. Cy3-tagged DNA oligonucleotides (D1) were then surface-immobilized onto the quartz slides through streptavidin−biotin chemistry. The preadsorbed and completely quenched Cy5-labeled oligonucleotides with the GO were real-time flown into the sample chamber containing the D1 substrate.

Our home-built prism-type total internal reflection-based setup is developed on an inverted microscope (Olympus IX 71), as shown in Figure S2. A solid-state diode laser of 532 nm (Laser Quantum, U.K.) was used to excite Cy3 using the evanescent wave generated because of total internal reflection of the light beam by a pellin-broca prism. A 532 nm solid-state green laser is used to excite Cy3, and the emission signals from both Cy3 and Cy5 were simultaneously collected using a water immersion objective (60×, 1.2 NA; Olympus). After the signals pass through a long-pass filter (550 nm; Chroma), the fluorescences of Cy3 and Cy5 are separated using a dichroic mirror (640DCXR, Chroma). Individual signals were recorded simultaneously using an electron multiplying charge coupled device camera (emCCD, Ixon3 + 897; Andor Technologies), with a frame integration time of 30 ms. The Visual C++ (Microsoft, WA)-based data acquisition software used was a generous gift from T.J. Ha (University of Illinois) or Tae-Hee Lee (Pennsylvania State University). Each image frame, containing ~500 molecules, was analyzed by program codes written on an Interactive Data Language platform, and the legitimate FRET traces were extracted. Cy3 emission bleeds though to the Cy5 channel (typically <5%) is rectified during the data analysis. All experiments are carried out at room temperature.

Individual time traces were corrected for cross-correlation and background noise. The legitimate FRET traces were chosen to construct single-molecule time-dependent trajectories for the donor−acceptor chromophore. FRET efficiency was calculated using the relationship

$$E_{FRET} = \frac{I_A}{I_D + I_A} \qquad (1)$$

where E_{FRET} is the FRET efficiency and I_D and I_A are the intensities of Cy3 and Cy5, respectively. A hidden Markov model algorithm was used to fit the FRET trajectories and extract all kinetics information for individual FRET states. Approximately 100 traces were included in constructing the FRET histogram. The FRET distances of different states were calculated using the following equation

$$E = \frac{R_0^6}{R^6 + R_0^6} \tag{2}$$

where R and R_0 are the Förster distance and the distance between the donor and acceptor, respectively.

3. RESULTS AND DISCUSSION

The efficiency of adsorption of ss-DNA onto a GO surface is stronger compared to that of ds-DNA due to $\pi-\pi$ stacking, hydrogen bonding, hydrophobic interactions, and so forth.[21] The Watson—Crick hydrogen bonding and helical structure reduce the adsorption efficiency of ds-DNA. However, when the [DNA]/[GO] ratio is substantially less, ds-DNA is adsorbed onto the GO surface and undergoes partial structural deformation.[43,47] The experiments carried out so far to postulate a proper mechanism for DNA adsorption onto or desorption from the GO surface have been mainly focused on the addition of either cDNA or homopolymers to the existing probe DNA on the GO surface. Because of the similar adsorption affinities, the former rather blurs the hybridization mechanism, whereas the latter maximizes the difference in the adsorption energy of the probe DNA toward the GO surface. Moreover, in most cases, as the target DNA is not fluorophore-labeled, it contributes less to the study of the hybridization mechanism. To have a clear picture of the adsorption/desorption mechanism, we have individually labeled both the probe and target DNAs, having similar adsorption powers, keeping the percentage of purines and pyrimidines almost equal (Table 1). The calculated T_m and hybridization energy have been presented in Table S1. The two dyes (Cy3 and Cy5) used here are a well-known FRET pair.[48]

Upon addition of GO to the 100 nM Cy3-labeled D1 oligonucleotide, the fluorescence intensity was gradually quenched, as expected[21] (Figure S1), and the quenching has been found to have a temporal effect as well. This quenching due to the adsorption of the oligonucleotide onto GO follows first-order kinetics, with a rate constant of 2.98×10^{-3} s^{-1} at room temperature (Figure S3) and an equilibrium affinity constant of 1.1×10^{-4} M. After the fluorescence was almost quenched for 40 μg/mL GO, the experiment was continued with the addition of an unlabeled complementary oligonucleotide of D1 (i.e., D3) to this DNA/GO complex to recover the fluorescence. Similarly, the experiments were also performed with the addition of unlabeled D1 (i.e., D4), unlabeled duplex D6, and an ss-DNA that is not complementary to D1 (i.e., D5). According to the law of mass action, upon addition of target DNA the fluorescence is expected to increase due to the displacement of the preadsorbed oligonucleotides from the GO surface, as adsorption and desorption of DNA onto the GO surface are reversible processes and also depend on concentration.[21] The experiments were performed maintaining the same concentrations of probe and target DNAs, by adding the target DNA in three subsequent steps. A plot of fluorescence intensity versus DNA concentration (Figure 1) reflects that the recovery of fluorescence intensity of the probe DNA is distinctively higher (~44%) on addition of its complementary sequence (D3) compared to that on addition of the other two sequences (Figure 1, inset). The observed recovery of fluorescence due to the addition of duplex DNA D6 is substantially less (~3%), which argues for a very low displacement power of ds-DNA, and this could be due to the low adsorption capability of ds-DNA on the GO surface.[36] The
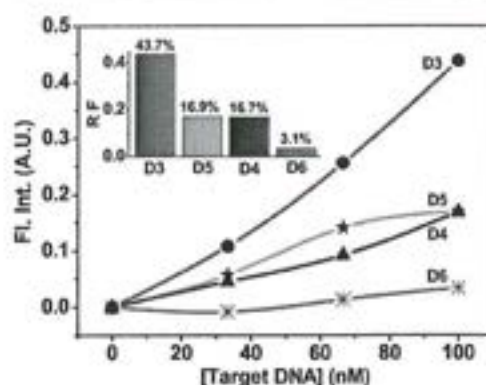
Figure 1. After complete quenching of Cy3 of the probe DNA (D1), we treated this with D3 (red), D4 (blue), D5 (green), and D6 (magenta) separately as the target DNA in three subsequent steps to recover the fluorescence intensity. Here, the concentrations of the probe and target DNAs were the same. The inset represents the relative fluorescence intensity (RF), which is a ratiometric form of the fluorescence intensities after (F) and before (F₀) the addition of target DNA. The recovery intensity is high for D3 (~44%), almost the same for D4 and D5 (~17%), and very low for D6 (~3%).

moderate fluorescence recovery values (16.7 and 16.9%) for the addition of D4 and D5 entail the involvement of higher-order interactions compared to those with ds-DNA (Figure 1, inset). This indicates a possible involvement of the displacement mechanism with the preadsorbed probe on GO. The proportionate probe desorption effects observed for D4 and D5 (~17% recovery) could be due to their comparable adsorption and desorption affinities toward GO, as the percentage of purine and pyrimidine bases in D4 and D5 are nearly the same (50:52 and 50:48). However, the addition of D3 induced maximum probe desorption (~44% intensity recovery), indicating a different mode of interaction with the probe as compared to that with the other target DNAs. Had only the displacement mechanism been followed, it would have produced a similar effect as that in the cases of D4 and D5. The higher probe desorption is only due to the formation of duplexes upon addition of the complementary sequence (D3). The temperature variation fluorescence study for both D7 (donor- and acceptor-labeled duplex) and D1 adsorbed onto GO also indicate a higher hybridization energy compared to the D1/GO adsorption energy (Figure S4). As one target complementary DNA should induce the desorption of one probe DNA, ~100% desorption is quite expected.[21] However, after the formation of the duplex (which is unfavorable to readsorption), a vacant space is formed on the GO surface and the freely diffusing target DNA is adsorbed into that vacant position; thus, the probability of recovery is compensated to some extent due to the adsorption of freely diffusing target DNA. Hence, desorption of the probe DNA from the GO surface is not 100% anymore, unless excess target DNA and enough incubation time are provided.[21] This is more likely the cause for the ~44% recovery of fluorescence intensity for the complementary target DNA (Figure 1), as we have used 1:1 probe and target DNAs. Moreover, D4 or D5 only displaced the preadsorbed D1 from the GO surface. The results also emphasize that although displacement occurred in all cases the mode of displacement was entirely different for different oligonucleotides. On the addition of a complementary sequence, displacement occurred predominantly because of

duplex formation. This also proposes the substantial role of the nucleotide sequence of the probe DNA in facilitating the displacement. To further validate/explore the actual desorption pathways, we have designed two parallel sets of experiments to see how complementary sequences influence the displacement process.

Experiment 1: To prove our hypothesis that displacement of the probe DNA occurs only because of duplex formation upon addition of complementary sequences, we have added an acceptor (Cy5)-labeled complementary strand (i.e., D2) to the completely quenched donor (Cy3)-labeled strand (D1). In this case, both the donor and acceptor are labeled at the same end, with six-nucleotide differences, having an approximate distance of ~4.5 nm. Once they hybridize to form ds-DNA, a high FRET is expected upon excitation of the donor. FRET efficiency (E_{FRET}) was calculated using eq 1, and Figure 2
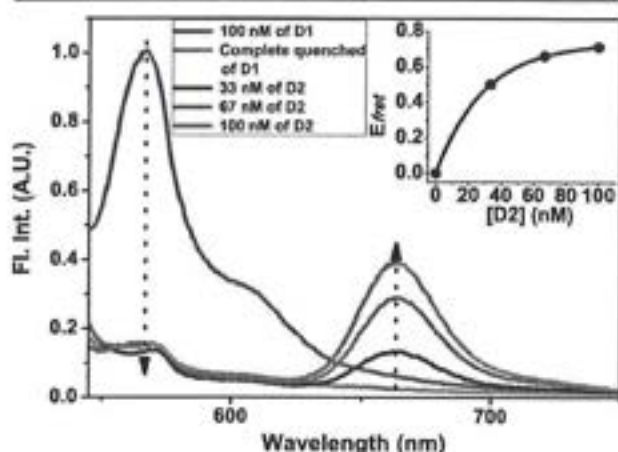
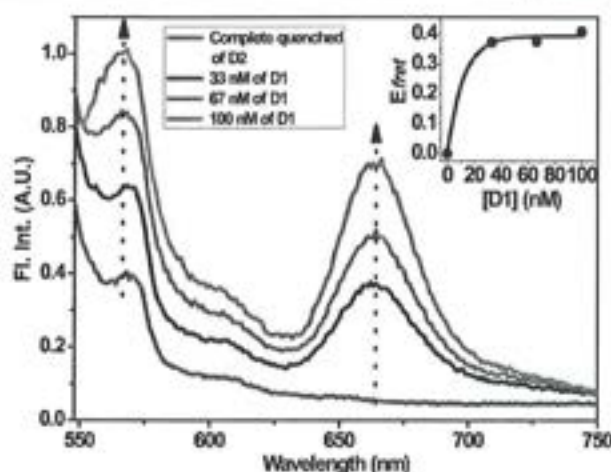Figure 2. After complete quenching of Cy3 on D1 (100 nM), the D1/GO complex is treated with D2 as a target DNA in three subsequent steps, maintaining the same probe concentration. With a gradual increase in [D2], the FRET efficiency increased and Cy3 intensity remained almost same as that in the quenched state. This indicates the presence of a dual-labeled duplex only in solution. The inset represents the exponentially fitted curve of E_{FRET} vs [D2], showing a gradual increase in E_{FRET} with an increase in [D2].

(inset) shows that E_{FRET} gradually increased upon addition of D2. Had it been only due to displacement, we would rather expect an increase in the donor intensity to some extent; however, no such competitive observation was encountered in this case (Figure 2). This truly emphasizes the absence of free D1, supporting the presence of a mixture of hybridized ds-DNA and free D2 in the solution.

Experiment 2: This experiment was the reverse of Experiment 1; i.e., aliquots of D1 were added to the adsorbed complex of D2 and GO (completely quenched) in a stepwise manner. It was observed that E_{FRET} as well as the donor intensity gradually increased with an increase in the concentration of D1 (Figure 3). Moreover, E_{FRET} is found to be less compared to that in the previous case (Experiment 1). In this case, E_{FRET} (Figure 3, inset) and the donor intensity increased simultaneously, as the solution contains both donor- and acceptor-labeled ds-DNA.

To minimize the error, all of the oligonucleotides used here are designed to have almost similar efficiencies of adsorption onto and desorption from GO. In Experiment 1, as the entire content of donor-labeled D1 was adsorbed onto the GO surface

Figure 3. After complete quenching of Cy5 on D2 (100 nM), we added D1 as a target DNA in three subsequent steps, maintaining the same probe concentration. With a gradual increase in [D1], the FRET efficiency gradually increased, but the increase was less than that observed in Figure 2. This is because both labeled duplex and target D1 were present in the solution. Hence, the FRET efficiency and Cy3 signal simultaneously increase. The inset represents the exponential fitting of E_{FRET} vs [D1], showing an increase in E_{FRET} with increasing [D1].

initially, the addition of acceptor-labeled D2 would result in either of the following two cases: (1) hybridization to form a duplex on the GO surface, followed by diffusion into the solution or (2) displacement of D1 from the GO surface, followed by immediate duplex formation in solution. Figure 2 shows an increase in E_{FRET} instead of an increase in the donor intensity. This also supports the idea that either the incoming target DNA displaced the probe DNA (D1) only under the hybridized condition or displacement of the probe DNA and hybridization with the target DNA occurred simultaneously once the probe DNA was added. Upon duplex formation of the ss-DNAs used here, Cy3 and Cy5 come very close to each other. Hence, a high FRET predominates instead of an increase in the donor intensity.

So far, the results illustrate that if the target oligonucleotide was complementary to the probe, then displacement occurred only because of the formation of a duplex. In the case of noncomplementarity, the target DNA only displaced the probe DNA from the GO surface. The exact region of duplex formation, i.e., whether it takes place in the solution or explicitly on the GO surface, still remains ambiguous. Using significantly different adsorption and desorption coefficients of probe and target DNAs, Liu et al. suggested that hybridization occurred in the solution phase after nonspecific probe displacement.[26] On the other hand, Kim et al. recently suggested that hybridization between target and probe DNAs takes place on the GO surface, followed by desorption from the surface and diffusion to the solution.[43] However in both of these cases, the experiments were carried out using single-labeled oligonucleotides and hence the probe could not contribute significantly to explaining the mechanism.

Although ensemble methods are suitable for portraying both advanced materials and biomolecules, they are mostly not suitable to precisely represent and define biomolecular structures at the interface. The limitation of the existing methods lies in their inability to provide the local electronic

E

Before addition of D2 /GO complex   **After addition of D2 /GO complex**
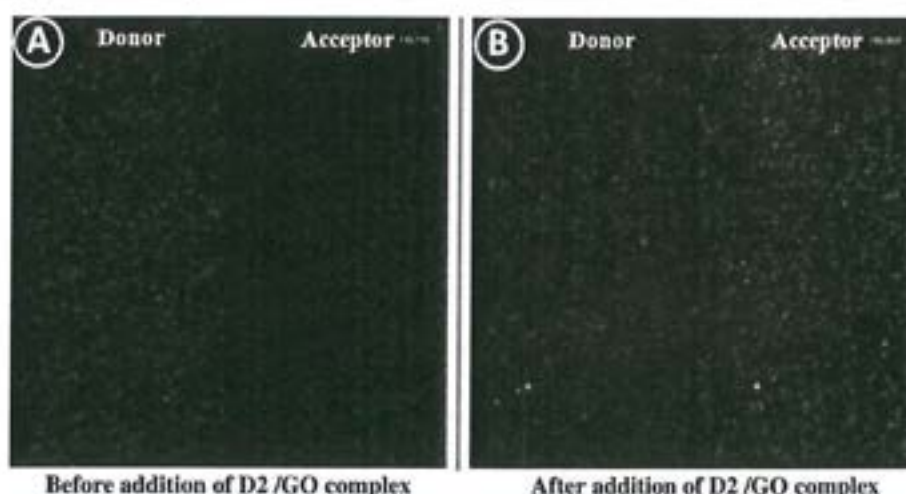
Figure 4. Captured image from the sm-FRET experiment. The left and right panels represent the donor and acceptor sides, respectively. (A) Initially, only the Cy3 signal was observed in the donor channel, from Cy3-labeled D1 DNA. (B) After delivery of the preadsorbed D2/GO complex to the sample chamber, the same number of Cy5 spots appeared at the acceptor channel. This indicates that most of the immobilized D1 formed a duplex with D2.

Scheme 2. Possible Mechanisms from the sm-FRET Experiment: (A) Displacement and (B) the Langmuir–Hinshelwood Mechanism[a]
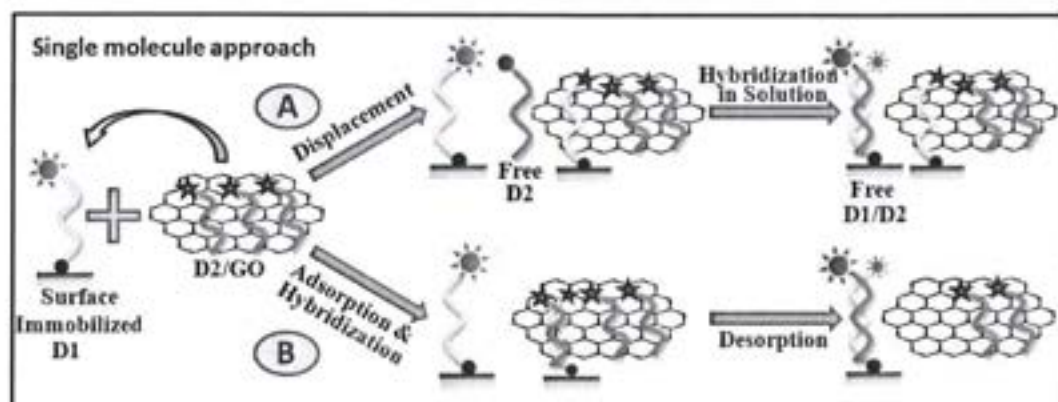
[a]Biotin (black solid circles) and Cy3 (green star)-labeled D1 (yellow) was immobilized on a quartz slide, and completely quenched (black star) Cy5-labeled preadsorbed D2 (cyan) was delivered in real time. Fluorescence recovery of Cy5 is denoted as a red star.

properties, bioavailability, basic molecular structure, and conformation of complex biological systems. Because of this, the prediction of relevant biological activities of these systems is inhibited. Recently, the sm-FRET technique has been proven advantageous in this regard due to its simplicity for building ratiometric fluorescent systems. In contrast to one-signal sensors, ratiometric sensors can eliminate most ambiguities in detection by self-calibration of two emission bands, as they contain two chromophores of different wavelengths and use the ratio of these two fluorescence intensities to detect the analytes quantitatively. The ratio between the fluorescence intensities is not influenced by external factors, such as fluctuation of the excitation source. Although, single-molecule measurements also encounter a major limitation, that is a constraint in the volume from which fluorescence signals are acquired, the constructive advantages of this technique make it an important tool to study complex biophysical phenomena with significant findings. Our attempt to use the sm-FRET technique has presented information that would remain rather challenging to be inferred from traditional bulk-phase measurements.

The sm-FRET experiments were carried out as described previously,[48] using both complementary and noncomplementary target DNA to study the hybridization mechanism. In our experiment, Cy3-labeled D1 was immobilized on a quartz surface via biotin–streptavidin chemistry and GO-adsorbed, completely quenched Cy5-labeled complementary oligonucleotide D2 was delivered in real time (Figure S5). Initially, ~500 Cy3 molecules were seen in the donor channel, without any molecule in the acceptor channel (Figure 4A). Once the GO/D2 mixture was delivered after monitoring ~50 frames, substantially fewer molecules appeared in the acceptor channel. In this situation, duplex formation is expected to occur only when the adsorbed D2 and immobilized D1 interact with each other to hybridize. The two expected outcomes are explained in the subsequent section.

When the preadsorbed D2 comes close to the immobilized D1, it should be displaced by the immobilized D1, with subsequent adsorption of D1 onto the GO surface. So, the attached Cy3 on D1 is also expected to be quenched. After desorption, the free D2 will approach another immobilized D1

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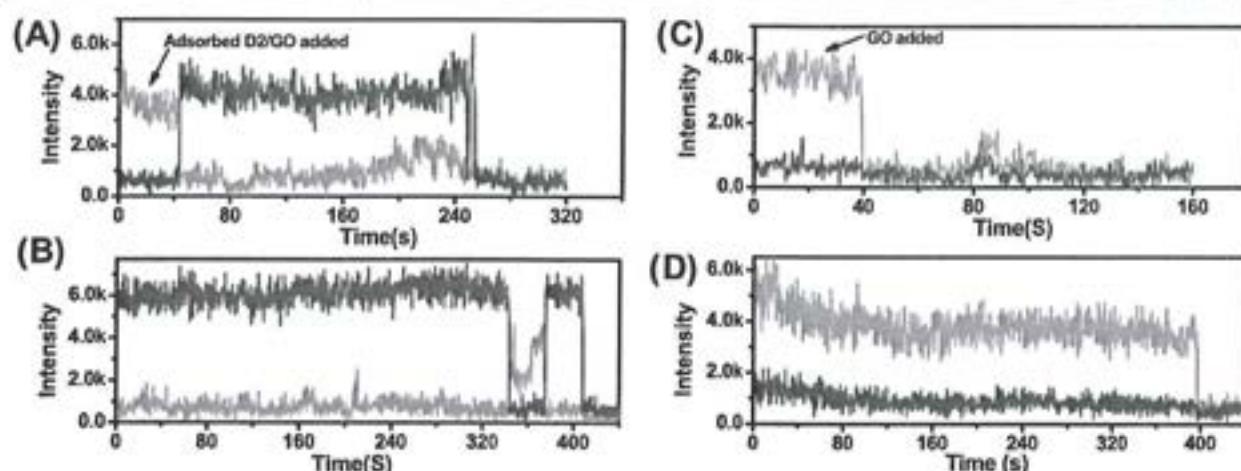
Figure 5. (A) Time traces of real-time delivery of the preadsorbed D2/GO complex to immobilized D1. (B) Time traces of dual-labeled ds-DNA D7. (C) Time traces of real-time delivery of GO to immobilized D1. (D) Photobleaching time traces of D1. The red trajectories represent the acceptor signal, and the green ones represent the donor signal. The arrows are an indication of the time of delivery.
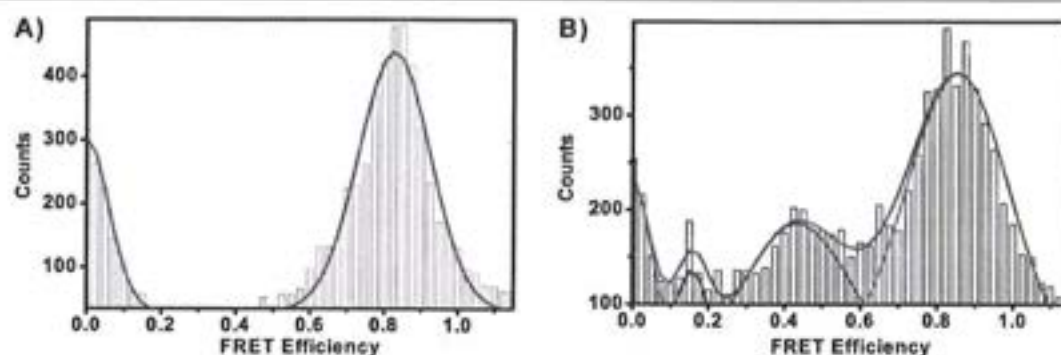
Figure 6. (A) Histogram of control DNA (i.e., D7), showing only one FRET state (0.85). (B) Real-time histogram of duplex formation, showing two additional distinct FRET states (0.16 and 0.43).

to form a duplex, following the displacement mechanism (Scheme 2, path "A"). The other possible mechanism could be as follows: when the adsorbed D2 comes close to the immobilized D1, hybridization takes place on the GO surface itself and the formed duplex subsequently leaves the GO surface. This is very similar to the Langmuir–Hinshelwood mechanism, represented in path "B" of Scheme 2.

Considering the mechanism followed in path A, most of the immobilized Cy3 on D1 would gradually be quenched and the rest would hybridize to form duplexes. This should also result in a reduced number of molecules appearing in the acceptor channel. However, after incubating for about an hour, approximately 91% of the molecules appeared in the acceptor channel (Figure 4B). This clearly indicates duplex formation due to hybridization with Cy3-labeled D1; thus, there was an increase in the number of FRET events as well. The explained deliberations in combination suggest that the formation of a duplex does not follow the displacement mechanism of path A. Two sets of control single-molecule experiments were also carried out with real-time delivery of preadsorbed non-complementary D5 and unlabeled complementary D3 on GO, respectively, to immobilized D1. In the case of addition of the complementary oligonucleotide, we could still see approximately 93% of the Cy3 molecules (Figure S6A), whereas on addition of the noncomplementary oligonucleotide, there were about 70% Cy3's in the donor channel (Figure

S6B). This is due to duplex formation in the former case, whereas the latter contributes significantly in displacement but is not affected by the immobilized target D1. A partial hindrance by interactions with GO might be responsible for not observing 100% hybridization.

If path B was being followed, the donor intensity would have been quenched as soon as D1 came near the GO surface during the real-time experiments, before transfer of energy to Cy5. However, no such competitive processes of quenching and energy transfer were observed from the sm-FRET experiment. Rather, for most of the events, the trajectories are found to be well anticorrelated at a particular FRET state (Figure 5A). This does not support the argument that duplex formation follows path B. Figure 5B represents the FRET trajectories of donor- and acceptor-labeled duplex DNA (D7) in the absence of GO. Moreover, in the control experiment, involving the addition of an unlabeled complementary oligonucleotide to GO, most of the trajectories show a constant high fluorescence intensity over a long time period. However, a few trajectories reflect a slight temporal decrease in fluorescence intensity and continue until they photobleach. This is because the hybridization could initiate either at the two ends or at the middle portion of the oligonucleotide. Although the occurrence of a similar effect during the delivery of D2-adsorbed GO cannot also be ruled out, the number of such events is probably negligible due to predominant energy transfer. Control experiments of real-time

delivery of only GO to immobilized D1 simply results in one-step quenching of Cy3 (Figure 5C) because of immediate adsorption and certainly not because of photobleaching. Figure 5D shows a substantially long trace trajectory for D1 only.

The kinetic parameters have been obtained from a hidden Markov analysis of about 100 FRET trajectories of both control DNA (D7) (Figure 5B) and a real-time duplex formed by D1 and D2/GO (Figure 5A). The kinetic data indicate that the rate of duplex formation in both the cases are almost same (0.7/s for control and 0.64/s for experimental duplex). Similarly, ~100 trajectories were considered to build up the FRET histogram. Although in the control experiment (D7) we could see only one FRET state of 0.85 (Figure 6A), analysis of the real-time experiment of duplex formation shows two additional individual FRET states of 0.16 and 0.43, indicating the presence of two distinct intermediate states (Figure 6B). One of them could be a result of conformational changes in the immediate interactions between the individual oligonucleotides during the hybridization processes and the other could be due to hydrophobic interactions between the newly formed ds-DNA and the existing GO. The possible existence of other conformational states cannot be explained for the time being and assignment of the exact conformational state to the corresponding FRET state requires further investigation, which is still underway. Nonetheless, combining the above considerations along with the previously published results, we postulate a mechanism in which the hybridization neither exclusively materialized on the GO surface nor completely in the solution phase. Rather, it follows marginally a hybridized pathway, in which the desorption of the probe DNA from the GO surface and hybridization with the target DNA occur simultaneously as an "in situ" process, i.e., following the Eley–Rideal mechanism (Scheme 3). This means, when the adsorbed

Scheme 3. Representation of the Proposed ds-DNA Hybridization Mechanistic Pathway on the GO Surface
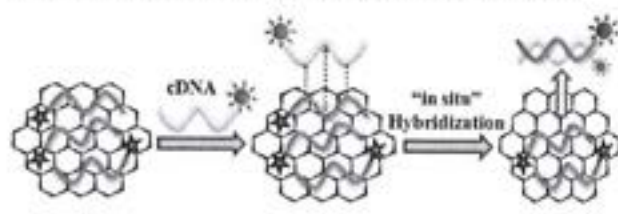
D2 interacts with the immobilized D1, duplex formation occurs immediately and the duplex leaves the GO surface instantly. For this reason, the initial high donor intensity is compensated by an increase in the FRET efficiency, with identification of fairly anticorrelated traces (Figure 5A). However, as the initial concentration of immobilized D1 is less, due to the reduced probability of interaction, duplex formation does not take place instantly. At the same time, a combination of effectively attractive forces between immobilized D1 and GO and preadsorbed complementary D2 works as the driving force to bring the adsorbed D2 closer to the immobilized D1. Duplex formation due to compelling hybridization appears as an increase in the Cy5 intensity and a substantial increase in the number of FRET pairs after incubation for some time.

4. CONCLUSIONS

We have systematically employed ensemble as well as single-molecule methods to illustrate the mechanism of DNA

hybridization on the GO surface. Although the donor–acceptor-labeled oligonucleotides are able to provide substantial information from the ensemble FRET measurements, the sm-FRET experiments provide considerable insight into details of the hybridization mechanism, which have never been explained previously. Our results postulate that the hybridization and diffusion to the solution from the GO surface occur in situ. Both hydrophobic interactions and electrostatic repulsion greatly influence the binding between GO and DNA. Hence, when the concentration of either the probe or target DNA was less, the rate of hybridization also decreased. This could be due to the incapability of the hydrophilic interactions to overcome the electrostatic repulsion or to the lesser attractive force between both the oligonucleotides compared to the desorption energy. This basic understanding of the adsorption–desorption mechanism can be applied to study the reaction mechanism in other bionanosystems and can help designing and optimizing sensors and devices based on these materials.

■ ASSOCIATED CONTENT

ⓢ Supporting Information

The Supporting Information is available free of charge on the ACS Publications website at DOI: 10.1021/acs.jpcb.6b06017.

DNA adsorption, sm-FRET instrumental diagram, and scheme of the real-time experiment (PDF)

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Notes

The authors declare no competing financial interest.

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Impact of Globalization on Indian Rural Markets

By Angira Sharma

consequences seem to be dominating over positive consequences. Despite of good that is globalization has done to the Indian rural markets, it has brought enormous changes to the culture, lifestyle, hardworking nature and attitudes of rural customers. As rural areas are treated to be the dominating markets in India, globalization by effecting rural markets has shown considerable effect on Indian economy. At the same time we cannot ignore the positive consequences of globalization to rural markets as they educated rural markets in many ways.

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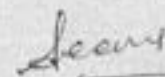
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19वीं और 20वीं शताब्दी के पूर्वाद्ध में भारतीय समाज अनेक कुरीतियों तथा रूढ़ियों में जकड़ा हुआ था। अनेकों सामाजिक बुराइयाँ यथा बाल विवाह, विधवा पुनर्विवाह निषेध, सती प्रथा, प्रर्दा प्रथा, जाति प्रथा आदि समाज में विद्यमान थी। समाज में धर्म के नाम पर अनेकों कर्मकाण्ड तथा आडम्बर निभाये जाते थे तथा अनेकों अंधविश्वास विद्यमान थे। समाज में चारों तरफ अशिक्षा और अज्ञान था। जनमानस में एक तरफ तो अशिक्षा और अज्ञान के कारण समाज में विद्यमान सामाजिक बुराइयों की वजह से तथा दूसरी तरफ स्वेच्छाचारी, निरंकुश तथा अत्याचारी ब्रिटिश राज की वजह से घोर निराशा फैली हुई थी।

स्वतंत्रता पूर्व अनेक महान व्यक्तियों जैसे राजा राम मोहन रॉय, स्वामी दयानन्द सरस्वती, महात्मा गांधी, डॉ. भीमराव अम्बेडकर, श्रीमती एनीं बेसेंट, स्वामी विवेकानन्द आदि ने जो विभिन्न मतों तथा धर्मों के थे, समाज में फैली इन कुरीतियों तथा बुराइयों को अपने चिन्तन द्वारा दूर करने की हर सम्भव कोशिश की। इन सभी समाज सुधारकों के अथक प्रयासों तथा चिन्तन द्वारा काफी हद तक समाज में जागृति आई तथा एक नई चेतना फैली। इस नई चेतना की अन्तिम परिणती देशवासियों में राष्ट्रवाद के जन्म के रूप में हुई। ऐसे ही एक चिन्तक पं. मोतीलाल नेहरू थे। अधिकतर लोग उन्हें स्वतंत्रता संग्राम के एक राष्ट्रीय नेता तथा भारत के प्रथम प्रधानमंत्री पं. जवाहरलाल नेहरू के पिता के रूप में जानते है। भारत के राष्ट्रीय आन्दोलन और संवैधानिक इतिहास में उनका विशेष योगदान रहा है, परन्तु वे राष्ट्रीय नेता होने के साथ–साथ एक चिन्तक तथा समाज सुधारक भी थे। उनके विचारों में मौलिकता थी। उनके विचारों का प्रभव उनके युग पर ही नहीं बल्कि आज तक स्वतंत्र भारत पर पड़ रहा है।

ऐसे समय में जब समाज अनेक सामाजिक बुराइयों तथा कुरीतियों में जकड़ा हुआ था पं. मोतीलाल नेहरू का जन्म 6 मई 1861ई. को आगरा में हुआ। उनके जन्म से पूर्व ही उनके पिता की मृत्यु हो जाने के कारण उनका परिवार अभाव तथा कठिनाइयों से गुजर रहा था, परिणामस्वरूप मोतीलाल जी का बचपन अनेक अभावों तथा कठिनाइयों में बीता।

परिस्थितियों के विपरीत वे बचपन से ही बड़े साहसी, दृढ़ निश्चयी तथा सत्य के लिए परिस्थितियों के आगे न झुकने का साहस रखने वाले व्यक्ति थे। वे शिक्षित तथा विद्वान व्यक्ति थे। वे परिस्थितियों को अपने अनुसार बदलने में विश्वास रखते थे न कि खुद उनके अनुसार बदलने में।

पं. मोतीलाल नेहरू ने आधुनिक युग के नये विचारों से प्रेरणा पाई थी। पाश्चात्य शिक्षा के खुले विचारों तथा वातावरण ने उनके व्यक्तित्व पर अमिट छाप छोड़ी थी। उनका दृष्टिकोण उदारतावादी था तथा वे धार्मिक उदारता और सहनशीलता के समर्थक थे। जीवन में अनेक अभाव तथा कठिनाइयों के बावजूद वे अपनी लगन, हिम्मत और मेहनत करने की आदत के कारण अत्यन्त सफल तथा समृद्ध वकील बने। वे अपने समय के हिन्दुस्तान के प्रसिद्ध वकीलों में से एक थे तथा उन्होंने वकालत से अपार धन अर्जित किया। उनके जीवन के प्रति सिद्धान्त स्वतंत्रता और उन्नति के थे तथा दृष्टिकोण तर्क पूर्ण था। स्वतंत्र पेशा होने की वजह से जब उन्होंने अपने सार्वजनिक जीवन में समाज तथा देश की परिस्थितियों को समझा और समाज में फैली इन कुरीतियों तथा बुराइयो की वजह से समाज तथा देश में फैली निराशा को महसूस किया तब उन्होंने इन सभी सामाजिक बुराइयों को समाज से दूर करने और सभ्य, शिक्षित तथा स्वस्थ समाज की स्थापना का निश्चय किया और वे अपनी इस कोशिश में जीवन पर्यन्त लगे रहे।

उनके स्वतंत्र तथा निर्भीक विचारों का पता हमें उनके जीवन में घटी कई घटनाओं से चलता हैं जैसे उस समय सामाजिक मान्यताओं के हिसाब से भारतीयो का विदेश जाना निषिद्ध था। यदि कोई चला जाए तो उसे जाति से बहिष्कृत कर दिया जाता था अन्यथा उसे प्रायश्चित करना होता था। अनेकों कर्मकाण्ड तथा आडम्बर निभाते हुए उसे ब्राह्मण द्वारा अपनी शुद्धी करानी होती थी तभी समाज तथा जाति में उसे पुनः सम्मिलित किया जाता था। सन् 1899ई. में मोतीलाल जी अपनी प्रथम यूरोप यात्रा पर गए। जब वे वापस आए तो उन्हें भी प्रायश्चित करने के लिए समाज कंटकों ने कहा। ऐसे में इन रूढ़िवादी विचारों और मान्यताओं का विरोध करने की बात भी सोचने का मतलब था समाज से बहिष्कार, परन्तु मोतीलाल जी ने इस रूढ़िवादी विचारधारा का सफल विरोध किया। उन्होंने 22 दिसम्बर 1899ई. को पृथीनाथ चक को लिखे अपने पत्र[1] में लिखा कि "मैं प्रायश्चित नहीं करूँगा। मैंने निर्णय कर लिया है, चाहे कुछ भी हो जाए, मेरी मृत्यु ही क्यों न हो जाए मैं प्रायश्चित जैसी तुच्छ मूर्खतापूर्ण कार्यवाही नहीं करूँगा। मेरे विरोधी मुझे झुका नहीं पाएगें।" वे पुनः 1905ई. को विदेश यात्रा पर गए और इस बार अपने पूरे परिवार के साथ गए, और अपने पुत्र जवाहर लाल का हारों के स्कूल में दाखिला करा कर लौटे।

मोतीलाल जी के विचारों का खुलापन उनके कार्यों और व्यवहार में स्पष्ट दिखता हैं। जब इलाहबाद हाईकोर्ट के जज हैरिसन फाकनर ब्लेयर ने उन्हें नाश्ते पर आमन्त्रित किया

तो उन्होंने इस निमन्त्रण को सहर्ष स्वीकार किया और उन्हें लिखा कि "आपके साथ नाश्ता करने में उन्हें कोई पूर्वाग्रह नहीं है।"[2] वे मानते थे कि देश को स्वतंत्रता तभी मिल सकती है जब हम पहले अपने इन सामाजिक बन्धनों से आजादी प्राप्त करें। उन्होंने कहा कि एक स्वस्थ समाज ही स्वतंत्रता की प्राप्ति कर सकता है और एक स्वतंत्र राष्ट्र 'भारत' की स्थापना कर सकता है।

अंग्रेजों द्वारा भारतवासियों को प्रतिभावान होते हुए भी प्रत्येक स्तर पर अंग्रेजों से कम आंका जाता था। मोतीलाल जी अपने देश में छिपी हुई प्रतिभाओं को जानते थे और मानते थे कि भारतीयों को अनेकों बार सामाजिक बन्धनों की वजह से विकास का मौका नहीं मिल पाता है, भारतीय किसी भी तुलना में अंग्रेजों से कम नहीं है बल्कि अंग्रेजों से ज्यादा योग्य साबित होंगे यदि उन्हें भी अंग्रेजों की तरह खुला वातावरण और विकास के अवसर मिले तो। अप्रैल 1909ई. में यूनाइटेड प्राविन्सेस का सामाजिक सम्मेलन[3] हुआ। इसमें अध्यक्ष के पद से बोलते हुए पं. मोतीलाल नेहरू ने कहा कि "सामाजिक सुधार मेरे विचार से राजनैतिक सुधार के बहुत अपमानित मात–पिता है।" अर्थात् वे मानते थे कि सामाजिक और राजनैतिक सुधारों में माता–पिता और संतान का रिश्ता हैं और सामाजिक सुधार राजनैतिक सुधारों से पहले होने चाहिए।

पं. जवाहरलाल नेहरू को मार्च 1906 ई. में लिखे अपने पत्र में उन्होंने लिखा कि "एक भारतीय लड़का अपनी उम्र के बराबर के अंग्रेज लड़के से ज्यादा विचारवान होता है।"[4] वे मानते थे कि भारतीय बच्चों में जितनी प्रतिभा होती है उतनी शायद कहीं और नहीं, जरूरत है तो सिर्फ उन्हें वो सामाजिक शैक्षिक वातावरण देने की जिसमें वे विकास कर पाए। उन्होंने शिक्षा के विकास के लिए अनेक कार्य किये। उन्होंने मार्च 1913ई. में यूनाइटेड प्राविन्स की काउन्सिल में लेजिस्लेटिव काउन्सिल के लिए एक पुस्तकालय[5] की स्थापना की माँग की। उसी दिन उन्होंने अतिरिक्त प्राथमिक विद्यालय[6] खोलने का भी समर्थन किया। वे उस युग में भी महिलाओं की शिक्षा के लिए चिन्तित थे उन्होने महिलाओं के लिए शैक्षिक संस्थाओं को आर्थिक सहायता[7] बढ़ाने का भी समर्थन किया। स्कूल खोलकर प्रशिक्षण कक्षाएं शुरू किये जाने की वकालत की ताकि सर्टिफाइट अध्यापक हर जगह उपलब्ध हो सकें। लड़कियों के स्कूलों के लिए अतिरिक्त सहायता देने की उन्होंने मांग की।

मोतीलाल जी शिक्षा के महत्व के साथ–साथ यह भी जानते थे कि गरीब अशिक्षित भारतीय जनता शिक्षा के महत्व को नहीं समझती है, वे आजीविका मुश्किल से कमा पाते है तो शिक्षा पर कुछ खर्च कैसे करेंगे इसीलिए सन् 1916ई. में उन्होंने मुफ्त और अनिवार्य शिक्षा[8] के प्रश्न पर सरकार से विचार करने का आग्रह किया। एक विशेष शिक्षा कर[9] (सेस) लगाये जाने की भी वकालत की। उन्होंने महिलाओं में चेतना जगाने और उन्हें सशक्त बनाने के लिए पर्दा प्रथा के बारे में लिखा कि "पर्दा केवल चेहरे से ही नहीं हटाना है बल्कि

दिमाग से भी पर्दा हटाना है।" इस कार्य के लिए उन्होंने लखनऊ में महिला वलब खोले जाने की बात कही जिसमे सभी धर्मों की महिलाओं को आमन्त्रित किया जायेगा, जिसमें स्थायन कक्ष और जलपान कक्ष भी होंगे।

मोतीलाल जी ने समाज के गरीब मजदूर तथा पिछड़े वर्ग के हितों की रक्षार्थ प्रतिज्ञापत्र प्रणाली द्वारा मजदूरी के लिए लोगों को देश से बाहर ले जाए जाने पर भी सवाल उठाए। उन्होंने मार्च 1917 ई. में संशोधित आर्थिक वक्तव्य" पर बोलते हुए कहा कि "बंधुआ मजदूर के रूप में प्रवास स्वयं में एक बुराई है और इसे रोका जाना चाहिए।" उन्होंने कहा कि भारतीयों को दूर देशो में ले जाया जाता है जहाँ उनसे अमानवीय स्थितियों में मजदूरी कराई जाती है जहाँ न सरकार और न जनता उनके अधिकारों की रक्षा तथा उनकी रक्षा की गारण्टी लेती है। उन्होंने कहा कि सरकार को प्रतिज्ञा पत्र प्रणाली पर होने वाले खर्च के बारे में नही बल्कि इस बुराई को खत्म करने के बारे में सोचना चाहिए।

मोतीलाल जी ने जातिवादी संगठनों की आलोचना की और कहा कि यह स्वयं जाति व्यवस्था पर आधारित है इसलिए इनसे जाति व्यवस्था समाप्त नहीं होगी। उन्होंने कहा "मैं पहले भारतीय हूँ और बाद में एक ब्राह्मण।" वे ऐसे सभी रीति रिवाजों का विरोध करते थे जिनसे सामाजिक कुरीतियाँ जन्म ले। उन्होंने मार्च 1919ई. के अपने एक पत्र[12] में प. जवाहरलाल नेहरू को लिखा कि मैंने इलाहबाद के हिन्दुओं की एक सार्वजनिक सभा बुलाई है जिसका उद्देश्य होली के दौरान होने वाली गंदी हरकतों को रोकना है। स्कूलों में धार्मिक शिक्षा को दिये जाने का उन्होंने विरोध किया। मोतीलाल जी भिखारी को दान देना धार्मिक पुण्य नहीं मानते थे। उन्होंने सितम्बर 1920ई. में कहा कि "छोटे बच्चों और लडकियों को भिखारी या साधु बनाये जाने से रोकने के कार्य से सरकार का यह भय उचित नहीं है कि इससे धार्मिक भावनाएँ आहत होंगी।"[13] वे ब्राह्मण होते हुए भी धर्म को किसी भी सामाजिक नसले से जोड़ने के पक्ष में नहीं थे तथा ऐसा करने का हमेशा विरोध करते थे। समाज में भाईचारा बना रहे, सामाजिक विभाजन न हो, जहाँ तक सम्भव हो विभिन्न सामाजिक समुदायों के बीच वैमनस्य खत्म हो, मनमुटाव न रहे, इसकी मोतीलाल जी हमेशा कोशिश करते थे।

मोतीलाल जी ने समाज के सभी वर्गों, समुदायों तथा धर्मों को समानता का अधिकार दिलाने के लिए सरकारी नौकरियों में केवल योग्यता पर ध्यान देने की हिमायत की। उन्होंने सनी पदों पर खुली प्रतियोगिता परीक्षा[14] द्वारा भर्ती किये जाने कि वकालत की। प्रान्तीय सिविल सेवाओं के सम्बंध में उन्होंने कहा कि "समाज के सभी वर्गों तथा सभी समुदायों को खुला अवसर मिलना चाहिए, एक समान पद के लिए सभी सदस्यों को एक समान वेतन व भत्ते मिलने चाहिए।"

असहयोग आन्दोलन के अचानक स्थगित हो जाने से देश की राजनीति में ठहराव आ गया। कांग्रेस के भीतर चितरंजनदास और मोतीलाल नेहरू के नेतृत्व में जो दल उमरा वह परिवर्तन वादियों का था। फरवरी 1923ई. में आनन्द भवन, इलाहाबाद में स्वराज पार्टी का कार्यक्रम तय किया गया।[15] मोतीलाल जी ने पार्टी के कार्यक्रम में अन्य राजनैतिक बिन्दुओं के साथ समाज सुधार के इन बिन्दुओं को भी रखा।

1. पार्टी औद्योगिक और खेतिहर मजदूरों का संगठन करेगी।

2. कांग्रेस के स्वदेशी खद्दर, नशाबंदी, अछूत समस्या, साम्प्रदायिकएकता और राष्ट्रीय शिक्षा तथा पंच–फैसला कोर्ट को बढ़ाने का पूरा प्रयास करेगी।

मोतीलाल जी ने मार्च 1923ई. में पंजाब का दौरा किया। वहाँ मलकाना राजपूतों की समस्या थी और शुद्धि आन्दोलन चल रहा था। मुस्लिम मजदूरों का हिन्दु बहिष्कार कर रहे थे। कूँचा–बंदी चल रही थी। निर्णय हुआ कि सामाजिक और आर्थिक रूप से एक समुदाय दूसरे समुदाय का बहिष्कार न करे तथा धर्म परिवर्तन में अनुचित साधनों का प्रयोग या शक्ति का प्रयोग न हो। अक्टूबर माह में उन्होंने जनता से गलत लोगों (सहधर्मी) का विरोध करने का आवाहन किया। उनके इस आवाहन[16] पर देवबन्द के मौलाना मो. उजैर, बी. जे. पटेल, सुभाष चन्द्र बोस जैसे सौ नेताओं के हस्ताक्षर थे। मोतीलाल जी का मानना था कि सभी धर्मावलम्बियों को धर्म का पालन तथा धार्मिक कार्य करने की स्वतंत्रता होनी चाहिए। उन्होंने कहा कि "धार्मिक कार्यों और संस्कारों में हिन्दू और मुसलमानों को अपने धर्मों के निर्देश एक दूसरे से स्वतंत्र होकर मानना चाहिए तथा सभी धर्म निरपेक्ष मामलों में दोनों को मिलकर कार्य करना चाहिए तभी हिन्दू मुस्लिम एकता स्थापित होगी।"[17]

मोतीलाल जी का मानना था कि किसी भी साम्प्रदायिक समस्या[18] का हल साम्प्रदायिक प्रतिनिधित्व नहीं हो सकता है। वे किसी भी समस्या का दूरगामी हल निकालने के पक्षधर थे। वे मानते थे कि इससे साम्प्रदायिकता बढ़ेगी न कि कम होगी। उन्होंने कहा "मैं ऐसी हर योजना का विरोध करता हूँ जो आई.सी.एस. में साम्प्रदायिक प्रतिनिधित्व को लागू करे।" उन्होंने रजा अली के द्वारा बताए गये साम्प्रदायिक प्रतिनिधित्व को भी दुर्भाग्य पूर्ण बताया यह प्रतिनिधित्व नगरपालिका और जिला बोर्डों से सम्बंधित था। उन्होंने कहा कि साम्प्रदायिकता[19] भौतिक लाभ से सम्बन्धित है। यह विरोधियों के प्रति घृणा पैदा करता है। छोटी–छोटी बातों पर संघर्ष हुए हैं। धार्मिक संकीर्णताओं को शिक्षा और आपसी समझदारी बढ़ा कर ही दूर किया जा सकता है। समाज में सभी लोग अपनी आवश्यकताओं की पूर्ति के लिए एक दूसरे पर निर्भर करते है। हमें उनकी आपसी निर्भरता को बनाए रखना है।

ब्रिटिश सरकार से बार–बार आग्रह पर भी निराशा मिली। मोतीलाल जी ने कहा कि सरकार जानबूझ कर शिक्षा का विकास नहीं चाहती है इसीलिए कोई ठोस कदम नहीं

उठाती है। उन्होंने 1928ई. में अपने एक साक्षात्कार में कहा कि "भारत में अज्ञान है। ग्रेट ब्रिटेन जिन राज्यों पर अधिकार करता है वहाँ की जनता को अज्ञान में रखता है जिससे वे जागरूक न बने।"[20]

मोतीलाल जी ने 1928ई. के भारतीय राष्ट्रीय कांग्रेस के 43वें अधिवेशन में अध्यक्ष[21] के रूप में बोलते हुए कहा कि उत्तर भारत की तुलना में दक्षिण भारत में छुआ–छूत अधिक है वहां सामाजिक विभाजन अधिक जटिल है। उन्होंने अछूतों की भलाई, शराब तथा पर्दाप्रथा का विरोध करने के लिए कहा। उन्होंने बताया कि हमने बाल–विवाह को रोकने का प्रयास किया है। भारतीय राष्ट्रीय कांग्रेस के दिसम्बर 1928ई. के इसी अधिवेशन मे जब भाषा के प्रश्न पर विवाद[22] उठा तो मोतीलाल जी ने कहा कि "भाषा के प्रश्न पर उत्तेजित होने की (हिन्दी भाषा से सम्बन्धित) जरूरत नहीं है। हिन्दी और उर्दू को राष्ट्रीय भाषा घोषित किया गया है। भाषा अभिव्यक्ति का माध्यम है विवाद का नहीं। भाषण हिन्दी, उर्दू और अंग्रेजी भाषा में दिये जा सकते है।"

मोतीलाल जी ने 12 फरवरी 1929ई. को उन्होंने उत्तराधिकार के हिन्दू कानून के संशोधन विधेयक[23] पर कहा कि समाज सुधारक के रूप में वे इस बिल का पक्ष लेते हैं। वास्तव में इस बिल में प्रत्यावर्ती उत्तराधिकारी या वारिस के विषय में निर्णय होना था। यह विशेष परिस्थितियों की बात थी जैसे कोई व्यक्ति बिना अपनी पत्नी या लड़कों को या लड़कियों को छोड़े मर जाए और उसके ममेरे चाचा हो तब क्या होगा। इस बिल के द्वारा पिता के पिता और चाचा के बीच महिला उत्तराधिकारियों को रखा गया था। प्रथम भाई (रिश्तेदारी में) पिता की ओर के चाचा थे। मोतीलाल जी ने इसमें मतदान में भाग नहीं लिया क्योंकि इससे महिला उत्तराधिकारियों को उत्तराधिकार में देर होती।

मोतीलाल जी सामाजिक बुराइयों को दूर करने के लिए राष्ट्रीय, प्रादेशिक तथा स्थानीय स्तरों पर स्वयं जनता के बीच गए उन्हें समझाने की कोशिश की, सभाएं की, तथा इन बुराइयों का कानूनी रूप से खण्डन करवाने के लिए इनके विरूद्ध कानून बनवाने की कोशिश की। उन्होंने शिक्षा के प्रचार और प्रसार के लिए निरन्तर कार्य किया क्योंकि शिक्षा के अभाव में ही या अशिक्षित समाज में आम जन की सोच सामाजिक रूढ़ियों में जकड़ जाती है। उन्होंने कहा कि "सुशासित देश की पहली चिंता एक अच्छी शैक्षिक नीति का निर्धारण होना चाहिए।"[24] उनके इन निस्वार्थ प्रयत्नों के बहुत अच्छे परिणाम रहे। वे मानते थे कि शिक्षित व्यक्ति समाज को नई दिशा दे सकते है तथा देश की समस्याओं को हल करने में अपना योगदान दे सकते हैं, वैसा ही हुआ। भारत में धीरे–धीरे शिक्षा का प्रसार होने लगा, अब विद्यार्थी भी राष्ट्रीय आन्दोलन में भाग लेने लगे। अब राष्ट्रीय आन्दोलन में अभूतपूर्व तेजी आई। मोतीलाल जी ने सविनय अवज्ञा आन्दोलन को और अधिक मज़बूती देने

के लिए बम्बई के विद्यार्थियों[25] से कहा कि "आपके लिए सबसे बड़ी शिक्षा इस समय आन्दोलन में उतरने की है तभी सरकार लकवा ग्रस्त हो जायेगी।"

मोतीलाल जी मानते थे कि राजनैतिक सुधारों से पहले सामाजिक सुधार होना चाहिए क्योंकि एक स्वस्थ समाज में ही स्वस्थ राजनीति सम्भव है। देश वास्तविक अर्थों में तभी स्वतंत्र हो पायेगा जब स्वस्थ समाज में रहने वाले लोग दिमाग से स्वतंत्र हो पायेंगे, उनकी सोच संकीर्णता, अन्धविश्वास, रूढ़िवादिता से ग्रसित नहीं होगी, उनके विचार स्वतंत्र और तार्किक दृष्टिकोण पर आधारित होंगे। शिक्षित वर्ग ने जिस तीव्रता से राष्ट्रीय आन्दोलन में भाग लिया, राष्ट्रीय आन्दोलन में उतनी ही तेजी आई। धीरे-धीरे राष्ट्रीय आन्दोलन जन-जन का आन्दोलन बन गया। चेतना जागृत करने का सबसे कारगर उपाय शिक्षा ही होती है। समाज सुधार और सामाजिक बुराइयों को दूर करने में मोतीलाल जी के प्रयास और कार्य उल्लेखनीय है। उनका चिन्तन सकारात्मक और तार्किक दृष्टिकोण पर आधारित था, विचारों में स्वतंत्रता और खुलापन था। उन्हें अपने इन कार्यों और उद्देश्यों में काफी हद तक सफलता भी मिली। अपने निस्वार्थ उद्देश्यों की पूर्ति में वे मृत्युपर्यन्त लगे रहे।

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GENDER AND WORK LIFE BALANCE: A STUDY OF SCHOOL TEACHERS

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ABSTRACT

Teaching is the profession that is opted by good number of females as career. But whatever be the area females have to face certain difficulties that are related to work life balance. In present time most of the workforce at the workplace wonder for one major perquisite in their careers i.e. Work life balance It is however difficult to achieve and maintain a healthy work-life balance, for both for men and women. The question here is "whether one gender is better than the other at managing a work-life balance? The work life balance among males and can be different. In this paper an attempt has been made to bring out the difference in the level of work life balance among male and female teachers. Certain test has been used by determining what differentiate work life balance among male and female. Sample of 51 teachers have been taken for study. Questionnaires have been framed with five point Likert scale with the ten items to find out the level of work life balance among the two genders. The score of two will depict the level. Better score shows better situation.

KEYWORDS: Work Life Balance, Workplace Wonder, Perquisite, Five Point Likert Scale.

Introduction

Indian education system like any other countries education system has undergone many changes. India is witnessing the change from guru Kul education to online education. Education has added new feathers in the life of females too. Teaching is very good and Nobel profession and consist of many spheres as work culture, responsibility towards society and students, authority etc. The term 'Education' now has to be accepted with much greater responsibilities than before. Till now the focus has been only on generating Quantity that is large number of lawyers, doctors, engineer, etc. But with the moving trends of excess occupation opportunities in any sector, this one definitely shift from Size to the Quality part within the learning generations. And the main focus will be on producing better human beings rather than ineffectual beings. This could be achieved for sure by strengthening our education sector that will than generate more of the opportunities and to strengthen education sector there is the need of better and devoted workforce called teachers. These teachers whether male or female have equal role and responsibility. And this responsibility could be achieved only when they are satisfied and happy at work and home. Both man and woman have equal status and equal opportunities as career, and this equality has to be shared in all spheres like equality in proper balance of work and life. The expression work life balance was first used in the United Kingdom in the late 1970s to describe the balance between an individual's work and personal life. In the United States, this phrase was first used in 1986 As said and described work life balance is "adjusting work patterns so that everyone, regardless of age, race or gender can find a rhythm that enables them more easily to combine work and their other responsibilities and aspirations" Pilinger (2001).Whatever kind of education system exist teachers role is always

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चित्तौड़गढ़ क्षेत्र के संगीत के इतिहास में मीरां का योगदान

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चित्तौड़गढ़ के संगीत—इतिहास में भक्तिमती मीराबाई का नाम विशेष उल्लेखनीय है। इसका समय विक्रमी संवत् १५५५—१६०३ माना गया है। मीरा ने अनेक पदों की रचना की और इनकी रागरागिनियों का निर्धारण किया। मीरा के पद सारे भारतवर्ष में रुचिपूर्वक सामान्य जनता से लेकर संगीत शास्त्रियों तक गाये जाते हैं। सामान्य जनता द्वारा चित्तौड़ में गाये जाने वाले मीराबाई के भजन लोकसंगीत के उत्तम उदाहरण है। मीरा को बाल्यकाल से ही संगीत शास्त्र का विशेष ज्ञान था और विवाहिता होकर चित्तौड़ राजपरिवार में आने के पश्चात् महाराणा कुम्भा द्वारा संगृहीत संगीत सम्बन्धी सामग्री का भी अवश्य ही मीरा ने अध्ययन किया होगा। मीरा ने अपने संगीत शास्त्र सम्बन्धी अध्ययन के आधार पर एक विशेष राग भी प्रचलित की, जिसकी मीरा की मल्हार कहा जाता है। मीरा की मल्हार के सम्बन्ध में संगीत—जगत में विशेष जानकारी के अभाव में मीरा के स्थान पर सामान्यतः मियां की मल्हार का ही अस्तित्व स्वीकार किया जाता है। वस्तुतः मियां की मल्हार' और मीरा की मल्हार दोनों का ही स्वतन्त्र अस्तित्व है, किन्तु वर्तमान में 'मीरा बाई की मल्हार' प्रचलित नहीं है।

मीराबाई स्वरचित भक्तिपरक पदों को भक्त—मण्डलियों में नृत्य करती हुई गाती थीं, जिसके विषय में नाभादास ने अपने 'भक्त माल' में यह उल्लेख किया है —

लोक लाज कुल श्रृंखला तजि, मीरा—गिरिधर भजी

सदृश गोपिन प्रेम प्रकट करलियुगति दिखायो।
निर अंकुश अति निडर रसिक जग रसना गायो।
दुष्टन दोष विचारि मृत्यु को उद्यम कीयो।
बार न बांको भयो गरल अमृत ज्यों पीयो
भक्ति निशान बजाय के काहु ते नाहिन लजी
लोक लाज कुल श्रृंखला नाज, मीरा गिरिधर भजी।।

मीरा—संगीत को तीन भागों में विभक्त किया गया है —

१. शास्त्रीय संगीत :— मीरा बाई के अनेक पद उच्च श्रेणी के संगीत—शास्त्रियों द्वारा विभिन्न राग—रागिनियों में गाये जाने रहे है। इनमें भारतीय संगीत—सम्बन्धी नियमों का पूर्णरूपेण निर्वाह होता है। इन रागरागिनियों में— भैरव, मालकंास, ललित पंचम, शंकरा, भूपाली, दुर्गा, कल्याण आदि मुख्य है। इन रागों के साथ लगने वाली तालों में चौताल, तिताल, एक ताल, धमार, झुमरा और दीपचन्दी आदि है।

२. सुगम संगीत :— मीरा के अनेक पद भजन और ठुमरी अंग में भी गाये जाते है। इस प्रकार के संगीत में सरल आलाप और तालों का प्रयोग होता है। मीरा को सुगम संगीत सम्बन्धी रागरागिनियों में काफी, खमाज, भैरवी, देश, सोरठ, बिहाग और पीलू आदि मुख्य है और इनके साथ कहरवा, तीनताल, दादरा, रूपक और दीपचन्दी आदि तालों का प्रयोग होता है।

३. लोक—संगीत :— सामान्य जनता द्वारा मीरा—पदावली को लोक—संगीत के रूप में गाया जाता है। इनके गायन में सरलता रहती है और संगीत—शास्त्रीय नियमों का कोई बन्धन नहीं होता है। तथापि मीरा—पदावली सम्बन्धी लोक—संगीत में मांड, झिंझोटी, पहाड़ी, मांड, पीलू, देस और सोरठ आदि राग—रागिनियों का प्रभाव स्पष्ट रूपेण लक्षित किया जा सकता है। इसके ताल भी कहरवा, दादरा, रूपक, अद्धा दीपचन्दी की लय में बजाये जाने वाले बोलों पर आधारित ठेके से सम्बन्धित होते है।

'मीरा अपने युग की महान् संगीतज्ञा थी। यही कारण है कि मीरा ने अपने पदों में यथा स्थान राग—रागिनियों एवं तालों आदि का निर्देश किया है। राग—रागिनियों का निर्धारण भी सम्बन्धित विषय और

भावानुसार संगीत—शास्त्र के अनुसार किया गया है। प्रतीत होता है कि मीरा स्वरचित पदों को शास्त्रीय राग—रागिनियों में निबद्ध गाया करती थी।

मीरा की समस्त रचनाएं गीतों अथवा पदों के रूप में होती है। जिसमें उनके हृदय का दिव्य निनाद्य अवतरित हुआ है। इनके गीतों में यथार्थ प्रतीति मिलती है, जिसमें सहज लोक—वृत्ति, सहज हृदयोद्गार है। कहीं भी विषय—वासना एवं कटु भावों का चित्रण नहीं हुआ है। झांझ, मंजीरा, करताल व इकतारा के रूप में वाद्य—प्रयोग और नृत्य के साथ गायन करते हुए, संगीत के तीनों अंगों की सफल समन्वित साधना करने का पूर्ण श्रेय मीराबाई को है। उनकी संगीत कला का लक्ष्य मोक्ष प्राप्ति है। इस कथन का सर्वोत्तम प्रमाण हमें ehjk d h xgjh l kluk esfey r k g$"

मीरा राजस्थान के दो प्रमुख राग—परिवारों से सम्बन्धित थी, क्योंकि इनका पोषण मेड़ता और मारवाड़ निवास था। स्पष्ट है कि इन्हें बाल्यकाल में ही विधिवत संगीत की शिक्षा प्राप्त हुई थी। मीरा को शास्त्रीय संगीत के साथ ही लोक—संगीत का भी विशेष ज्ञान था और यही कारण है कि इनके पद सामान्य जनता द्वारा लोक—गीतों के रूप में गाये है। इस विषय में "डॉ उमा मिश्रा" ने लिखा है— संगीत की दृष्टि से मीरा के पद जहां एक ओर तत्कालीन शास्त्रीय संगीत के आधार को ग्रहण करते हुए पूरिया कल्याण, वागेश्वरी, दरबारी, जैजैवन्ती, आनन्द भैरवी जैसे रागों में बंधे है वहीं अनेक पद कजरी, लावनी इत्यादि लोक—गीतों की धुन पर भी रचे गये है। अतः इसमें सन्देह नहीं कि मीरा को संगीत का अच्छा ज्ञान था।'

मीरा की संगीत—साधना की प्रमुख विशेषता शास्त्रीय और लोक—संगीत का अनूठा समन्वय है। इसी समन्वय साधना के कारण मीरा के पद सामान्य जनता से लेकर उच्च कोटि के संगीत—शास्त्रीयों तक प्रिय है। "श्रीकुमार गन्धर्व ने मीरा—पदावली की लोकप्रिय धुनों के आधार पर 'मालवती' नामक राग का प्रचलन किया है। इसी प्रकार श्री ओंकारनाथ ठाकुर ने मीरा के पदों को भैरवी और 'मालकंस' राग में गाया है।'

'मीरा पदावली में २६ रागों का समावेश हुआ है। मीरा ने विषय और रस के अनुसार रागों का

प्रतिपादन किया है जिससे ज्ञान होता है कि मीरा संगीत-शास्त्र में पारंगत थी। संयोग, श्रृंगार का निरूपण करते हुए मीरा ने कांफी, कालिंगडा, पूर्यिकल्याण, पूर्वी शील, विभास, गौरी, ललित, खमाज, बागेश्वरी, कुंतारी और गारा आदि राग अपनाये हैं जिनमें प्रेम-मिलन की तीव्र अभिलाषा, मादकता सरसता और आनन्द उल्लास व्यक्त करने की क्षमता है।"

'मीरा पदावली में लोक प्रचलित धुनें मिलती है जिनका समावेश कालान्तर में शास्त्रीय रागों के अन्तर्गत भी हो गया। ऐसी रागों में देस, मांड, सोरठ, और गारा आदि है। लौकिक राग सम्बन्धी मीरापदावली के निम्नलिखित पद मुख्य है'''—

राग देस — १. दरस बिण दूखा म्हारा नैन।
२. म्हाणे चाकर राखो जी गिरधारी लाल
३. जोगी म्हाणे दरस दिया मुख होय

राग सोरठ — १. थाने कांई कांई बोल सुणावां, म्हारा सांवर गिरधारी।
२. देखां भाई हरि मण काठ किया।
३. पतिया कैसे लिखूं, लिखपोई न जाय।

राग मांड — १. माई री म्हां लिया गोविन्दा मोल।
२. तेगे कोई नही रोकणहार, मगन होय मीरा चली।
३. दीज्यां म्हाने द्वारिका को बास कड़ा गणछोडूजी।

मीरा ने मध्यकालीन महिला होने के नाते लोकगीत अवश्य ही सुने और गाये थे। साथ ही सामूहिक लोक नृत्यों में भी भाग लिया था। यही कारण है कि मीरा-पदावली में चित्तौड़ के परम्परागत लोक-संगीत और लोक-नृत्यों का प्रभाव है।

मीरा-पदावली में लोकवाद्य :— मीरा के गीतों में घन, अवनद्ध, सुषिर और तत्तु चारों प्रकार के वाद्यों का उल्लेख हुआ है। एकतारा और करताल दोनों ही मीरा के प्रिय वाद्य रहे है जिनका निरूपण मीरा के विविध चित्रों में भी किया जाता है। एकतारा तंतु वाद्य है और यह मीरा की एकान्तिक भक्ति का प्रतीक है। घन वाद्यों में झांझ, करताल और मंजीर आदि का उल्लेख है। अवनद वाद्यों में ढोल, डफ, पखावज, मृदंग आदि राग के अनेक गीतों में बताया गया है—

ताल पखावज मिरदंग बाजे, स्यारे अंग दिखावा मुरली राग बजत डफ नांगे, स्वर सुर्वरंतार न्यारे
ckJ; la>la] ene ejfy: ¥ ckJ laoj 5orॣ¢K लोक-वाद्य ढोल का भी उल्लेख किया गया है—

जाको नाम मूरति को ईंगे, कींडिन प्रेम चढ़ऊं
ए माय, ज्ञान का ढोल बज्यो अति भारी, गगन होंद गुण माऊं ए माय

मोरचंग चित्तौड़ जिले का एक विशेष लोक-वाद्य है जिसका प्रयोग राजस्थान के लोक-गायक लोग बन्धु भी करते हैं। मीरा ने भी इनका उल्लेख किया है—

तन करूं ताल, मन करूं मोरचंग, सांची सुन जमाऊं ए माय'

सुषिर वाद्य — सुषिर वाद्य में मुरली का प्रयोग अनेक गीतों में हुआ है।

तंतु वाद्य — तंतु वाद्य में इकतारा मीरा का प्रिय वाद्य है जिसका उल्लेख अनेक पदों में हुआ है। ताल योजना के अन्तर्गत मीरा बृहत पदावली में निम्नलिखित ताले प्रमुख है—

१.तिनाला (त्रिताल), २.झहन्दा, ३.त्रिताल धीमा (विलम्बित त्रिताल), ४.इकताल, ५.दादरा, ६. जैत, ७.दीपचन्दी, ८.धमार, ९.नवक १०.चौताल ११. त्रिवट, १२ झूमरा, १३.आ, १४.तिलवाड़ा, १५.सरता, १६.झपताल, १७.सिन्दूरा।

उक्त उल्लेखों से प्रमाणित होता है कि मीरा संगीत और नृत्य में विशेष प्रवीण थी। प्राचीन और मध्यकालीन अनेक पुरुष संगीतज्ञों के वर्णन प्राप्त होते है जैसे— भरत, नारद, मतंग, जयदेव, विद्यापति, हरिदास, बैजू, चमन्त और सूरदास आदि। महिला-संगीतज्ञों में मीरा का ही नाम विशेष रूप में उल्लेखनीय है।

(Footnotes)
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' डॉ ओझा-जयपुर का इतिहास खण्ड भाग-पृ ३५९—३६०
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भीलवाड़ा क्षेत्र में प्रचलित 'गैर नृत्योत्सव'

डॉ. प्रभा बजाज

असिस्टेंट प्रोफेसर, संगीत विभाग,
कानोडिया पी.जी.महिला महाविद्यालय,
जयपुर, राजस्थान

****

आजादी के पूर्व से ही भीलवाड़ा नगर एक महत्वपूर्ण औद्योगिक एवं व्यापारिक केन्द्र होने के साथ ही धर्म और संस्कृति का भी केन्द्र रहा है। यह क्षेत्र होलिका दहन के बाद आरम्भ होने वाले इन्द्र धनुषी पखवाड़े के लिये प्राचीन काल से ही प्रसिद्ध रहा है जिसमें धुलण्डी, शीतला पूजन, दशा माता पूजन रंग पंचमी व रंग तेरस, बादशाह की सवारी, होली का नहाण, नाहर नृत्य, फूलडोल उत्सव आदि के साथ—साथ पूरे पखवाड़े रात्रि को मंदिर के चौक में गैर नृत्य के कार्यक्रम भी आयोजित होते रहे हैं। प्रतिवर्ष चैत्र शुक्ला एकम की रात्रि को राजस्थान के प्रसिद्ध औद्योगिक नगर भीलवाड़ा में संगीत कला केन्द्र के मंच पर "भीलवाड़ा गैर नृत्योत्सव" का आयोजन होता है। इस लोक कला समारोह का आयोजन ऐसे समय में होता है जब खेतों में गेहूँ की पकी फसल लहरा रही होती है जिसे देख कर किसान का प्रफुल्लित मन नाचने को करता है। हमारे अन्य सांस्कृतिक पर्वों की ही तरह इसका सम्बन्ध भी ऋतु से है। सर्दी की विदाई और गर्मी के आगमन के मध्यकाल के बासन्ती वातावरण में यह कार्यक्रम सम्पन्न होता है। होली के दहन के बाद, होली की मस्ती में भीलवाड़ा जिले में एक पखवाड़े तक विभिन्न धार्मिक एवं सांस्कृतिक पर्व सम्पन्न होते हैं तभी गाँव—गाँव में रात्रि में गैर नृत्य भी चलते हैं इस पर्वमय पखवाड़े का समापन "भीलवाड़ा गैर नृत्योत्सव" से ही होता है।

स्वतन्त्रता प्राप्ति के पश्चात् लुप्त प्रायः हो गये इस परम्परागत गैर नृत्य को पुनर्स्थापित करने में स्वर्गीय कला मर्मज्ञ पद्मश्री देवी लाल सामर की प्रेरणा एवं प्रयत्न प्रशंसनीय रहे हैं जिन्होंने गाँव—गाँव घूम कर ग्रामीणों को पुनः गैर नृत्य प्रारम्भ करने के लिये उत्साहित किया तथा कुछ वर्षों पूर्व "भीलवाड़ा गैर नृत्योत्सव" का आयोजन कर इस नृत्य के पुनरूत्थान का सूत्रपात किया। गैर नृत्य का तात्पर्य गोल घेरा बना कर नाचना है परन्तु कालान्तर में घेरा या घेर शब्द का अपभ्रंश होकर लोकभाषा में गैर व गैर नृत्य हो गया। गैर नृत्यों की सबसे बड़ी विशेषता यह है कि इसमें सभी वर्गों एवं व्यवसायों के पुरूष बिना किसी भेदभाव के एक साथ नृत्य करके साम्प्रदायिक सद्भाव को पुष्ट करते हैं। इस नृत्य में नौ वर्ष की आयु के बालक से लेकर नब्बे वर्ष तक के वृद्धजन भी एक ही घेरे में पूरे उत्साह पूर्वक नृत्य करते हैं।

वैसे इस नृत्य में भाग लेने वाले नर्तकों के लिये कोई निर्धारित वेशभूषा नहीं है फिर भी अलग—अलग स्थानों के गैर दल अपनी विशिष्ट एक सी वेश भूषा पहन कर अपनी अलग पहचान बनाते हैं। अधिकतर गैर दलों की वेशभूषाओं पर स्थानीय आंचलिकता की छाप स्पष्ट रूप से दिखाई पड़ती है, कोई गैर दल धोती—कुर्ता और पगड़ी धारण करता है तो कोई साफा व अंगरखी या बगतरी धारण करते हैं। लम्बे कोट भी कई गैर नर्तक पहनते हैं। अनेक नर्तक केसरिया मेवाड़ी पाग तथा कमर बंधे व दाढ़ी—जाड़िये भी बांधते हैं। अधिकतर गैर नर्तक विभिन्न प्रकार के आभूषण पहनना भी पसन्द करते हैं, जिनमें कानों में लोंग, मुरकियाँ व झेला, गले में माला, कंठी, रामनामी और खुंगाली, तथा हाथों और पाँवों में कड़े पहनते हैं। इन वेशभूषाओं के

अतिरिक्त गैर नर्तक विचित्र एवं कलात्मक स्वांग बनते है जिनमें पशु–पक्षियों के सिवाय विभिन्न देवता, साधु संत, व बहुरूपीयों द्वारा सजाये जाने वाले लगभग सभी पात्र सम्मिलित होते है जिनकी सजावट पर दिल खोल कर खर्चा किया जाता है।

गैर नृत्य में मुख्य रूप से तो ढोल, नगाड़ा व बाँकिये की ही संगत होती है परन्तु कई दल अलगोजे, बाँसुरी, शहनाई, मंजीरे, काँसे की थाली, तुरही, ढोलक, आदि भी बजाते हैं। चंग का प्रयोग भी कहीं किया जाता है। कई नर्तक पाँवों में घुंघरू बाँधते है जो नृत्य के समय ताल के साथ सुमधुर ध्वनि गुंजाते हैं। धार्मिक दृष्टि से इस नृत्य का सम्बन्ध श्रीकृष्ण के महारास से जोड़ा जाता है। गैर करने वाला प्रत्येक नर्तक स्वयं को कृष्ण का ग्वाला मान कर समर्पित भाव से ही नृत्य करता है और अच्छी फसल देने के लिए प्रभु का आभार प्रकट करता है। यही कारण है कि गाँवों में ठाकुर जी के मंदिर के सामने वाले चौक में ही गैर नृत्य आयोजित किये जाते हैं और हर नर्तक यह अनुभव करता है कि ठाकुर जी उसे नृत्य करते निहार रहे हैं।

गैर नृत्य मेवाड़ की प्राचीन सांस्कृतिक परम्परा है यह नृत्य होलिका दहन के दूसरे दिन की रात्रि से प्रारम्भ होकर चैत्रकृष्णा चनुर्दशी तक गाँव–गाँव में होता है। चैत्र कृष्णा अमावस्या को फूल डोल उत्सव में ठाकुर जी की "बैवाण यात्रा" के साथ ही होलिकोत्सव का पखवाड़ा समाप्त हो जाता है। भीलवाड़ा में बड़े मंदिर के चौक में लगभग डेढ़ सौ वर्ष से गैर नृत्य का आयोजन होता आ रहा है। यहाँ मन्दिर के एक कोने पर बने कँवर पदा के महल में कलात्मक झूले पर ठाकुर जी बाल स्वरूप में विराज कर गैर नर्तकों को निहारते रहते है। कँवरपदा के महल का निर्माण भगवान द्वारा गैर नृत्य के अवलोकन हेतु ही किया गया है जिसकी छतों पर भीलवाड़ा के ही चित्रकारों द्वारा अन्तर्राष्ट्रीय ख्याति प्राप्त पड़ शैली में महारास का चित्रण किया हुआ है।

गैर नृत्य में छड़ियां की बहुत महत्वपूर्ण भूमिका रहती है। इसलिये नर्तक इन छड़ियों को सजाने–संवारने का बड़ा ध्यान रखते है। इन छड़ियों पर कुछ नर्तक तो आग में तपा कर काले व्हारिये बनाते है। कोई सात रंगों से रंगते है तो कोई प्लास्टिक की डोरियां गुंथवाते है। कई नर्तक छड़ियों के एक सिरे पर पीतल या चांदी की घुंघरियां बांधते है जो छड़ियों के टकराने पर मधुर स्वर निकालती है। तीन से चार फुट के आसपास लम्बी ये छड़ियां गैर नृत्य के समय आपस में टकरा कर अन्य वाद्यों के साथ ताल मिलाती हैं और नर्तकों की गति को नियन्त्रित करती है।

भीलवाड़ा जिले में गैर नृत्य की भिन्न–भिन्न शैलियाँ प्रचलित हैं जिनके लय, ताल और पद संचालन की गति में काफी अन्तर रहता है। कोई दल एकवड़ा, कोई दोवड़ा तथा कोई चौवड़ा गैर खेलते हैं। चौवड़ा गैर में पद संचालन की गति एकवड़ा गैर से चार गुनी तेज होती है। छड़ियों के आपस में टकराने व पैरों के संचालन का तरीका भिन्न शैलियों में भिन्न होता है। उदाहरण के तौर पर मांडल का गैर दल सागर की उछाल मारती लहरों सा नृत्य करता है तो चांदरास का दल मंद गति से बहते पवन की तरह नाचता है। शैली में भिन्नता के बावजूद दोनों ही दलों का नृत्य मन–मोहक व बहुत कलात्मक और शुद्ध होता है। ऐड़ी से लेकर चोटी तक शरीर के हर अंग का ताल एवं लय पर संचालन विभिन्न शैलियों की विशेषता है जिसमें छड़ियों के टकराने का अन्तर भी अलग–अलग होता है।

भीलवाड़ा में आयोजित होने वाले नृत्योत्सव में देश के कई ख्याति प्राप्त नृत्य दल भाग ले चुके है जिनमें शेखावटी की घूमर, मारवाड़ का डंडिया, गुजरात का गरबा व कच्छी घोड़ी, आबू का गणगौर दल, नाथद्वारा, राज नगर व भदेसर के गैर दल प्रमुख है। इस नृत्य समारोह में कच्छकारी के

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संगीताचार्य महाराणा कुम्भा

डॉ. प्रभा बजाज
असिस्टेंट प्रोफेसर,
संगीत विभाग,(H.O.D.),
कानोडिया पी.जी.महिला महाविद्यालय,जयपुर

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महाराणा कुम्भा :— "कुम्भा के जन्म के सम्बन्ध में प्रारम्भ से ही विवाद रहा। किंतु जयपुर के राजकीय पुरातत्व संग्रहालय में कुम्भा का एक प्राचीन चित्र है। यह मेवाड़ के राजवंश का रहा है। जिससे इसकी विश्वसनीयता बनती है। इस पर कुम्भा का जन्म वर्ष वि.स. १८१८ अंकित है, जो ईस. १०७ होता है। वि.स. १८९०(१८३८ ई.) की निम्बाड़ प्रशस्ति में जो स्तव उनके समय की है, महाराणा कुम्भा का वर्णन बड़े ही गौरव के साथ किया गया है।" कुम्भा को अपने पिता के ज्येष्ठ पुत्र होने के कारण मेवाड़ की गद्दी तक पहुंचने में कठिनाई नहीं हुई। कुम्भा के राज्यगृहण के विषय में भी बहुत मतभेद रहे।

वीर विजयी विद्वान तो कुम्भा थे ही, सतत सफल संघर्ष में साधन—सम्पन्नता, शताब्दियों बाद भी अविश्वसनीय सा बृहद भवन निर्माण तथा स्वर्गीय साहित्य का सृजन संभव उन्होंने कर दिखाया। चतुर्दिक सफलताएँ उनका श्रृंगार तथा शक्तियां बन गई थी और वर अनुपम गए अद्भुत निर्माणकर्ता हो गये। मेवाड़ के आस—पास जो इक्का राज्य थे उन पर उन्होंने अपना आधिपत्य स्थापित किया। राष्ट्रव्यापी परतन्त्र धुंध को मिटाकर उन्होंने भारत की पूर्नजागरण में समुन्नत किया।

साथ—साथ सैन्य एवं देव भवन निर्माण में दुर्ग तथा प्राचीरों की मूर्तिरूप देने में स्थिर कीर्तिमान स्थापित किये। उनके बनवाये बत्तीस दुर्गो में निम्बाड़गढ़, कुम्भलगढ़, अचलगढ़ जाति मत्स्यन—स्थापत्य में सौंदर्य हैं चढ़ा इन पावन दुर्गो में उन्होंने अपने आराध्य कुभ स्वामी के

लिंग कलश कलश में नमस्कृत कर्म बाल देव भवन (मंदिर) बनवाया। उनको हो कीर्ति का कलश निम्बाड़ का विजय विख्यात कीर्ति स्तम्भ है। जो उनका विजय स्मारक बना, और सदा के लिए राष्ट्र सेवा का संकल्प भी।

'महाराणा कुम्भा द्वारा रचित 'संगीत राज' को साहित्य का कीर्ति स्तम्भ कहा गया है। जयदेव के 'गीतगोविन्द' को उन्होंने रसमय 'रसिक प्रिया' टीका दी, और उसे 'सृडप्रबंध' में प्रकांड पांडित्यपूर्ण विवेचना। 'चंडी शतक' और 'कामसूत्र' को भी उन्होंने नए रूप में प्रस्तुत किया। संस्कृत को स्वर तथा मेवाड़ी को स्वरूप प्रदान किया। शक्ति, सरस्वती, गति, तीनों सृजनात्मक सलिलाओं में उनका अवगाहन अद्वितीय रहा : पूर्ण कलश कुम्भा पूर्ण पुरुष थे।"

संगीताचार्य महाराणा कुम्भा :—

भारतीय संगीत—जगत में महाराणा कुम्भा (वि. स.१४९०—१५२५) को देन महत्वपूर्ण है। इन्होंने संगीत विषयक अनेक ग्रंथों की रचनायें की—संगीत—राज, संगीत मीमांसा और सृड प्रबन्ध।

संगीत—राज सोलह हजार श्लोकों में रचित एक वृहद् संगीत—ग्रन्थ है जिसके कारण कुम्भा की गणना भारतीय संगीत के प्रमुख आचार्यों में होती है। नवीन अनुसन्धान से प्रकट हुआ है कि सुप्रसिद्ध संगीत ग्रन्थ जयदेव कृत गीतगोविन्द की रागरागनियों का निर्देश भी सर्वप्रथम महाराणा कुम्भा द्वारा ही किया गया। गीतगोविन्द की यह प्रति अब भी सुरक्षित है। महाराणा कुम्भा द्वारा निर्मित विजय स्तम्भ, कुम्भ—श्याम मन्दिर आदि स्थानों की मूर्तियों से भी संगीत सम्बन्धी अनेक महत्वपूर्ण ज्ञातव्य मिलते है। "श्रीकृष्ण विम्दावर्ली" से कुम्भा के सम्बन्ध में कतिपय महत्वपूर्ण सूचनाएं ज्ञात होती है।—

संगीतराज :—

कुम्भा रचित संगीत विषयक ग्रन्थों में से सर्वोत्कृष्ट रचना संगीतराज है। संगीतराज ग्रन्थ पांच कोषों में विभाजित है —

१ पाठ्यरत्नकोष,   २ गीतरत्नकोष,
३ वाद्यरत्नकोष,   ४ नृत्यरत्नकोष,
                 रसरत्नकोष।

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सूड प्रबन्ध —

संगीतराज के अतिरिक्त महाराणा कुम्भा ने सूड प्रबन्ध नामक संगीत विषयक ग्रन्थ का प्रणयन किया था। इस रचना का उल्लेख संगीतराज प्रबन्धान्तर्गत गीत रत्नकोश के सूड प्रबन्ध परीक्षण तथा कीर्ति स्तम्भ प्रशस्ति में हुआ है। इस रचना की एक मात्रा प्रति श्री अगरचन्द नाहटा को अहमदाबाद में श्री पुण्यविजय जी के संग्रहालय में प्राप्त हुई थी। उपलब्ध पाण्डुलिपि में महाराणा कुम्भा के अन्य ग्रन्थों — गीतगोविन्द की टीका, कामराज रतिसार आदि के साथ सूड प्रबन्ध की प्रतिलिपि उपलब्ध है। इस ग्रन्थ की रचना गीतगोविन्द के पदों के संगीतात्मक विवेचन के लिये की गयी थी, जिसमें रागों के साथ-साथ आलापों पर भी टिप्पणी लिये मिलते है। प्रस्तुत ग्रन्थ की रचना तिथि वैशाख शुक्ल १३ संवत १५०५ मिलती है।

संगीत रत्नाकर की टीका :—

महाराणा कुम्भा ने संगीत-रत्नाकर नामक सुप्रसिद्ध ग्रन्थ की टीका भी की थी लेकिन उस टीका की कोई पाण्डुलिपि अब तक उपलब्ध नहीं हुई। आनन्दाश्रम से संगीत-रत्नाकर के जिस पाठ का प्रकाशन हुआ है, उसके परिशिष्ट में प्रदत्त मूल ग्रन्थ के टीकाकारों की नामावली में महाराणा कुम्भा का भी नामोल्लेख हुआ है। इसी आधार पर यह कहा जा सकता है कि कुम्भा ने संगीत रत्नाकर की टीका अवश्य की थी।

संगीतक्रम दीपिका :—

संगीत रत्नाकर की टीका के समान ही कुम्भा के 'संगीत-क्रम दीपिका' ग्रन्थ का भी मात्र उल्लेख मिलता है। मूल प्रति उपलब्ध नहीं है। इस रचना का उल्लेख गीत-गोविन्द की कुम्भा कृत रसिकप्रिया टीका के तृतीय सर्ग में हुआ है।

वाद्य प्रबन्ध :—

कुम्भा ने 'वाद्य प्रबन्ध' नामक ग्रन्थ की रचना भी की थी, जिसका मात्र नामोल्लेख 'एकलिंगमाहात्म्य' में हुआ है। महाराणा कुम्भा की एक पुत्री रमाबाई नाम की थी। यह संगीत-शास्त्र में पारंगत और भक्त आदि के रागों का ज्ञान था। इसी कारण रमाबाई के लिए

'संगीतराज' विशेषण का प्रयोग हुआ है और इन्हें लिए लिखा गया है :— ......संगीतगुणसंपूर्ण प्रवीणा।

इस प्रकार बहुश्रेणीय सांस्कृतिक विविधता के कारण राजस्थान संगीत राजस्थान कहलाता है। संगीत चित्तौड़गढ़ भी राजस्थान का एक जिला है। यहां कुछ परम्पराएं सामान्य रही तो कुछ विशेष इसी कारण सांस्कृतिक वैविध्य भी शामिल है। चित्तौड़ के अनेक कविकोविदों ने गेय रचनायें प्रचुर परिमाण में प्रस्तुत की है। इनमें मांडवी, महाराणा कुम्भा, नरूसिंह, पं. मोहनलाल व्यास और आधुनिक युग के अनेक गीतकार है।

(Footnotes)

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८. सोमानी, श्री रामवल्लभ—महाराणा कुम्भा—पृ. सं.—४३,४४,४५

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VOICES

Voices of Interdisciplinary Critical Explorations
(UGC Approved Peer Reviewed Journal)

Editor
Rajul Bhargava

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Narcopolis: Postmetropolis

The Opium Scapes of City Sites

Preeti Sharma

"A genre of its own" said a reader. Another book about drugs, sex, death, perversion, addiction, love and God but isn't this stuff fiction has been made of? Are not these the familiar literary sites in post-modernist novels? Don't these make up the tattered fabric of today's fragmented metropolis? and Thayil's *Narcoplis* is yet another attempt by a writer of today to explore the cosmopolitan cityscape and to center stage the disparate characters on the margins of society who are as much a part of the carnivalesque that the world is turning into. Squeezing in four decades into the narrative space of between 1970 to early 2000, Thayil traces lives hopelessly intertwined in the depths of human depravity and brings out dingy joins as the bastions of the morally bankrupt. The sub text, deconstructs the shams of the so called capitalism that let sky scrapers soar vertically higher and higher and let the horizontal back alleys take a counterspread. The cosmopolitan city stands up stark and metallic against one conflicted and mixed in depravity. This is what Thayil is working out in his novel *Narcopolis.*

Cosmopolitanism is back with a bang and literature today is using it as a backdrop to foreground the cultural conflicts it has brought in its wake. However, it has acquired so many nuances and meanings as to negate a putative role (most eloquently argued for by Held, 1995) as a unifying vision for democracy and governance in a globalising world. Some broad brush divisions of opinion immediately stand out. There are those, like Nussbaum (1996;1997), whose vision is constructed in opposition to local loyalties in general and nationalism in particular. Inspired by the stoics and Kant, Nussbaum presents cosmopolitanism as an ethos, ' a habit of mind a set of loyalties to humanity as a whole, to be inculcated through a distinctive educational program emphasizing the commonalities and responsibilities of global citizenship. Against this are ranged all manner of hyphenated versions of

cosmopolitanism, variously described as 'rooted', 'situated', 'vernacular', bourgeois', also 'actually existing', 'postcolonial', 'feminist', 'working'... and so on. Cosmopolitanism here gets particularised and pluralized in the belief that detached loyalty to the abstract category of 'the human' is incapable in theory, let alone in practice, of providing any kind of political purchase even in the face of the strong currents of globalisation that swirl around us.

Cosmopolitanism is a particular mode of social apprehension of globalisation production process of a new world space/place to which cosmopolitan design symbols, render in an inclusive and dialogical fashion, the symbolic landscape of cosmopolitanism illustrates this argument; a sense of immanent planetary crisis is an important way in which the world is being conceived.

According to Archibugi "There is a growing divergence between the demos and the ethos, especially concerning the perception and the treatment that should be reserved to the 'diverse': immigrants, minorities, gays and so on are more and more perceived as threat xenophobias is rising

Daniel Archibugi (The Global Commonwealth of Citizens: Toward Cosmopolitan Democracy 2008)

And what of Cosmopolitan moralism? Where the task of philosophers is to divine the certain moral principles that guide the universal rights project, the activist is the figure through which the moralized politics of that project is played out.

In an interview with Anita Jaiman (Oct 11, 2012) Thayil's said that his locale, Shukla Ji Street, is disappearing like the entire area between Mumbai Central and Grant Road—being bought by real estate sharks replacing the broken down houses with tall buildings. These houses with their million storeys will be razed and Bombay will become a very uniform looking place—a high rise basement kind of look uniformly. Mumbai will lose its seductivity—the old world, romantic, glamourous charm. Thayil brings this out in the symbolic difference between opium (old) and heroin (quick, brutal, degrading). Opium was respectable, heroin projects the class shift-down and cut street gaiji peddle it – bringing out the culture shift reminding one of Arnold's Doverbeach.

For the world, which seems
To lie before us like a land of dreams,
So various, so beautiful, so new,
Hath really neither joy, nor love, nor light,
Nor certitude, nor peace, nor help for pain;
And we are here as on a darkling plain,
Swept with confused alarms of struggle and flight,
Where ignorant armies clash by night. *(l. 31–37)*
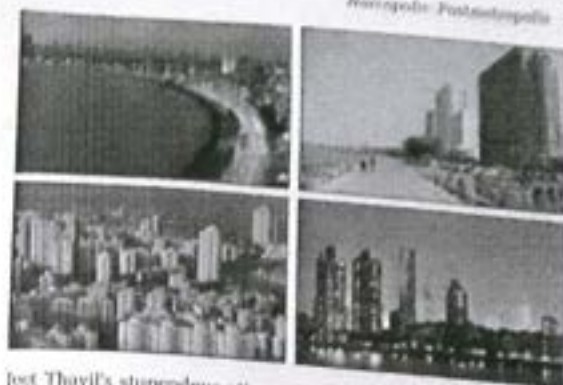
Jeet Thayil's stupendous attempt to show how Mumbai is growing to deteriorate is visible in his novel *Narcopolis*. It is a rich, chaotic, hallucinatory dream of a novel that captures the Bombay of the 1970s in all its compelling squalor. With a cast of pimps, pushers, poets, gangsters and eunuchs, it is a journey into a sprawling underworld written in electric and utterly original prose.

The novel attests to what is a 'postmetropolis', what Edward W. Soja defines as a the globalized city that he supposes to be involved in a radical transition process that began in the modern city, the fruit of the third urban revolution, and leads to the postmetropolis, the fruit of the late capitalist economic restructuring and its fourth urban revolution.

One of the main characteristics of the postmetropolis is its formal complexity. In it simultaneous deterritorialization and reterritorialization process converge : i.e, processes of the dissembly of pre-existing urban realities and the recolonization of the city with new ones. The first are characterized by the weakening of the idea of place and the territorially defined social communities, and the second by the appearance of a new spatiality where what is urban is inseparable from what is non-urban, where the limits between the interior and the exterior have become blurred, where concepts such as 'city', 'suburb', 'country', and 'metropolitan area' are hard to separate.

Contemporary critical studies have recently experienced a significant spatial turn. In what may eventually be seen as one of the most important intellectual and political developments in the late twentieth century, scholars have begun to interpret space and the embracing spatiality of human life with the same critical insight and emphasis that has traditionally been given to time and history on the one hand, and social relations and society on the other. *Thirdspace* is both an enquiry into the origins and impact of the spatial

unapologetically described a way of life – in New York, New Orleans, and Mexico City-that by the 1940's was already demonized by the artificial anti-drug hysteria of an opportunistic bureaucracy and a cynical, prostrate media.

A masterpiece of autobiography, and perhaps the first literary memoir of an addict, *Confessions* is a remarkable account of the pleasures and pains of worshipping at the 'Church of Opium'. Thomas De Quincey consumed large quantities of laudanum (at the time a legal painkiller) daily, and this autobiography of addiction hauntingly describes his surreal visions and hallucinatory nocturnal wanderings through London, along with the nightmares, despair and paranoia to which he became a prey. The result is a work in which the effects of drugs and the nature of dreams, memory and imagination are seamlessly interwoven, describing in intimate detail the mind-altering pleasures and pains unique to opium. *Confessions of an English Opium-Eater* forged a link between artistic self-expression and addiction, paving the way for later generations of literary addicts from Baudelaire to James Frey, and anticipating psychoanalysis with its insights into the subconscious.

Narcopolis is a blistering debut that can indeed stand proudly on the shelf next to Burroughs and De Quincey. Thayil is *quoted as saying that he lost* almost 20 years of his life to addiction, with a novel like this the experience seem not to have gone waste. We can celebrate that he emerged intact and gave us this book.

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insights in interdisciplinary and trans-disciplinary studies, invites research papers and scripts to be submitted. We welcome submissions from any discipline, including but not limited to English literature, language, translation, comparative and contrastive studies, film studies, management, communication, development studies, media studies, cultural studies, gender studies, queer studies, philosophy, religious studies, anthropology, sociology, history, geography, psychology, economics, political science, policing, administration, education, population studies, environment and aspects of scientific researches impacting human behaviour and leading to paradigm shift. We appreciate and encourage creative writings potent enough to change the prevailing attitudes and ungrounded preconceptions and discussions instrumental in negotiating, constructing and reconstructing different nuances in challenging environments and testing times. Studies in folklore, occult sciences and fine arts can also be entertained for change of focus to such disciplines. Original efforts to develop cognitive, affective and spiritual dimensions necessary for successful strengthening of interdisciplinary studies will be given priority.

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Deadlines for submissions: January 2018

Submissions will be evaluated in terms of research merit and their significance for more than one discipline.

Articles should be no longer than 7,000 words and should be prefaced by a 150-word abstract prepared according to the latest MLA Handbook style.

Publication of the papers accepted may be shifted to further issues as per specializations.

Submissions may be accepted subject to revisions.

A cover page showing brief bio-data, complete contact address, telephone numbers, e-mail address, institutional affiliations and a photograph/jpg image of the author must accompany the submissions.

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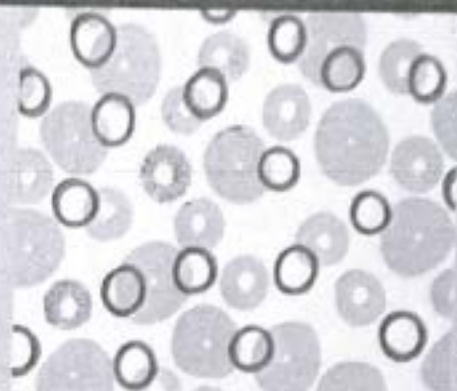
Special issue
CITYSCAPES

Editor
Rajul Bhargava

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Travels through Time: Twelve Cities

Jerry Pinto and Rahul Srivastava's *Talk of the Town*

Charu Goyal

Renew, Release, Let go. Yesterday's gone, today is a new day. Gone are the times of the townships, we now live in the age of the city. The defined, enclosed boundaries have burst open as the ground swell of population breaks the banks and overflows into the suburbs. The towns are turning inside out and taking the shape of a heterogeneous agglomeration. The contours have now been restructured and the social mosaic is reconstructed. As Nietzsche said 'cities do not expend themselves but transform themselves. What Jerry Pinto and Rahul Srivastava are doing in their book *Talk of the Town* (1996) is exactly a narration of this growing 'without'. In their sub-title they say 'Story of Twelve Indian Cities', thus the town Vs city dialogic is an essential part of their book. As spaces of representation they juxtapose historicity with modernity following the idea of the cultural logic of late capitalism (Jameson: 1991). The authors trace the differences between then and now sometimes highlighting the connection between historical development and the new material culture. In order to craft a meaning they bring in a fictional imaginary that intensifies the change.

In the first description they take up Bengaluru or Bangalore as it was called few years ago. Deriving its name from a phrase 'Town of Boiled Beans' in local dialect 'Bende Kaala Ooru' it flourished in medieval period and traces its history from about 1537. First Kempe Gowda then down to Haider Ali and Tipu Sultan there is a quick round up of how the city came into being. And then came the British changing the Wodeyar territory into a military cantonment and gradually the old city faded away. The bustling narrow streets of a typical Indian small town with its pathways for bullock carts, crowded shops, temples, mosques and chapels gave way to ornate buildings, wide roads and gardens, a typical British township. A cultural change also set in with pubs and roadside cafes displaying Anglo Indian delicacies and mushroom growth of tea clubs and eateries.

As the cuisine expanded to make way for a western/modern taste the language started showing signs of disruption and the sartorial image gradually became more cosmopolitan. Along with Bombay, Bangalore was firmly placed on India's new urban map and became the geek capital of the world. As with most metropolises in India this city too lives in a duality, upper its pristine lineage of cultural heritage alongside with the fast changing vertical contours of the new millennium. The little story by Anita Nair appended at the end of the description 'Tea time at Koshys' says it all. A sweeping look across the space of the café gives it all away.

Men with a stolen hour sipping at beers; a long blue-eyed shaggy-haired tourist sprawled on a chair nursing an omelette and reading a book; another group of student tourists comparing notes in loud raucous caws; a bunch of ferocious-face women in khadi kurtas and terracotta earrings holding

fort; a young couple brushing shoulders, entwining fingers; writers, actors, film-makers, artists, photographers and somewhere amidst this cornucopia of the intellectual and the artistically inclined, an old man in a tweed coat quietly stirring sugar into his cup of south Indian coffee ... (13)

Egg sandwiches, mutton cutlets, apple pie, fruit salad with ice cream are the wares and the story of the change is complete. What this introductory narrative does is to chart out the changing cultural geographies and along with it map the emergent city scapes of today. As a tech hub and a major out-sourcing center it vies with any city of the West and displays vividly the new place of globalized cosmopolitanism.

The next story is of the Lake City Bhopal and once again the history goes back to Raja Bhoja and then to the Begum's of Bhopal in the late nineteenth and the early twentieth century. The city then came under the influence of the British and the Goan architect Charles Correa exquisitely recrafted it. Besides the Mughal and the British influence, the local grassroot artisans and the craftsmen are the modern day reconstruction of the city. Ashok Vjapayee's little piece sums up the cyric, the epic and the tragic of the now Bhopal. Talking about the incredible Muslim cuisine, the glamorous Masjid and Minarets and then the post Bhopal gas tragedy scenario, he says:

> Most of new Bhopal consisted of people who had come from outside. They had shifted there when Bhopal became the capital of Madhya Pradesh. The majority were government servants who had come from Mahakoshal, Chhattisgarh, Nagpur, Rewa, Gwalior etc. They carried with them new convictions and conventions of work culture, codes of conduct the regulated the different layers of the bureaucratic hierarchy. They also brought with them dialects of Hindi and Marathi. The notion that they belonged to a new state called Madhya Pradesh took time to sink in: for long, they continued to belong to their erstwhile states and held on to their cultural roots. This made Bhopal unwittingly cosmopolitan and diverse.

This is the polyphonic heteroglossia which is so characteristic of the new cityscapes of India. The old and the new rub shoulders together and the city acquires a layered dimension

with the horizontal strata and the vertical coexisting in an antag- onistic harmonly.

The third city is an experiment in modern living – Le Corbusier's planned Chandigarh. However, what has happened to the masterplan is just what happens to any metropolis today. The satellite townships of Panchkula and Mohali have overgrown their confines and today the planned city is gradually turning into an unplanned one because of:

the spontaneous way in which new citizens' takeover streets and shop fronts and build homes on available land to create a bustling lively city. This often works quite well with the old structure and only makes the city more dynamic and energetic. The other is the intense way of real estate devel- opers who love re-shaping the city for their own profit.

Nayantara Sehgal's little interlude of the 'Anokha' turning into a 'Dhokha' depicts the pain that many have felt who have seen Chandigarh 'grow'.

In the story about Madras and Delhi Pinto and Shrivastava trace out the rise of the industrial city and the software outsourcing caters as well as the power politics of capital of the nation. Both these cities are no longer cities but many cities occupying a designated space where many cultures and many ideologies clash together. Similarly, in the Charminar city, Hyderabad becoming Cyberabad lives a nostalgic memory of what was and how its divergent and radically opposed traditions are erasing the Nizams spleadour. Kaumudi Marathe touches our hearts in her little note where she says:

As Hyderabad grew and construction increased, the thunderous sounds of dynamite daily signaled the quarrying of those rocks. After with sanding the elements for millennia, in the last quarter century, our breathtaking rock formations were turning to gravel, cement and finally dust.

History is not just test in books about events that happened a long time ago. In my lifetime, Hyderabad's monumental rocks, once a sign of the grandeur of nature and evolution, have become history instead.

We wish that the authors would have been more just to this city of culture called Calcutta not Kolkata. The historical

narrative leaves much to be said about the art and culture of this erstwhile British Capital of India. Their last take, very aptly sums up not just what has happened to all cities.

The city continues to reinvent itself and today has adapted well to the changes in the country's global economy – however not without very sharp critiques and acts to resistance as well-when things go wrong.

and Amit Choudhary's half a page is a beautiful reminder of the decadence of 'Sunoji ye Calcutta hai'.

Lucknow takes us to the elegance and sophistication of Shuja-ud-Daula and Wajid Ali Shah and then through the blood and gory politics of the British. The Nawab gave it an urbane setting as well as many cultural traditions and cuisines that flourish even today, and the British gave it an ambience that aggravated the legends of the old. What it is today as a distant cry from the Nazakat of pristine times of this over popular city and as Rakhanda Zalil says in a different context we feel 'a rage at missing Awadh'.

Perhaps the longest section is on Mumbai/Bombay and traces the constant fast forward of the city. Beginning from the times of Ashoka then the Chanakya dynasty through the European influence down to today the author talks of the battle-field of diversities and of disparate forces that have worked here to make it the most globlised and cosmopolitan city of India. Although not elaborated upon Pinto and Shrivastava point out to the whole process of what in happing in our cities where the outlying villages have become slums in which the poor struggle to live and where the middle classes have been squeezed into tiny apartments in far-flung suburban 'chals' and where only the rich and the privileged can live in the luxury complexes of Navi Mumbai. The glitter and the giltz of Bollywood the affluence of
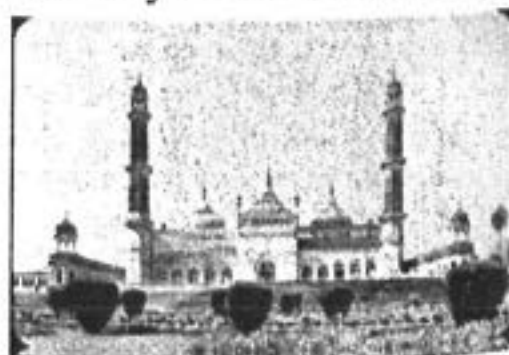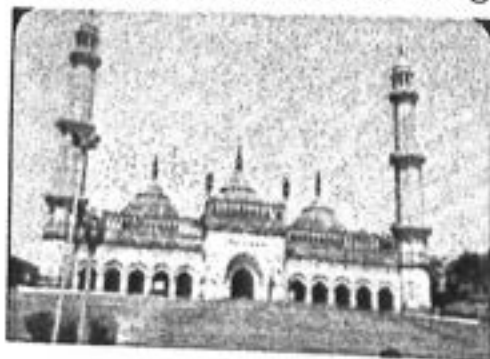
Dalal Street and the benign presence of Siddhi Vnayak cannot bring back yesteryears of the charisma that is no more. Today's Mumbai has not been really summed up as Nissim Ezekiel has done in his poem 'A Morning Walk'.

Barbaric city, sick with slums

Deprived of seasons, blessed with rain,

Its hawker's, beggars, ironlunged,

procession led by frantic drums,

A million purgatorial lanes,

and child like masses nerd tonged

Whose wages are in words and crumbs (15–21)

or what he says in 'Island'

Unsuitable for song as well sense

the island flowers into slums

and skyscapers, reflecting precisely the growth of my mind (1–4)

Patna, Shillong and Thriuvanatpuram are the three other cities that authors take up. As they say at the end in the author's note that they are not qualified historians but have tried to introduce readers to the history of these twelve cities for us they have become interesting sources palimpsesting the new that we know for the old that has been.

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पांचवां स्तंभ

सकारात्मक चिंतन एवं विकास का संवाहक

रंगीलो राजस्थान

पाँचवाँ स्तंभ

इस अंक में

डॉ. सीता शर्मा 'शीतांश'

बिन लांगुरिया अधूरी है कैला शक्ति पूजा

यह लोक विश्वास है कि नवरात्र के दिनों में आदि शक्ति कैला मैया साक्षात् रूप में अपने विग्रह में विराजती हैं, इसलिए अधिक से अधिक जन समुदाय नवरात्र में कैला श्रीविग्रह के दर्शन द्वारा साक्षात् माता भगवती के साक्षात्कार का पुण्य लेने के लिए प्रतिवर्ष इन दिनों भारी संख्या में यहाँ आता है।

....र्ष में दो बार आने वाले नवरात्रों के दौरान चैत्र शुक्ला प्रतिपदा से एकादशी के बीच यदि आपको राजस्थान के करौली जिले में स्थित कैला शक्ति पीठ पर जाने का अवसर मिल जाए तो आप पाएँगे कि माँ के वात्सल्य में डूबा जन समुदाय भाव-विभोर, बेसुध होकर मैया कैलादेवी के विग्रह की एक झलक पाने के लिए गात-बजाता और नाचता चला जा रहा है....

एक ही धुन है, एक ही जुनून सवार है, मैया की आराधना में डूब जाने का। जन-सैलाब में जहाँ नव दम्पति गठजोड़ा बाँधकर मैया की जय-जयकार करते जा रहे हैं तो कहीं माता-पिता अपने रिश्तेदार-नातेदार के साथ अपने नौनिहाल को सजा-संवारकर चूड़ाकरण संस्कार (मुण्डन) के लिए भक्ति में डूबे मैया के भवन की ओर एक-एक पग आगे बढ़ा रहे हैं। कनक दण्डवत् देते पति के धरती पर लेटते ही उसकी चरण धूलि को माँ का आशीर्वाद मानकर पत्नी मस्तक पर लगा रही है, तो कहीं ब्रज वनिताओं का पुरुषों के साथ वात्सल्य से सराबोर होकर "दै दै लम्बी चौंक लांगुरिया बरस दिना में आंगन"/ अ "कैसी बैठी विकट पहाड़न में जय जगदम्बे मैया"/"बारे लांगुरिया तेरी धन खाई लई कारे नाग ने" जैसे परम्परित गीतों के साथ ही "लांगुरिया बैठुंगी मैं तो मोटर कार में" जैसे आधुनिक स्वरों के साथ धीरे-धीरे झूमते मैया के भवन की ओर बढ़ रहे हैं। कैलादेवी का यह लोकोत्सव राजस्थान का ऐसा विराट मेला है, जिसमें मैया के वात्सल्य की आराधना को जीवन की विभूति बना दिया जाता है। आगे-पीछे, ऊपर-नीचे, कण-कण में, हर मुख की वाणी में, बालक-वृद्ध स्त्री-पुरुष, युवक-युवती, सभी की जिह्वा पर लांगुरिया गीतों द्वारा बस मैया की जय-जयकार, माता के प्रति पूर्ण समर्पण, माँ की ममता की आराधना, माता के वात्सल्य भाव के साथ, दिग-दिगन्त में गूँजते श्रद्धा और प्रेम के साकार सत्य के अतिरिक्त यहाँ और कुछ नहीं होता।

यह लोक विश्वास है कि नवरात्र के दिनों में आदि शक्ति कैला मैया साक्षात् रूप में अपने विग्रह में विराजती हैं, इसलिए अधिक से अधिक जन समुदाय नवरात्र में कैला श्रीविग्रह के दर्शन द्वारा साक्षात् माता भगवती के साक्षात्कार का पुण्य लेने के लिए प्रतिवर्ष इन दिनों भारी संख्या में यहाँ आता है। साथ ही यह भी विश्वास है कि कैला देवी में बहती काली सिंध नदी में स्नान के पश्चात् ही माँ के दर्शन का पुण्य लाभ मिलता है, इसलिए दर्शन से पूर्व प्रत्येक श्रद्धालु काली सिंध में स्नान अवश्य करता है। ये गीत देखिये, जिसमें लांगुरिया को भी स्नान मग्न होते दिखाया गया है—

"कारी सिल पै कर स्नान, मगन अति है रह्यौ लांगुरिया।"

ऐसा लोक विश्वास है कि कैला मैया से यदि आपको अपनी मनौती मनवानी है तो पहले 'लांगुरिया' को मनाना, उसे प्रसन्न करना अनिवार्य होता है। बालपन से किशोर रूप तक अपनी अठखेलियों तथा विविध क्रीड़ाओं से कभी वनिताओं को छेड़ता है तो कभी उनका दुलार पाता है। कभी ये स्त्रियाँ कैला मैया से उसकी शिकायत करती हैं—

'मैया लांगुर कूँ समझाय लै, मेरे पइयो पिछारी रे।'

तो कभी उसे कचहरी में बुलाने की चेतावनी तक दे डालती हैं—

'कैसे आयो महल जनाने में, बताय दै लांगुर मोहै?
बताय दै लांगुर मोहै... बताय दै लांगुर मोहै।
मेरे ससुर की जुरै कचहरी, माहि चुलबायल हूँ तोया।।
हाथ हथकड़ी, पामन बेड़ी सजा कराय दऊँ तोया।

कभी यह छलिया किशोर मदमस्त होकर जोगनियों के साथ नृत्य करता है तो कभी ये स्त्रियाँ इसे अपनी पीड़ा बताती हैं—

ऐसी मारी है बछेड़ा ने लात, लांगुरिया
चुनरिया के चारों पल्ले फट गये।
मेरी ससुर देखै मोसे कछू ना कहै,
मेरी सास करैगी बदनाम, लांगुरिया...

कैला मैया पर जाने वाले श्रद्धालु अपने घर से ही लांगुरिया गायन शुरू करते हैं और रास्ते भर उसकी मनुहार करते रहते हैं। एक गीत में रस पीने का खुला निमंत्रण लांगुरिया को दिया जा रहा है-

"चरखी चल रही बड़ के नीचे रस पी जा लांगुरिया।
पी जा लांगुरिया, कि रस पीजा लांगुरिया।"

भले ही यह किशोर है, परन्तु देवी की श्रद्धालु इन स्त्रियों को कभी-कभी लांगुरिया से सचेत भी रहना पड़ता है। एक लांगुरिया गीत में यही अभिव्यक्ति देखिए-

"जो में लांगुर आवैगौ नेक ओटी इयोठी रहियो।"

नवरात्रों के नौ दिन तक राजस्थान के पूर्वांचल में इसी प्रकार भक्त अपने भावों की अभिव्यक्ति इस लांगुरिया के माध्यम से करते हैं; विशेष रूप से स्त्रियाँ लांगुरिया के माध्यम से अपना प्रत्येक हर्ष और विषाद बाँटती है, लेकिन प्रश्न यह है कि आखिर यह लांगुरिया है कौन? इसकी उत्पत्ति और स्वरूप क्या है?

पुराणों में लांगुरिया का संदर्भ देखें तो शिव द्वारा शक्ति को प्रदत्त एक वीर गण के रूप में इसकी पुष्टि होती है, लेकिन लांगुरिया गीतों में इसका स्वरूप कृष्ण के अधिक निकट बैठता है। वही बालपन की अठखेलियाँ, वही किशोर वय की चंचलता, रसिक पन, छेड़छाड़।

पुनर्नवा उपन्यास के अनुसार भागवत धर्म में चतुर्व्यूह (देव चतुष्टय) की उपासना प्रचलित है। ये चार देवता- बलराम, श्रीकृष्ण, प्रद्युम्न और अनिरुद्ध हैं। आमीर राजा ने इस मण्डली में कृष्ण के छोटे पुत्र साम्ब को भी जोड़कर पाँच वृष्णि-वीरों की, उपासना आरम्भ की, राजा ने इनका विशाल मन्दिर मथुरा में बनवाया, यही साम्ब 'लाहुरावीर' के नाम से जाना गया।

अतः लांगुरिया का साम्य कृष्ण छवि के अधिक निकट जान पड़ता है। साहित्यकार विष्णु चन्द्र पाठक ने भी कैला मैया को यशोदा माँ और लांगुरिया को कृष्ण का रूप माना है। चूँकि लांगुरिया ब्रज संस्कृति से उद्भूत है, पूर्वी राजस्थान में आज भी श्रीकृष्ण की बालरूप व किशोर छवि, लोक मानस-पटल पर इस भाँति अंकित है कि उन्होंने शक्ति के गण को भी रसिक कृष्णमय बना दिया। इतना ही नहीं यह लांगुरिया कृष्ण की ही भाँति माखन खाता है और गाय भी चराने जाता है। एक लांगुरिया गीत में कैला मैया की भक्त उसे माखन का लालच दे रही है-

"बंसी बज रही है कुंजन में माखन खाजा लांगुरिया।"
तथा
"मेरी घन (गाय) खाय लई करे नाग ने बचाय लै लांगुरिया।"

लांगुरिया लोकगीत ब्रज संस्कृति का दर्पण हैं, जैसा आसपास में घटित होता है, जैसा आमजन सोचता है, वह सब इन लोक गीतों में झलकता है। लोकगीतों से सीधा सा अर्थ है, पूरा समाज जिसमें साकार हो उठता है, वही लोकगीत है। प्रत्येक देश के लोकगीत व लोक संगीत में वहाँ की आत्मा प्रतिध्वनित होती है। वे जिस अंचल के होते हैं, वहाँ का पूरा सामाजिक एवं सांस्कृतिक सौष्ठव और वैशिष्ट्य उनमें विराजता है। वे लोकगीत उस परिवेश की झाँकी प्रस्तुत करते हैं। ब्रज में गाये जाने वाले लांगुरिया लोक गीतों में भी पूरा ब्रज समाज हमारे सामने साकार हो उठता है। लोक अर्थात् समाज और उस समाज का पूरा

लांगुरिया लोकगीत ब्रज संस्कृति का दर्पण है, जैसा आसपास में घटित होता है, जैसा आमजन सोचता है, वह सब इन लोक गीतों में झलकता है। लोकगीतों से सीधा सा अर्थ है, पूरा समाज जिसमें साकार हो उठता है, वही लोकगीत है। प्रत्येक देश के लोकगीत व लोक संगीत में वहाँ की आत्मा प्रतिध्वनित होती है। वे जिस अंचल के होते हैं, वहाँ का पूरा सामाजिक एवं सांस्कृतिक सौष्ठव और वैशिष्ट्य उनमें विराजता है। वे लोकगीत उस परिवेश की झाँकी प्रस्तुत करते हैं। ब्रज में गाये जाने वाले लांगुरिया लोक गीतों में भी पूरा ब्रज समाज हमारे सामने साकार हो उठता है। लोक अर्थात् समाज और उस समाज का पूरा सांस्कृतिक जीवन। लोकगीतों से आशय लोक जीवन से गहराई तक जुड़े हुए वे गीत हैं, जो उस जीवन की प्रत्येक साँस के साक्षी और जीन-सहयात्री होते हैं। »

सांस्कृतिक जीवन। लोकगीतों से आशय लोकजीवन से गहराई तक जुड़े हुए वे गीत हैं, जो उस जीवन की प्रत्येक साँस के साक्षी और जीन-सहयात्री होते हैं। इन लोकगीतों के माध्यम से हम उस समाज में प्रचलित मान्यता, विश्वास, परम्परा, संस्कृति का ध्यान कर सकते हैं। लोक गीत समाज के इतने अभिन्न अंग होते हैं कि उस समाज की संस्कृति को बिना लोकगीतों के समझना असंभव है। लोकगीत एक पीढ़ी से दूसरी पीढ़ी को स्थानान्तरित होते हुए अपने गर्भ में लोक संस्कृति की अमूल्य धरोहर को संजोये हुए निरन्तर चलते रहे हैं।

लांगुरिया गीत दो प्रकार के हैं, एक पारम्परिक लांगुरिया, दूसरे सामयिक लांगुरिया। साहित्य समाज का महज दर्पण ही नहीं होता अपितु वह अतीत और वर्तमान की अभिव्यक्ति के साथ भविष्य की सम्भावनाओं को भी उद्भाषित करते हुए मानव समाज को जाग्रत और तत्पर रखता है।

लांगुरिया गीत अपने समय के समसामयिक संदर्भों को बड़ी ही समरसता से व्यक्त करते हुए लोक साहित्य की कसौटी पर स्वयं को सिद्ध करते आ रहे हैं। भारतवर्ष का स्वतंत्रता संग्राम हो या अंग्रेजियत का अस्वीकार। कुछ गीत प्रस्तुत हैं-

"सखी री ब्रज कौ बसिबौ री तजी, अँगरेजन की रीति बुरी।
मार तरवरिया भरतपुर लूट्यौ, गुइयाँ ठकुराइन कूं कैद करी।
काऊ की तिरिया काऊ कौ पुरुष गुइयाँ वा तौ राजी बोल गई।
सखी री जा ब्रज को बसिबौ तजो।"

*   *   *

"रे लांगुरिया दिन पन्द्रह अगस्त कौ आय गयौ
जा दिन देस भयौ आजाद। लांगुरिया...
रे लांगुरिया सरदार भगत सिंह, आजाद और गांधी,
सुभाष, लाजपत ने दै प्रान गंवाये
रे लांगुरिया दिन पन्द्रह अगस्त कौ आयो।"

*   *   *

"बारे लांगुरिया फैसन में दीवानो ऐसी है रह्यौ

तेने धरको कियो नहीं ख्याल लांगुरिया
बारे लांगुरिया कपड़ा सिमावै टैरीलीन के
चाहै घर में ना होय आटौ दाल लांगुरिया।"

शिक्षा के क्षेत्र में दिनोदिन बढ़ते हुए प्रचार-प्रसार से लांगुरिया लोकगीत भी अछूते नहीं हैं। जहाँ कुछ समय पहले सिर्फ पुरुषों की शिक्षा अनिवार्य होती थी, वहीं स्वतंत्र भारत में नारी शिक्षा पर भी विशेष बल दिया जाने लगा है। इसकी पुष्टि इस गीत से होती है–
"लांगुर दसमीं फेल जोगिन आई एम.ए. पास।"

*   *   *

"खोबे चिलम भरत दिन जाय, बड़ी रे पिवैया लांगुर गाँजे कौ।"
"लांगुर कर परिवार नियोजन, जब लै जाऊँगी जात कूँ।"
बाल मनोविज्ञान की समझ माँ को रखनी ही चाहिए–
"कैसे बने वीर बलवान देस के बालक लांगुरिया
छः माह पहले ते चूल्हे की माटी खावै
हऊआ-हऊआ कहके बालक कूँ डरपावै।"

इस प्रकार लांगुरिया गीत अपने समय और समाज के प्रत्येक घटनाक्रम और मनोविज्ञान को बड़े ही सटीक ढंग से सहज भाव और भाषा में अभिव्यक्त करने में समर्थ हैं। यह गीत नारी लोकमानस से उद्भूत और कोटि-कोटि मधुर कण्ठों से निःसृत ऐसी रसिक निझरिणी हैं। मानव-मन सदियों से गोते लगाता हुआ स्वयं को मानसिक जिसके आह्लाद रूप स्वस्थ अनुभव करता है; किन्तु यह गीत केवल मानस का आह्लाद ही नहीं अपितु लोक हृदय से उद्भूत इन गीतों में सम्पूर्ण ब्रज लोक की हलचल प्रत्यक्ष हो जाती है। आधुनिकता की चकाचौंध में पागल मानव भी जब कैलादेवी मेले में इन गीतों पर अपनी प्रस्थिति,

▬ इस प्रकार लांगुरिया गीत अपने समय और समाज के प्रत्येक घटनाक्रम और मनोविज्ञान को बड़े ही सटीक ढंग से सहज भाव और भाषा में अभिव्यक्त करने में समर्थ हैं। यह गीत नारी लोकमानस से उद्भूत और कोटि-कोटि मधुर कण्ठों से निःसृत ऐसी रसिक निझरिणी हैं। मानव-मन सदियों से गोते लगाता हुआ स्वयं को मानसिक जिसके आह्लाद रूप स्वस्थ अनुभव करता है; किन्तु यह गीत केवल मानस का आह्लाद ही नहीं अपितु लोक हृदय से उद्भूत इन गीतों में सम्पूर्ण ब्रज लोक की हलचल प्रत्यक्ष हो जाती है। ▬

गर्व, अपनी हैसियत को भूलकर बेसुध होकर घंटों नाचते, गाते, झूमते दिखते हैं तो फिर ब्रज तो है ही प्रेम भाव का भूखा, वह भला कैसे इन भक्तों पर द्रवित हुए बिना रह सकता है और माँ जगतभवानी तो अपने पुत्रों के लिए कृपा करनी माँ हो ही जाती है, जब ऐसे निश्चल हृदय से निकले सरस और भावुक गीत अपनी संतान के मुख से सुनती है। कैला मैया का देवालय न तो मंदिर है, न कोई मठ है, वह तो साक्षात् माँ का घर है, जहाँ प्रत्येक व्यक्ति या माँ के बालक को प्रवेश की पूर्ण सुविधा है, यहाँ कोई विशिष्ट या साधारण नहीं, यदि है तो सभी विशिष्ट। यही इस लोक साहित्य की सफलता है।

साहायक आचार्य, हिन्दी विभाग
कानोड़िया महिला महाविद्यालय, जयपुर (राज.)

(रचनाकार अज्ञात)

चरखो तो ले ल्यूँ, भँवरजी, रांगलो जी

चरखो तो ले ल्यूँ, भँवरजी, रांगलो जी
हाँ जी ढोला, पीढ़ा लाल गुलाल
तकवो तो ले ल्यूँ जी, भँवरजी, बीजलसार को जी
ओ जी म्हारी जोड़ी रा भरतार
पूनी मैंगा ल्यूँ जी क बीकानेर की जी
म्होरे म्होरे री कातूँ, भँवर जी, कूकड़ी जी
हाँ जी ढोला, रोक रुपइये रो तार
म्हे कातूँ थे बैठा विणज ल्यो जी
ओ जी म्हारी लल नणद रा ओ वीर
अब घर आओ प्यारी ने पलक न आवड़े जी
गोरी री कमाई खासी रांडिया रे
हाँ ए गोरी, कै गांची कै मणियार
म्हे छौं बेटा साहूकार रा जी
ए जी म्हारी घणीए प्यारी नार
गोरी री कमाई सूँ पूरा न पड़े जी

भावार्थ : 'एक रंगीला चरखा ले लूँगी मैं, ओ प्रियतम! अजी ओ ढोला, एक लाल-गुलाल पीढ़ा ले लूँगी। उत्तम, पक्के लोहे का, ओ प्रियतम! मैं तकला ले लूँगी। अजी ओ, मेरी जोड़ी के भरतार! बीकानेर से पूनियाँ मँगवा लूँगी, एक-एक मोहर के दाम से कातूँगी एक-एक कूकड़ी (पूनी)। अजी ओ ढोला, एक-एक रुपए का होगा एक-एक धागा। मैं कातूँगी और तुम बैठे इसका व्यवसाय करना। अजी ओ, मेरी लाल ननद के भाई! जल्दी घर आओ, तुम्हारी प्यारी को अब पल भर भी चैन नहीं।' ...स्त्री की कमाई खाएगा कोई नामर्द या कोई इत्र बेचने वाला, या यूँ कोई मनिहार। जी स्यामती! मैं तो साहूकार का बेटा हूँ। हे मेरी प्यारी नारी! पत्नी की कमाई से काम नहीं चलता।'

Contents

ROLE OF FDI IN TELECOMMUNICATION SECTOR

Prof. A.K Gupta
Sakshi Sharma

Abstract

Economic history is evident of the fact that presently developed nations of the world developed with the help of foreign capital. A developing country like India may need foreign capital on account of - Low Capital Formation, Need for High Level of Investment, Development of Basic Economic Infrastructure, Backwardness in Technologies, Making Balance of Payment Favorable, and Filling the Gap of Private Entrepreneurs. Since then every government has encouraged the expansion of FDI. When the Indian government opened up cellular telephony to private industry, several foreign investors were ready to enter India's telecom sector. However beating other manufacturing and services sectors, Indian telecom had attracted major inflow of FDI since August 1991. Foreign investment in telecommunications brings technology transfer, huge capital, and increased market competition, which help national telecommunications development.

Keywords: FDI, Telecommunication Industry, Global Market, Economic Benefit, Developing Country.

Introduction

During the past few decades, foreign investment has rapidly increased worldwide and has enhanced economic growth in developing countries. Although foreign investment brings huge economic benefits, many developing countries fear that by opening up markets to competition and foreign investment without restriction, they will lose control of their strategic industries. Among those industries, telecommunications is a sector with substantial impact and influence on national security, social stability and economic development.

Telecommunications sector plays a dual role in economic activities, not only itself a distinct circle in economic system but also a supplying mean for other sectors. Having Contemporary Management Research, 30 of this kind of special character, telecommunications cover can relate to many other industrial and

economic sectors such as manufacture, entertainment, and communication sector. Foreign investment has been one of the most important driving force in the exploration of natural resources and improvement of economic conditions in underdeveloped and developing countries for centuries. In recent times, foreign investment has not only increased quickly but also covered a wide range of industries around the world. The role played by foreign investment is an important role in the world's economy.

Table 1: Showing FDI Inflows in Different Sectors

Ranks	Sector	%age to total inflows in USA (upto Jan. 2014)
1	Service sector	18%
2	Construction Development	11%
3	Telecommunications	6%
4	Computer Hardware & Software	6%
5	Drugs & Pharmaceuticals	5%
6	Chemicals (Other than Fertilizers)	4%
7	Automobile Industry	4%
8	Power	4%
9	Metallurgical Industries	4%
10	Hotel & Tourism	3%

Objectives of the Study

The main objective of the study is to find out the role played by FDI in telecommunication industry in India. This present paper also tries to find out the impact of FDI in Telecommunication on economic growth and to find out the various economic benefits derived from this industry. FDI brings the promotion of economic growth, technology transfer and the creation of employment. This study will examine current international investment regime and their relation with telecommunications as an influence in developing countries. This article hopes to find a new position for telecommunications in a integrated global market

FDI and Its role in Telecommunication Sector

Among FDI, telecommunications is one of the most strategic industries of national economic control. Even though foreign investments on telecommunications will bring advanced technological skills, large amount of funds, as well as market competition and will benefit national telecommunications development, many countries guide policy and legal requirements to control foreign investment to correspond to their economic and developmental demands. Telecommunications have a substantial and important influence on national security, social stability and economic development as well as many industrial sectors. Due to its particular character, telecommunication industries are often state-operated and monopolized in many countries. Therefore, the balance between economic gains from foreign investment and national telecommunications sovereignty presents a challenging task. This article will examine international investment regime and its relation with telecommunications as an influence in the global economic market.

Foreign direct investment on telecommunications comprises to establish a commercial presence in a foreign territory for the purpose

companies by foreign investors or joint ventures between local and foreign partners to establish new telecommunication service companies. Historically, the opportunities for foreign investment in the telecommunication services sector have been limited by the fact that most countries had state-owned monopoly telecommunication carriers. For increasing the proportion of foreign investment on telecommunication sectors, foreign capital has to be raised. Under the process of privatization of telecommunication industries, there are increasing numbers of opportunities for foreign investors to establish foreign subsidiaries or to combine with others in joint ventures. Liberal foreign investment on telecommunication will promote more economic gains including new and improved telecommunication products and services with lower prices and additional investment on other industrial sectors.

Table 2: Showing **Total FDI Inflows and FDI inflows in Telecom Sector**

Year	Total FDI Inflows (US$ in millions)	FDI Inflows in Telecom Sector (US$ in millions)
2005-06	8961	617.98
2006-07	22826	476.51
2007-08	34843	1260.70
2008-09	41873	2548.63
2009-10	37745	2539.26
2010-11	34847	1664.50
2011-12	46556	1997.24
2012-13	34298	303.87
2013-14	36046	1306.95
2014-15	37758	2831.67

Source: RBI's Bulletin March 2015

Opening foreign investment on the telecommunication services sector should result in more competition, lowering prices for most businesses and for many consumers and providing both with a choice of different service providers.

FDI brings not only new technology and developmental funds to telecommunications industries; it also brings innovation and competition for telecommunications providers. These positive effects promote the capacity of telecommunication in underdeveloped and developing countries and benefit the formation of "world village." For most developing and developed countries foreign investment on telecommunications is not merely a provider for improvement of local telecommunication equipments but also a driving force for telecommunication market Contemporary Management Research 35 competition and transformation.

Seeing the huge benefits from foreign investment in telecommunications a large portion of the world hopes to attract foreign investment to pursue a schedule of projects to improve the basic telecommunications infrastructure. By deregulating domestic telecommunication regimes, it is expected that local telecommunication markets will be more efficient and attractive for foreign firms. Second, to attract more foreign investment and to operate toward an integrated global economy, countries have to make more available high-speed data networks

cellular radio, mobile satellite services, internet access and facsimile for foreign firms. In developed countries, they have concentrated more on recognizing telecommunications trends and have tried to satisfy the complex requirements of multinational enterprises. Both developed and developing countries face the same pressure to upgrade and diversify the telecommunications sector, but developing countries typically have less financial, technical and operational resources to do so, particularly in light of an incomplete basic infrastructure.

Table 3: Table Showing Total Factor Productivity of Telecommunication Sector

Year	Total Revenues (in crores)	Total Investment (in crores)	Year on Year Growth %	TFP	TFP Index 2006-07= 100
2006-07	86700	178831		0.485	100
2007-08	87312	199843	-0.109	0.437	90.12
2008-09	107382	240710	0.021	0.446	92.015
2009-10	129460	278599	0.04	0.465	95.847
2010-11	152360	337788	-0.03	0.451	93.036
2011-12	150660	416429	-0.247	0.362	74.624
2012-13	166752	479278	-0.04	0.348	71.764
2013-14	179914	525564	-0.016	0.342	70.609
2014-15	191145	556501	0.003	0.344	70.847

The study has calculated the total factor productivity on the basis of ratios. It is evident that the TFP coefficient throughout the study has declined significantly from 0 .485 in 2006-07 to 0.344 in 2014-15, except for marginal increase in 2011-12. This indicates that technological transfer (FDI) is not a single determinant of total factor productivity in Telecommunication sector.

Privatization and increased foreign investment in telecommunication markets has resulted in substantial progress in meeting developing countries' basic telephony upgrading goals. It is also expected that market competition as the provision of international and domestic telecommunication services will bring a significant reduction in prices and more parity between domestic and international telephone services. Where markets have been liberalized, the level of investment, particularly foreign investment, has generally increased and telephony and network development has proceeded more rapidly. This combination of competitive markets, private ownership and foreign investment has created an appropriate environment for next generation global telecommunications development.

Economic Benefits of FDI

Opening up of markets have given immense opportunities to the business leaders in India to capture the opportunities over the globe. The fast rising economic performance of Indian Economy has created an environment of optimism on the part of the investors to invest more and more indian industries in the fields of information and technology, Steel, Textile, Software and some others

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have brought tremendous success for the country. Attracting foreign direct investment (FDI) has become a key part of national developmental strategies for many countries. While many highlight FD's positive effects, others blame FDI for "crowding up" domestic investment and lowering certain regulatory standards. The effect of FDI can sometimes barely be perceived, while at other times these can be absolutely transformative. The following are the major impact of FDI in the host countries:

- Faster economic growth.
- Increase in trade,
- Employment and skills levels,
- Technology diffusion and knowledge transfer;
- and linkages and spillover to domestic firms

FDI on Telecommunications and Economic Growth

Investment in telecommunications is a prerequisite for broad based economic development. The dual role of telecommunications as both a traded service and a vehicle for trade in other service sectors means that price reductions, improvements in the level of investment and the development of infrastructure and services brought about by liberalization should also have an impact on other sectors of the economy. In addition, efficient, low-cost telecommunication networks will provide the necessary platform for the growth of electronic commerce. The implementation of liberalized telecommunication investment should produce significant benefits not only within the country's telecommunication sector but also for the national economy as a whole.

Growth in total subscribers

Telephone Subscribers (in millions)

Source: Telecom Regulatory Authority of India, TechSci Research
Notes: CAGR - Compound Annual Growth Rate; FY16*- Till September 2015

- India is currently the second-largest telecommunication market and has the third highest number of internet users in the world
- Between FY 07-16* India's telephone subscriber base expanded at a Compound Annual Growth Rate (CAGR) of 19.5 per cent to 1,022.61 million and teledensity to 80.98

In September 2015, total telephone subscription stood at 1,022.61 million while teledensity was at 80.98 percent

FDI in Telecom
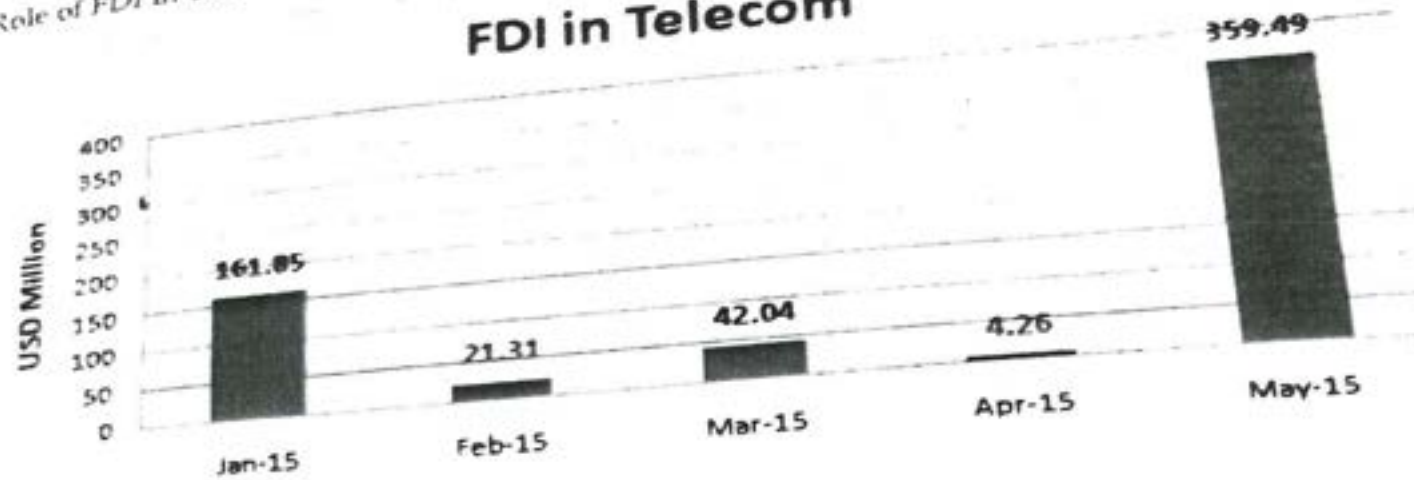
Source: DIPP

Management Research comparative has/the disadvantage in attracting investment, and lowers the quality of living standard as well as personal access to communication. The evidence leaves no doubt that there was indeed a correlation between economic development and investment on telecommunications. Throughout economic developmental history, telecommunication infrastructure has played an important role in supporting the economic development of counties. There are numerous documented examples about the direct relationship between investment in telecommunication infrastructure and economic growth. The growth of global telecommunication development will bring rapid expansion of new and advanced information services, attract more domestic and foreign investments, and improve economic development and global competitiveness, as well as a better living standard of health care and education.

Conclusion

The study found that there is a significant telecom equipment-manufacturing base in the country and there has been steady growth of the manufacturing sector during the past few years. Rising demand for a wide range of telecom equipment, particularly in the area of mobile telecommunication, has provided excellent opportunities to domestic and foreign investors in the manufacturing sector. The are the major impact of FDI in telecommunication.

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(A tribute to Late Shri Narendra Singh Kothari)

Growth of Indian Telecom Sector

*Ms. Sakshi Sharma

Telecom is one of the fastest-growing industries in India. Today India stands as the second largest telecommunications market in the world. The mobile phone industry in India will contribute US$ 400 billion in terms of gross domestic product (GDP) of the country in 2014. sector which is growing exponentially is expected to generate about 4.1 million additional by 2020, as per Group Special Mobile Association (GSMA).

In the period April 2000 to January 2014, the telecom industry has got in foreign investments (FDI) of about US$ 59,796 million, which is an increase of 6 per cent to the total inflows in terms of US$, as per report published by Department of Industrial Policy Promotion (DIPP). India's global system for mobile (GSM) operators had 4.14 million subscribers as of January 2014, bringing the total to 285.35 million.

Data traffic powered by third generation (3G) services grew at 146 per cent in India in 2013, higher than the global average that saw usage double, according to an MBit Index study Nokia Siemens Networks (NSN).

India's smartphone market grew by 171 per cent in 2013, to 44 million devices from 16.2 million in 2012, as per research firm IDC India. The increasing popularity of bring-your-own-device (BYOD) in the workplace is further adding momentum to the smartphone market.

Indian telecom industry has grown from a tele-density of 3.58% in March 2001 to 74% in June 2013. This great leap in both numbers of consumers as well as revenues from telecom service has not only provided sufficient contribution in Indian GDP growth but also provided much needed employment to India youth.

Market Size

Driven by strong adoption of data consumption on handheld devices, the total mobile service market revenue in India is expected to touch US$ 37 billion in 2017, registering a Compound Annual Growth Rate (CAGR) of 5.2 per cent between 2014 and 2017, according to research firm IDC.

India is expected to have over 180 million smartphones by 2019, contributing around 13.5 per cent to the global smartphone market, based on rising affordability and better availability of services among other factors.&

According to a report by leading research firm Market Research Store the Indian telecommunication services market will likely grow by 10.3 per cent year-on-year to reach 103.9 billion by 2020.

According to the Ericsson Mobility Report India, smartphone subscriptions in India is expected to increase four-fold to 810 million users by 2021, while the total smartphone traffic is expected to grow seventeen-fold to 4.2 Exabytes (EB) per month by 2021.

According to a study by GSMA, smartphones are expected to account for two out of every three mobile connections globally by 2020 making India the fourth largest smartphone market. Total number of Fourth-Generation (4G) enabled smartphone shipments in India stood at 13.9 million units in the quarter ending December 2015, which was more than 50 per cent of total shipments, thereby surpassing number of Third-Generation (3G) enabled smartphone shipments for the first time.^ Broadband services user-base in India is expected to grow to 250 million connections by 2017.

The service sector growth worldwide has been phenomenal which is reflected in its increased contribution to Gross Domestic Product (GDP) as well as employment generation mechanism. Liberalisation, Privatisation and Globalisation have brought unprecedented changes in the economic, trade, and industrial scenarios. India is fast moving from a protected economy to an open market economy and becoming integrated with the world economy. The change environment has exposed various organizations including the service sector to the challenges of competition, service quality, cost, and the competitive environment. It will help organizations to modernize. Some of those unable to cope with the changes may have to face the consequences of the survival of the fittest. India, like many other countries of the world, has adopted a gradual approach to telecom sector reform through selective privatisation and managed competition in different segments of the telecom market. To begin with, India introduced private competition in value-added services in 1992 followed by opening up of cellular and basic services for local area to private competition. Private competition was also introduced in National Long Distance (NLD) and International Long Distance (ILD) telephony at the start of the current decade. The Indian mobile services industry is moving in full swing, be it investment, subscriber base, technology or Value Added Services (VAS). Also the industry is coming up with innovative ways to lower their cost of operations. Apart from this, cut-throat competition in terms of technology as well as among the service providers has pushed the industry to innovate which has benefited the ultimate consumer. This section of the thesis through a light on the growth & development in Indian telecom sector and also give brief introduction of selected telecom operators.

Telecom subscriber base expands substantially

- India is currently the second-largest telecommunication market and has the third highest number of internet users in the world
- Between FY 07-16* India's telephone subscriber base expanded at a Compound Annual Growth Rate (CAGR) of 19.5 per cent to 1,022.61 million and teledensity to 80.98
- In September 2015, total telephone subscription stood at 1,022.61 million, while teledensity was at 80.98 percent.

Growth in total subscribers

Telephone Subscribers (in millions)

FY07 FY08 FY09 FY10 FY11 FY12 FY13 FY14 FY15 FY16"

Source: Telecom Regulatory Authority of India, TechSci Research
Notes: CAGR - Compound Annual Growth Rate. FY16" - Till September 2015

Composition of telephone subscribers (FY16")

- Urban Wireless
- Rural Wireless
- Urban Wireline
- Rural Wireline
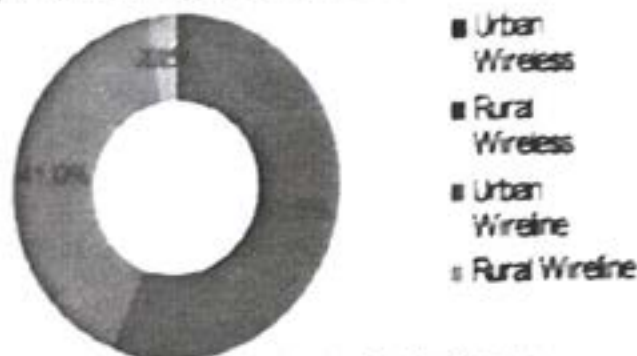
Source: Telecom Regulatory Authority of India, TechSci Research
Note: FY16" - Data as of September 2015

Telecom Growth Comparison :
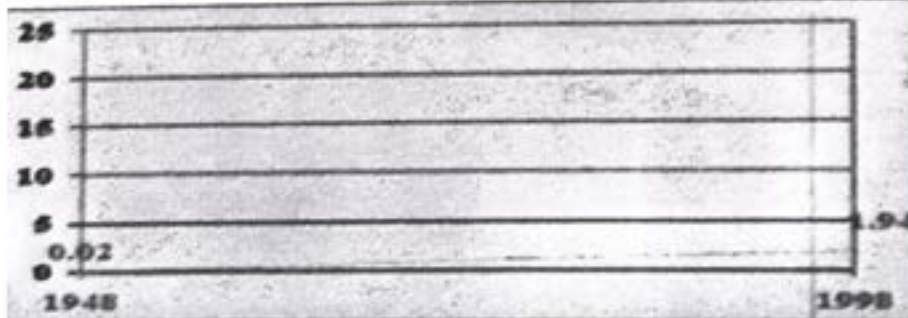
Mobile Subscriber Growth Chart
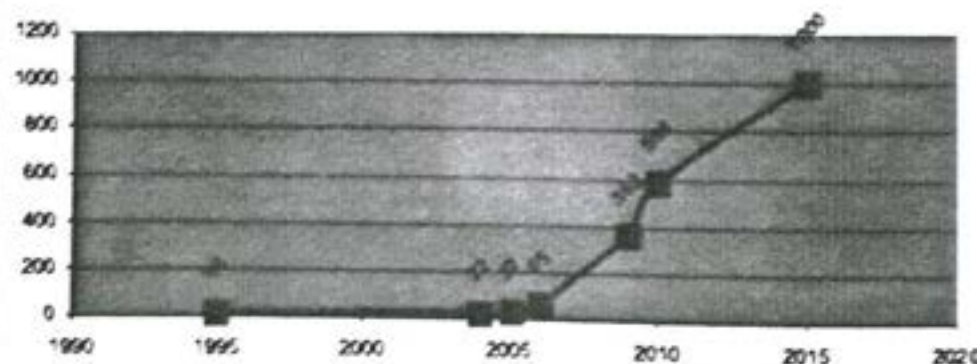
Total No. of Mobile Subscriber in the year 2015 will be 1000 Million.
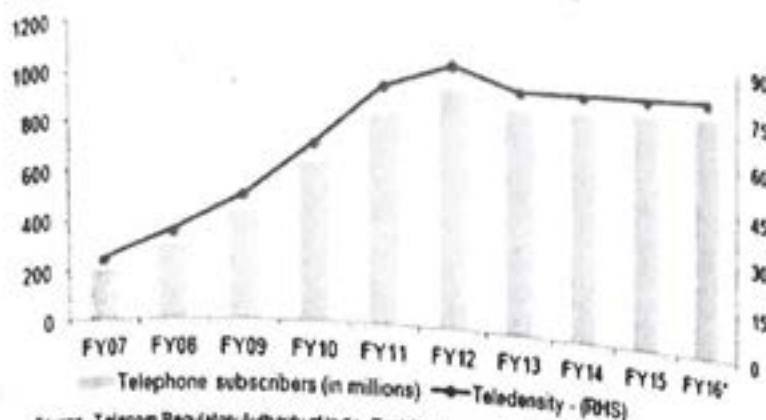
Growth in total subscribers

Source: Telecom Regulatory Authority of India, TechSciResearch,
Notes: CAGR - Compound Annual Growth Rate, FY16*- Till May 2015

Frontiers of Growth

3G and BWA services The commendable growth of the mobile sector in India is yet to be followed in broadband sector. While the last few years were witness to mobile revolution, the next few years look even more exciting in the field of broadband and mobile value added service (MVAS). After two decades of strong growth in voice services, data services will be the next trigger for growth in the Indian telecom market- for both the wire line and wireless segment. Data usage is expected to grow at a faster pace with 3G and BWA deployments. Increasing use of smart mobile devices like I-Phones are also expected to catalyze the data usage growth.

Value Added Services (VAS) The mobile value added services such as m-banking, m-education, m-governance, mhealth, m-agriculture, etc. has assumed significance in recent times due to the rapid growth in wireless subscriber base. Consequently, the mobile phones have transformed into a persuasive medium to deliver information services spanning various usage areas such as governance, commerce, agriculture, education and health. Thus, m-POWERING is playing an instrumental role in bringing about empowerment to all strata of society by their delivery of services.

Manufacturing The exponential growth witnessed by the telecom sector in the past decade has led to the development of the telecom equipment manufacturing and other supporting industries. With the advent of next-generation technologies and operators looking to roll out 3G and broadband wireless access services, the demand for telecom equipment has increased rapidly. In an attempt to capitalize on this opportunity, the government is focusing on developing the domestic manufacturing industry. The Indian equipment manufacturing sector has come a long way in the past few years. From being an import-centric industry, it is slowly but steadily moving towards becoming a global telecom equipment manufacturing hub.

Changes in Structure of Telecom Sector in India Wire line vs. Wireless The growth of wireless services has been substantial, with wireless subscribers growing at a compounded annual growth rate (CAGR) of 42.7% since 2007. Wireless has overtaken wire lines. The share of wireless phones has increased from 80.19% in 2007 to 96.47% in December'11. On the other

Growth of Indian Telecom Sector
Ms. Sakshi Sharma

hand, the share of wire line has steadily declined from 19.81% in 2007 to 3.53% in December Wireless phones have increased as they are preferred because of their convenience affordability. As a result, telephones today have come within the reach of the common man

Private vs. Public The fruits of the liberalization efforts of the Government are evident in growing share of the private sector. The private sector is now playing an important role in expansion of telecom services

Broadband Services Broadband connectivity is increasingly being seen as an integral driver improved socio-economic performance. The Indian Government strongly believes that citizens of the country should have access to broadband and the transformative opportunit Broadband services empower masses. They allow individuals to access new career educational opportunities, they help businesses reach new markets and improve efficiency they enhance the Government's capacity to deliver critical services like health, banking commerce to all of its citizens. Provision of Broadband in rural and remote areas will also help bridging the "digital divide" and the widespread adoption of broadband in rural areas will have multiplier effect over the long-term. It will help improve productivity in rural areas, he overcome the constraints of an inadequate transport infrastructure and overall improve quality of life in rural areas. Given the significant economic and social benefits, expand affordable access to broadband has become a high priority for the Government. T development of a robust broadband ecosystem will be the key to meet Government's objectiv It is a known fact that wireless is the quickest and most efficient medium to provide broadba services in the access network.

CONTRIBUTION OF THE MOBILE ECOSYSTEM TO GDP IN INDIA
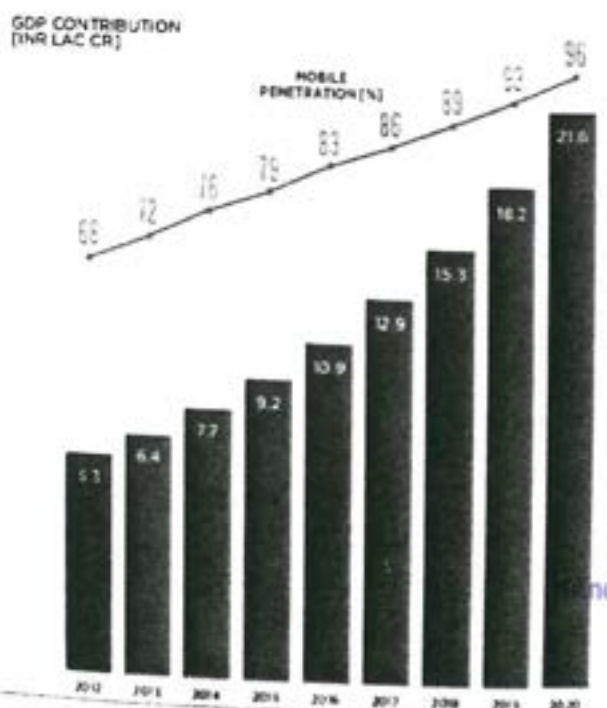
Growth of Indian Telecom Sector

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Financial Review of Department of Posts: India

Dr. Mrinali Kankar

Abstract

Today, the Department of Posts is passing through transitory path to development with expansion of the Postal Services useful to a common man (Aam Aadmi) and corporate sector in the changing marketing environment, technological advancement era. The Department of Posts has faced a period of changes due to increasing competition, computerization, technological changes and opening of its markets to competition. Thus on the one hand, the role of the Department of Posts is undergoing a complete image change from dealing with basic mail functioning to that of multifaceted business center having involvement of huge finance at every step.

Keywords: India Post, Post Offices, Postal Services, Means of Communication, Value Added Services, Financial Services.

Introduction

It is seen that the India Posts has faced drastic changes during last 150 years in its role & functioning. In the current form it existed for the last 110 years. Now its role is not limited to traditional role of conveying of mails but meets out the requirements of efficient and value added postal services, financial services and insurance services on demand of today's society, large business houses, corporate sector. It is fully competent to compete with private couriers in open and globalised competitive market along with fulfilling its social obligations for providing basic postal services across the country at affordable price. It is a blend of traditions and modernity and had adopted vision statement that reads -"India Posts is a socially committed, technology driven, professionally managed and forward looking organization".

Therefore aiming at to fulfill vision of the Department, it provides communication services pertaining to letters, registered and unregistered mails, collection, transmission and delivery of mails upto doorstep of the customers, transportation services relating to logistics of goods and articles, value addition to basic postal services like Speed Posts, Business Posts, Direct Posts, Bill Mail Service, Express Parcel Posts, Retail Posts etc., financial services relating to Savings Bank and Saving Certificates, Postal Life Insurance, Rural Postal Life Insurance, International Money Transfer, Remittances of funds through Money Orders etc. within the country.

The Department of Posts, with its network of 1,54,910 Post Offices, is the largest postal network in the world and is performing all the services to every nook and corner of the country.. The beginnings of this vast postal network can be traced back to the year 1727 when the first Post

Office was set up in Kolkata. Simultaneously it is facing many challenges in performing its new role due to increase in commercialization of economic activities, growing competitions, globalization, open market economy, rapid advancement in technology, customization and the most important factor of rising expectations of customers about quality of services.

Therefore, the Department of Posts has taken action in the areas of modernization and computerization of Head/Sub Post Offices, Administrative Offices, Accounts Offices and opening of Financial Postal Marts as "One Stop Solution" for financial services, computerization of the work relating to processing and conveying of mails aiming at speedy transmission of mails i.e. computerization of the Head Record Offices, Registration Centers, setting up of Automated Mail Processing Centers, introduction of various channels of mails- Metro, Rajdhani, Green, Business and Patrika, creation of Mail Grid, induction of freighter aircrafts etc., has been introduced. Mail Motor vehicles are equipped with Global Postal System (GPS) in some areas of the country. All Accounts Offices also been computerized. In addition, setting up of "Business Development and Marketing Directorate", introduction of e-enabled services, improving of human resource skills through arranging more training programs, introduction of "Project Arrow" etc, are also important initiatives of the Department to transform Indian Post Offices as vibrant and responsive organization.

The Department of Posts appears to face problems like:

1. Non growth of revenue at a satisfactory level since long.

2. Year to year growing expenses of the department, which are beyond control.

3. Non commensuration with the demands of today's business environment specially relating to –

   (a) Product proposition i.e which product is required and which is not required. Whether all the traditional products are still useful to a common man and corporate sector or require modification in the wake of growing competitive circumstances, globalization of market economy and fast changing technology.

   (b) Poor/incomplete implementation of information level and,

   (c) Problems relating to Human Resource Development in the changing technological era.

The role of the Post offices is undergoing transformation the world over, as the electronic mail and new technologies supplement traditional postal services / activities. In the wake of globalization and deepening of market mechanism in India, the Department of Posts had to fulfill its responsibility of rendering social services as well had to fulfill the current requirements of the business world. The Post Office is increasingly adopting new business to help to optimize its strength by providing new services of public utility and new financial services suiting to the socio-economic need of the country. It is also simultaneously upgrading traditional services through inducting new technology, introducing new products and services in order to meet the

challenges of providing faster, more reliable and more responsive service to the customer in the time of increasing competition from private couriers and continuing advancements in communication technology since the last decades especially since 1990s and onward. The Department of Posts is facing twin challenges posed by the private couriers and continuing advancements in communication technology especially mobile telephony and the World Wide Web and the Department had devised a sound strategy to meet these challenges by changing the Department at multiple levels say:

(i) Personal / agential / Human Resources by repositioning the Department at the human resource level by providing quality training to all categories of staff,

(ii) Re-engineering of business process for Saving Bank and Insurance, mail operations, introducing E-enabled services and Business Development activities, Human resources and establishment, Accounting and Finance, setting up Rural Business Division to explore market potential for postal products and to serve their needs in rural areas,

(iii) Restructuring through technology,

(iv) Introducing new concept of Project Arrow during 2008-09 an initiative to transform India Post into a vibrant and responsive organization and to make a visible and positive difference in postal operations to benefit the customers, and;

(v) To provide greater satisfaction to the customers, 'Pick Up Mail Facility' (w.e.f. 18th July, 2005), different e-Enabled services, logistic services, instant money orders etc. reoriented.

Review of Literature

1. **Postal History, published by Postal Training Centre, Mysore:** This book shows the complete history of the Posts i.e. this book contains details from where post came into existence, how did it grow and develop. This book further shows the evolution of Postal System in Europe, America and Asia. This book contains the Postal history and development since emergence of Postal System in India to 20th Century. This book was published by the Department of Posts.

2. **Story of Indian Post Offices, written by Mulk Raj Anand:** This book contains the history of Post Offices in India i.e. how it came into existence, from where they started, how the system worked from time to time. Development of Post Offices from beginning onwards is the subject matter of the book.

3. **Business Development and Financial Services, compiled by S.B. Rao:** This book was compiled by Mr. Rao, an officer in the Department of Posts to analysis the development of business by its Premium Products and new financial services.

4. **"Think Big" by Major General V Sadasivam** – Assistant Director General, APS, New Delhi discussing with various aspects for development of Postal System published in Dak Patrika (June 2007).

5. "Role of Indian Post Office as building the Indian History", written by C.R. Vijaylakshmi: This article was published in Dak Patrika (March 2005) showing development of Post Offices and its services in Indian History.

Objectives

1. Appraisal of existing financial management system and critical review of financial position.
2. Examine the facts for non increase in revenue and make suggestions for increasing revenue and control over expenses.

Research Methodology

The statistical data for the study have been collected from the secondary sources. Secondary data have been collected from the various annual reports, publications of economic survey reports, books, journals and periodicals. The period of study is taken for 5 years i.e. from 2011-12 to 2015-16.

Revenue of Department of Posts

The Department of Posts is known for providing services to the society at affordable price without relating it to the actual costs of its products and services, even then there are some earnings of the Department. The sources of earnings of the Department are in the form of "Recoveries" and "Revenues".

The "Recoveries" include the amount of commission earned by the Department of Posts for performing agency functions on behalf of other Government Departments/organizations, such as commission for –

(i)   Disbursement of military pension through Post Offices.

(ii)   Payment of Coal Miners, Employees Provident Fund/Family Pension & other Misc. services.

(iii)   Payment of Railway Pensions.

(iv)   Postal Life Insurance.

(v)   Custom Duty Realization.

(vi)   Commission on Account of International Money Transfer-Western Union Scheme.

(vii)   Telegraphs share of Combined Offices.

(viii)   Mahila Samridhi Yojna.

(ix)   Commission on sale of Non Postal Stamps of Delhi Administration.

(x)   Recoveries from Army Postal Service Accounts.

(xi)   Recoveries from other Government Departments and share of establishment debitable to Capital, etc.

"Revenue" includes the earnings on account of –

(i)   Sale of Postal articles.

(ii)   Commission on money orders and Indian Postal orders.

(iii)   Receipts from premium product services.

(iv)   Remuneration for Saving Bank and Cash Certificate work done on behalf of Ministry of Finance.

Thus, the earnings of the Department are in form of 'Revenue' and 'Recoveries'. The 'Recoveries' represents the amount of commission earned by the Department for agency services rendered on behalf of other Departments and Organizations, where as 'Revenue' is on account of sale of Postal Articles, Commission on Money Orders/Indian Postal Orders and receipts from premium product services, service charges retained by the Department of Posts for sale of Pass Port Application form, Pass Port Fee Stamps, Central Recruitment Fee (CRF) Stamps, Receipt from other Postal Administration etc.

Gross revenue including amount of remuneration received from Ministry of Finance for Saving Bank & Cash Certificates Work, and amount of Recoveries (deducted from Gross Total Expenditure for the work done as agency functions on behalf of other Departments/ Organizations) of the Department of Posts at all India level was Rs. 12,939.79 during the year 2015-16.

Revenue Status of the Department of Posts as prevailed during last five years has been shown in TABLE 1:

TABLE 1
Revenue of Department of Posts, India

(₹ in Crore)

Sources of Revenue	2011-12	2012-13	2013-14	2014-15	2015-16
Sale of Stamps	663.03	649.06	670.67	576.18	441.75
Postage Realized in Cash	2277.62	2752.11	3161.71	3240.10	3468.41
Commission on MOs/IPOs	490.78	514.87	606.89	641.98	464.84
Other Receipts*	163.84	418.86	375.88	507.69	780.91
Total (A)	3595.27	4334.90	4815.15	4965.95	5155.91
Remuneration for Savings Bank / Cash Certificates (B)	4304.08	5031.60	5915.27	6670.03	7783.88
Total (A + B)	7899.35	9366.50	10730.42	11635.98	12939.79

*This includes revenue from sale of Passport Application Form, Passport Fee Stamps, Central Recruitment Fee Stamps, and Receipt from Other Postal Administration etc.

It is worthwhile to mention that in the year 1980-81 total revenue of the Department of Posts was only `278 crore which gradually rose and reached to `12939.79 crore in the year 2015-16 showing increase by 4554.60 %. But the above increase is in a long span of 28 years where as prevailing trend during last five years of Revenue reflects total revenue growth to `12939.79 crore in the year 2015-16 from `7899.35 crore in the year 2011-12 recording an increase of 63.81%. However the pace of growth of revenue in the year 2008-09 over 2007-08, i.e. in one year was only 11.21%. Revenue from commission of Money Orders/Indian Postal Orders, declined by 27.59% in one year. Revenue from "Sale of Stamps" and under the head 'Other Receipts' also declined during last five years. Major share of total revenue was earned from "Postage Realized in Cash" equal to 26.80% and remuneration from SB/CC services was worth 60.16% in the financial year 2015-16. Main factors attributing to revenue growth in recent years can be identified as technological advancement and computerization in the functioning of Post Offices enabling speedy growth of premium product services and launching of e-enabled services, increase in corporate/business mails and revision of rates of SB/CC remuneration etc.

Expenditure of The Department of Posts

The Department of Posts provides Postal facilities within the reach of every citizen in the country with the bounding of providing postal services at affordable price under Universal Service Obligations through a vast network of 23,344 Post Offices existed at the time of Independence now reached to 1,54,910 Post Offices. The Department of Posts is a part of General Budget of India for the purpose of revenue and expenditure. It receives all funds from the General Budget of India.

The Department has to incur expenditure for its operational services and on workforce for the purpose of operations and administration.

"Expenditure" of the Department of Posts consists mainly:

(i) Working expenses (Non Plan) on account of payment/liabilities of Salary, Rent Rates Taxes, Materials and Supplies, Advertisement & Publicity, Professional Services, Machinery & Equipments, Pension, Audit Charges etc pertaining to (a) General Administration (b) Operations (c) Agency services and others like welfare activities & maintenance of buildings etc.

(ii) Capital outlay on Land, Building, Apparatus and Plants. Other Fixed Assets etc (Plan & Non Plan both).

(iii) Plan expenditure on account of Mechanization & Modernization and improvement of ergonomics of the postal operative units etc.

Status of Gross working expenses and Net working expenses of the Department of Posts at national level during last five years is shown in TABLE 2.

Table 2
Expenditure of Department of Posts, India

(₹ in Crore)

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16
General Administration	786.01	841.96	942.08	1043.54	1077.04
Operations	8719.95	9555.45	10242.51	11191.01	11895.89
Agency Services	423.60	443.02	472.29	536.82	745.31
Others*	4234.35	4640.73	5139.82	5785.19	5936.43
Total Gross Expenses	14163.91	15481.15	16796.71	18556.56	19654.67
Less: Recoveries**	458.64	688.77	593.19	661.98	707.70
Net Expenditure	13705.27	14792.38	16203.52	17894.58	18946.97

* This includes audit and accounts, amenities to staff, pension charges, stationary and printing etc.

** Less Recoveries: It means that these are recovery of working expenses on account of Agency Services performed by the Department of Posts for

(i)   Military Pension,

(ii)   Payment of Coal Miners and Employees Provident Fund/Family Pension and Misc. Services,

(iii)   Payment of Railway Pension,

(iv)   Postal Life Insurance,

(v)   Custom Duty Realization,

(vi)   Mahila Samridhi Yojna,

(vii)   Commission on account of International Money Transfer, Western Union Money Transfer Scheme,

(viii)   Telegraph Share of Combined Charges,

(ix)   Commission on Sale of Non Postal Stamps of Delhi Administration,

(x)   Incentive paid to Staff from commission required under Retail Posts,

(xi)   Accounts and Audit,

(xii)   Commission on account of Payment of Provident Fund,

(xiii)   Share of spread Margin received from Western Union Finance Service International (WUFSI) etc.

Gross Expenditure comprises expenditure on account of General Administration, operations, providing Agency Services and other functions. The expenditure generally includes salary/wages/office expenses/overtime/rent & taxes/ professional services. Maintenance of Land/Buildings and assets, amenities to staff, pension charges, material and supplies, other administration expenses – audit and accounts.

Simultaneously, Department performs some agency services on behalf of other Departments/organizations and receives remuneration on mutually agreed rates from those Departments/organizations. Such amounts are treated as recovery and are deducted from Gross Working Expenses to get Net Working Expenses of the Department.

Analysis of the data of expenditure in **TABLE 2** reveals that Net expenditure of `340 crore existed 28 years back in the year 1980-81 reached to `18946.97 crore in the year 2015-16 showing an increase 5472.64%. It has also marked 38.76% increase in Total Gross Expenditure in the year 2015-16 over the 2011-12. Gross working expenditure for the year 2015-16 was `19654.67 crore against the previous year's expenditure `18556.56 crore showing an increase of 5.92%. Conclusively – a regular increase in Gross and Net Working Expenditure has been seen during this period. The increase was mainly due to payment of arrears of Pay and Allowances on implementation of 6th Pay Commission Report and regular increase in Dearness Allowance, increased Pension Charges, increase in Cost of Index causing increased Cost of Operational items, Postal Products and Postal Services, much lesser costing of Postal Services in comparison of their actual costs.. After 1980, the Department of Posts had to bear the financial implications of 4th, 5th & 6th Pay Commissions, Talwar Commission Report on Extra Departmental Agents, and expenditure on modernization /computerization etc.

Status of the recoveries during last five years is shown against the item "Less Recoveries" in **TABLE 2**. In the year 2015-16 total amount of recovery was `707.70 crore against `458.64 crore in the year 2011-12 showing increase of 54.30% in five years.

TABLE 3
Deficit of Department of Posts, India

(₹ in Crore)

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16
Net Expenditure	13705.27	14792.38	16203.52	17894.58	18946.97
Revenue	7899.35	9366.50	10730.42	11635.98	12939.79
Deficit (Net Expenditure – Revenue)	5805.92	5425.89	5473.10	6258.60	6007.18

Overall, the expenditures are more than the revenues of the Department of Posts which results into deficit which is increasing year by year. After analyzing the **Table 3**, it is to be concluding that the Department of Posts was in the deficit of ` 5805.92 crore in the year 2011-12 which increased to `5425.89 crore, `5473.10 crore and `6258.60 crore in the year 2012-13, 2013-14, 2014-15 respectively. In the year 2015-16, the financial position of the Department again resulted into deficit of `6007.18 crore but it was less than the deficit of year 2014-15.

Conclusion

This study has revealed that The Department of Posts has witnessed all-round development with introduction of new products/services along with expansion and modernization of traditional products/services and abnormal increase in deficit simultaneously. The budgetary deficit of India Posts was over `6007.18 crore in the year 2015-16 which was increasing from the last many years .The main reasons for increase in deficit are the marked unbalance in escalation in establishment expenditure in the environment of growing competition, globalization and open market economy, rapid advancements in technology, rising expectations of delivery of services and customization, under pricing of products/services than their actual cost, increasing price level, uncontrolled expenditure on operational services, mechanization and modernization, implementation of various Pay Commissions' report etc. and increase in running cost of the Department. The other reasons for the increase in the deficit are Talwar Committee Report on ED employees, Increase in pension charges, increase in price index causing price hike of operational consumables, running cost of the office establishments, non increase suitably the rates for the work done on behalf of other Ministries/Departments as Agency Services, ageing factor of manpower indirectly causing an increase in salary due to increments/promotions etc. and the most important reason of non increase of postal tariffs corresponding to increased cost of postal services and products which are causing loss to the Department of Posts.

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Work Life Balance among Female Teachers of Private Schools

Preeti Agarwal

Abstract:

Growth and development of any nation is correlated with its education system. And this education system comprises of many sub systems or mechanism. School education is one such subsystem yet one important unit or can say system in itself. For the development of any school resources are required and the most important resource is the HUMAN, which exist in schools in the form of Teachers and others. These are teachers only that are in direct contact with students. From last two decades the role and responsibility of the school teachers have evolved noticeable change. Certain social, economic, cultural changes have also affected teaching and teachers. Teachers are the source of inspiration and motivation for students. So to keep teachers motivated is equally important as keeping students. Motivated teachers can protect the balance. And female teacher might have different work life balance. The private have different work atmosphere. To analyze that whether there is problem of work life balance among female teachers, work private schools, the study was conducted. Sample was collected on convenience basis. Question arises consisting 10 statements was used to know whether work life balance issue is there with private school teachers.

Keywords: Work life balance, Private schools

Introduction:

Females are the mother of race and liaison between generations. It is the female only who has molded future of any nation. It is female only who has courage, love, affection, feeling, emotions and beyond all devotion towards all spheres of life. She is the one who can build not only home but nation, but yes, she is also a human who can feel pain, disappointment, depression if she is not able to perform her any of the duty say duty towards house, duty towards profession, if she is working. Then duty becomes more urgent and important if it is matter of number of students, and yes if it is the duty as a teacher(Pallavi and young 1969). "A distinguished psychologist once said that there are three roles no sensible person should undertake: parent, statesman, and teacher". And simultaneously he says that there is something in nature that pulls human towards greatest task in life. Man here does not mean man but human being. And due to this nature to challenges adopted by masses in professions and so is by females. It becomes important for teacher to have confidence of those whom they teach, to have this confidence teacher need to be active, smart and happy and should have good record. Here is tragic condition for females which they encounter daily, but topic of what exactly is the problem is difficult to answer. The first question that need to be answered is there problem about work life balance.

Objective

1. To examine is is that there is work life balance among female teachers of private schools or not.

... the research questionnaire comprising 10 statements was framed, as it was impossible to ... population, the sample of 50 female teachers was taken, the researcher has collected the ... And sample selected included the features like female +teachers + private ... were given the questionnaire and were asked to tick the statements with ...

Review

... is an attempt to correlate the current studies with the appropriate abstract and academic ... these reviews is helpful in many ways.

... all relevant major constructs have been used in study

... to measuring instrument

... are common problems in research context.

... one cannot transfer to others, if one wants well being of those who are related with ... need to be genuine, authentic and sincere, calm and balanced. According to yogic ... the first and second components of personality are physical body and energy ... duty to keep this physical body fit and in good condition. To do so we need to ... which could be supported by proper work life balance. Companies are increasingly ... employees can do their best when they enjoy a good work-life balance. Companies are increasingly ... that there is a fine line between pushing employees and making them feel stressed out, which ... able to focus on ways to motivate employers to be more effective without compromising ...

... have pressurized employees to demonstrate their commitment to work in more ... (Duxbury and Ayman2006).

... a larger part of them have tended to be present at their work place for longer periods of ... blurring the time for which they are available at home. The internet and mobile phones have ... enabling the organizations to keep in constant touch with the employees both during the day ... (Morgan 2003). This has further intensified the work demands on employees. Consequently ... reports of stress and work imbalance (Bhargavgar 2009).

... balance implies the skill to plan the hours of an individual Professionals and individual life in ... with a healthy and a sport life. It accentuates the qualities, attitudes and convictions of women ... next to their age to work in arranging and adjusting their work and individual life. (K. Santhana ... Sujatha Gujare ath, Wilk 2013).

... balance is needed, in order to have a good quality of life and achieve a harmonious balance ... work and private responsibilities and interests (Redmond, J, Valuilis, M, Drew, E 2006)

Findings and discussion

Table 5

Work life balance issue among female teachers of Private Schools

S.No.	Scores	Frequency	Percentage
1	0-2	1	2%
2	2-4	5	10%
3	4-6	18	36%
4	6-8	16	32%
5	8-10	10	20%
Total		50	100

Interpretation

By looking at the table we can analyze that 18 females have scored between 4-6, that is 18 teachers tick 4-6 statement favoring work life balance issue. it means they face Average imbalance between work and life. This is the average score. 16 females have moderately high problem of work life balance and 10 have high imbalance.

Conclusion

It could be analyzes that, there is problem of work life balance among female teachers of private schools. A student is pulled toward the teacher who is more dedicated, active, and has balance in life. Private schools have more work responsibility and more working hours due to which teacher has to be more dedicated. The feeling of being tired, unproductive always surrounds the teacher when she face the problem. imbalance at work place and house. The results show that average teachers have problem of imbalance.

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- ... to select the statements with which they agree.
- ... I allocate sufficient time to house.
- ... manage my personal and professional life properly
- ... I never delay in completing my work within given time
- ... I do not have sufficient me time
- ... I am unable to manage relationships.
- ... I am prone due to work pressure
- ... I am less productive
- ... I could have enjoyed better life if I was not working
- ... I am trying to be jack of all trades and master on none.
- ... I always feel tired, unpleasant and irritated.

A Tribute to
Late Shri Narendra Singh Kothari

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Impact of Contemporary Issues on Financial Inclusion

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Abstract:

Financial inclusion is a way of providing basic banking facilities like deposit and payment facility, saving account, etc at the doorstep of each individual who is deprived of this facility at a very low cost so that they can be connected to the banking system.Financial inclusion means the availability of financial services which can meet the particular need of users without any discrimination. It is an attempt to provide basic financial services to all and especially to poor people.

Demonetisation also had a great impact on financial inclusion.The opening of bank accounts for depositing the banned currencies shows that it has promoted banking literacy among the people and connected the common man who was not under the net of the banking system.

The introduction of GST will also have a great impact on Indian economy. If both financial inclusion and GST are put together, will work as an extremely powerful tool. As India is an informal and cash economy and by creating these platforms, there is more encouragement for this informal economy to be formal economy and over the next 4-5 years these will underwrite a good healthy growth.

Keywords:- Financial Inclusion, Demonetisation, GST, Informal Economy, Banking System

Introduction

In the Indian context, the term 'financial inclusion' was used for the first time in April 2005 in the Annual Policy Statement presented by Y. Venugopal Reddy, the then Governor, Reserve Bank of India.For the progress of Indian economy with sustainable development, maximum participation is needed from all the sections of society. But the only hurdle in the way is lack of financial literacy and awareness amongst rural section of society. To cope up from this problem spreading financial literacy in rural areas was the tedious task. Financial Inclusion is the term which means spreading awareness and accessibility of financial services to each rural household all over the country. In India financial inclusion provides a type of social security to each household as they are not subject to extortion arising in the informal banking sector, including predatory lending. RBI is also trying to make it attractive for institutions to offer banking services to everyone as it is necessary building block for sustainable growth. Financial Inclusion has major impact on economic growth and development of nation as increase in the number of bank accounts will give a rise to reserves for Indian banks which allows for more loans to be taken out and increase consumption and investment in the economy. Financial inclusion broadens the resource base of the financial system by developing a culture of savings among large segment of rural population and plays its own role in the process of economic development.As per census 2011, only 58.7% of households are availing banking services in the country. However, as compared with previous census 2001, availing of banking services increased significantly largely on account of increase in banking services in rural areas. To connect all households with banking services a programme known as Pradhan Mantri Jan Dhan Yojna (PMJDY) has been launched that aimed at opening Zero balance saving account for every unbanked household, providing access to financial literacy, credit and pension. This is a time-bound two phase programme. PMJDY was launched in August 2014 in which an account holder-

I.   Is not required to maintain a particular balance
ii. Is eligible to receive subsidy payments directly into their account
iii. Can transfer funds and check balances through ones feature phone
iv. Is entitled to receive a RuPay debit card
v.   Is eligible to enroll in an accidental insurance plan at $0.20 a year for coverage of $3000
vi. Is eligible to enroll in life insurance plan at $5 a year for coverage of $3000
vii. Is eligible to enroll in a pension plan with a monthly payment of $15-75
viii. Is eligible to receive a $75 loan from bank after six months, depending on use.

The success of PMJDY is the result of continuous involvement of government in the implementation of programme as weekly video conference meetings were held and the data on currently faced problems and their consequence and solutions were reported.

Access to transaction account is a basic move towards financial inclusion. It allows people to store money and send and receive payments. A transaction account can also serve as a gateway to other financial services which ensures that people worldwide can have access to a transaction account is the focus of the world bank group's Universal financial access 2020 initiative.

One of the key enabler of financial inclusion is the technology, which includes branch on wheels a mobile van branch that provides banking services to a cluster of remote villages which are deprived of banking services.

Other financial inclusion policy initiatives:-

   regulatory dispensions on KYC norms

   simplifies branch authorization

   business correspondent model

Pradhan Mantri Jan-dhan Yojna

Beneficiaries as on 25/10/2017					
Bank Name / Type	Number of Beneficiaries at rural/semi urbancentre bank branches	Number of Beneficiaries at urban metro centre bank branches	Number of Total Beneficiaries	Deposits in Accounts (in Crore)	Number of Rupay Debit Cards issued to beneficiaries
Public Sector Banks	13.46	11.18	24.64	53172.37	18.43
Regional Rural Banks	4.15	0.76	4.91	11870.82	3.61
Private Sector Banks	0.59	0.38	0.98	2042.51	0.91
Grand Total	18.2	12.32	30.52	67085.7	22.95

Source: Government of India

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Significance of the study

This paper discusses about the Effect of contemporary issues (Demonetisation and GST) on financial inclusion. It also strives to describe the schemes like Pradhan Mantri Jan Dhan Yojna (PMJDY) and focuses on the impact of demonetisation on different groups of society and explains the benefits and effect of GST.

Review of Literature

Review of literature paves way for a clear understanding of the areas of research already undertaken and throws a light on the potential areas which are yet to be covered. The reviews of some of the important studies are presented below. Financial Inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs in a responsible and substantial way.

- According to RBI (2011) Financial Inclusion is the process of ensuring access to appropriate financial vulnerable groups such as weaker sections and low income groups at an affordable cost in a fair and transparent manner by mainstream institutional players.

- According to Raghuram Rajan (2014) Financial inclusion is about (a) the broadening of financial services to those people who do not have access to financial services sector; (b) the deepening of financial services for people who have minimal financial services; and (c) greater financial literacy and consumer protection so that those who are offered the products can make appropriate choices. The imperative for financial inclusion is both a moral one as well as one based on economic efficiency.

Research Methodology

The prepared paper is a descriptive study in nature. The study has been carried out based on the collection of the relevant secondary data. Secondary data collection was based on various sources such as published books, articles published in different journals & newspapers, periodicals, conference paper, working paper and websites, etc.

Demonetisation

Demonetization refers to an economic policy where a certain currency unit ceases to be recognized or used as a form of legal tender. In other words, a currency unit still loses its legal tender status as a new one comes into circulation. Indian currencies with denomination 500 and 1000 have ceased to be the medium of exchange from the midnight of 8th November 2016. This move was implemented as a tool to measure the amount of black money in these high denomination currencies and to curb the terrorist activities. The main idea of government was to bring undisclosed money to the banks by allowing a limited exchange of old currency to new issued currency and unlimited deposit of old notes till 31 Dec 2016.The Demonetisation has given a tremendous drive to financial inclusion. It has stimulated the Jan–Dhan accounts. From Demonetisation the Jan Dhan bank account which were opened for poorest of poor were then swelling with cash. The effect of demonetization on the process of financial inclusion can be studied on various sections of the society which are the participants in the financial inclusion drive. Demonetisation had both positive as well as negative impact on each sector of economy.

Impact Of Deonetisaton

Impact of demonetisation can be seen on various sector as it has a very wide range and effects almost all the sectors of economy

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Scanned with CamScanner

Common People:

With the introduction of Demonetisation large ques were seen in front of banks for exchange of old currency which made it problematic for common people. All the hardship was borne by common people as about 90 percent transactions were performed in cash. By it lending of money would be more approachable for common man as the bank rates will reduce making it easy for common man to avail fresh loans.

Banks:

Bank deposits has increasedby a huge margin which has increased their lending activities as well. Demonetisation has shifted economy from cash to cashless economy thus this cashless society has increase credit access and financial inclusion .But by Demonetisation deposits may rise in short term but this will not continue in long run.

Rural Population:

The effects of demonetization have been even more worrying in the rural parts of the country which are even more dominated by cash and which have limited physical accessibility to banks and other financial institutions. Visiting physical bank branches in rural areas still remains a time consuming and costly exercise for many. Other digital financial services like ATMs and POS machines at shops are limited in number and crippled with infrastructural issues. Ordinary rural residents are placed in great stress with nowhere to go.

Business:

e-commerce companies saw up to a 30% decline in cash on delivery (COD) orders. Several e-commerce companies hailed the demonetization decision as an impetus to an increase in digital payments. Digital payment need has increased financial literacy among people. They believe that it would lead to a decline in COD returns which is expected to cut down their costs. The demand for point of sales (POS) or card swipe machines has increased. The goods and services tax (GST), whose objective is to replace all taxes levied by the federal government and the states with one central tax.

Goods And Services Tax:

GST is one of the most crucial tax reform which was to be implemented from April 2010 , but it came in force from July 2017due to differing interests and political issues. GST is a detailed inter- disciplinary tax system that has seamlessly unified the economy into a single national market. This tax includes all indirect taxes which were previously implemented by states and central government like VAT, Service tax, etc. . The emergence of GST has separated India from other emerging markets as it will ensure long-term growth in Indian economy .The introduction of GST is making India one market, making business processes more efficient. GST was implemented with the Moto "ONE NATION, ONE TAX ".Most of the countries followed unified GST . In India also dual system of GST is followed including Central goods and services tax (CGST) and State goods and services tax (SGST).

Impact Of Gst:

The effect of GST can be seen on each and every sector of the Indian economy.GST also brings in the benefits of enabling Financial inclusion by-

- **Simplifying the Tax:**

  With uniform tax system, it is easy to learn, making it simpler for individual to absorb it. After one tax a farmer while purchasing seeds online is able to understand the tax charged and a rural individual who sells his handcrafted products to Maharashtra, will now not have tough time to know the common tax, rather than octroi charges applicable earlier.

- **One System Digitization**

  Digitisationautomation demands one system that could track the tax channels. With multiple tax laws integrating them into one system is tough. Hence many times we have seen people ignoring paying the tax because there was no system to track or pay it outside the formal system via cash. With solutions available now on mobile devices, it's easy for any rural person to track down his selling/purchasing in all cases.

- **Organised sectors with no middleman:**

  After GST unorganised sectors have been structured into organised sectors with no middleman. With Digital India, Aadhaar linking to Bank Accounts, PAN Cards, mobile phones, etc. the Government is trying to tie each individual to one identity. Now GST is linking the identification of individual to tax system which will enable small businesses and unorganised sectors to follow formal tax rule. For instance small handloom seller trying to sell his products across pan-India will now have a single identity card linked to his bank account and GST registration.

Conclusion:

Financial Inclusion is making rural household aware of the banking facilities at easy and affordable rates.RBI has played a key role in promotion of financial inclusion so that each and every household can be involved. Our banking sector and government are also making efforts to get remarkable result in the field of financial inclusion. Financial Inclusion is both moral as well as economic efficiency based . RaghuramRajan has said that if everyone had the tools and resources to better themselves , it would increase output,growth and economic preosperity. The vision of reserve of India is to open nearly 600 million new customers account and service them through a variety of channels by leveraging on IT by 2020.The 5 A's of promoting financial inclusion through cashless payment instruments are availability, accessibility, acceptability, affordability and awareness. Financial inclusion is a step which will in long term ultimately lead to the development of country. Financial Inclusion is an key enabler of making India a developed country.Both Demonetisation and GST has a impact on financial inclusion. Both these factors have positive as well as negative impact but it is assumed that it will have long term benefits in the development of economy.

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Indian Banking Industry : An Oneview

*Dr. Ranjula Jain
**Komal Yadav

Abstract

Banking is today an integral part of our everyday life: At home, at school, at office, at business, on travel everywhere we counter some aspect of banking. The significance of banking in our day to day life is being felt increasingly. Banking and finance is the life blood of trade, commerce and industry. Now a days, banking sector acts as the backbone of modern business. The banks play a major role in the development of the country, the strategic capital formation is possible only through mobilization of funds, such capital formation arises when the habit of saving inculcated among public. It deals with accepting deposits from those who want to save money and it lends money to those who need it.

In today's world, the banking is one of the most essential and important part of human life. Money plays a dominant role in today's life. Forms of money have evolved from coin to paper currency notes to credit cards. Commercial transactions have increased in content and quantity from simple banker to speculative international trading. In current faster life style, people may not do proper transition without developing proper network.

The banking system in India is dominated by nationalized banks. The performance of the banking sector is mainly linked to economy more than any other sector.Banking industry in India has also achieved new height with the changing times. The use of technology has brought a revolution in the working style of the banks. Nevertheless, the fundamental aspects of banking that is trust and confidence of the people on the institution remain the same. The majority of the banks are still successful in keeping with the confidence of the shareholders as also the stakeholders. However with the changing dynamics of banking business also brings new kind of risk exposure.

Evolution of Indian banking industry

'Bank' is mostly used in its commercial sense i.e. Commercial Bank. Germanic is its origin though some persons trace its origin to the French word 'Banqui' and the Italian word 'Banca'. It referred to a bench for keeping, lending, and exchanging of money or coins in the market place by money lenders and money changers. Before1640, there was no such word as banking.The practice of safe keeping and savings was succeeded from the temple of Babylon as early as 2000 B.C. Chanakya mentioned in his book about 300 B.C. about the existence of powerful society of merchant bankers who received deposits and advanced loans and issued letters of transfer. The Jain scriptures mention the names of two bankers who built the famous Dilware Temples of Mount Abu during 1197 and 1247 A.D.

In 1157, the 'bank of Venice' was the first bank in the world which was established in Venice, Italy. This bank was established for the emperor in his wars. The bankers of Lombardy were famous in England. After 1640, the modern banking system began with the English goldsmiths. In India, first bank was " bank of Hindustan" which was introduced by east India company in 1770 which is fully foreign capitalistic bank. But this bank was failed in 1782. Then "Bank of Bangal" was established in 1806 which was one of the presidency bank and first bank in the modern sense.

History apart, it was the 'merchant banker' who first evolved the system of banking by trading in commodities than money. Their trading activities required the remittances of money from one place to another. For this, they issued letters of transfer to remit funds. In India, such merchant bankers were known as 'Seths'.

The next stage in the growth of banking sector was the goldsmith. The business of goldsmith was such that he had to take special precautions against theft of gold and jewellery. If he seemed to be an honest person, merchants in the neighbourhood started leaving their bullion, money and ornaments in his care. As this practice spread, the goldsmith started charging something for taking care of the money and bullion.

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As evidence for receiving valuables, he issues a receipt. Since gold and silver coins had no marks of the owner, the goldsmith started lending them. As the goldsmith was prepared to give the holder of the receipt and equal amount of money on demand, the goldsmith receipt became like cheques as a medium of exchange and a means of payment.

The next stage in the growth of banking is the moneylender. The goldsmith found that on an average the withdrawals of coins were much less than the deposits with him. So he started advancing the coins on loan by charging interest. As a safeguard, he kept some money in the reserve. Thus the goldsmith-money-lender became a banker who started performing the two functions of modern banking, that of accepting deposits and advancing loans.

History of Indian banking system

The story of Indian coinage itself is very vast and interesting, and also throws tremendous light on the various aspects of life during different periods. The Rig Veda speaks only gold, silver copper and bronze and the later Vedic texts also mention tin, lead, iron and silver. Recently iron coins were found in very early levels at AttranjiKheri(U.P.) and Pandu RajarDhibi (Bengal). A money economy existed in India since the days of Buddha.

In ancient India during the Maurya dynasty (321 to 185 BC), an instrument was in use which is called adesha, which was an order on a banker desiring him to pay the money of the note to a third person, which corresponds to the bill of exchange as we understand it in modern language. During the Buddhist period, there was considerable use of these instruments. Merchants in large towns gave letters of credit to one another.

Indigenous banking grew up in the form of rural money lending with certain individuals using their private funds for this purpose. The scriptures singled out the vaishyas as the principal bankers. The earliest form of Indian Bill of Exchange was called "Hundi". In earliest form of India, barter system is used for export and import.

The origin of "rupee" is found in the word Sanskrit rūpya and also from the word "rupa" meaning silver. The standardisation of currency unit as Rupee in largely due to Sher Shah in 1542. The English traders that came to India in the 17th century could not make much use of the of indigenous bankers, owing to their ignorance of the language as well the inexperience indigenous

people of the European trade. Therefore, the English Agency Houses in Calcutta and Bombay began to conduct banking business, besides their commercial business, based on unlimited liability. The Europeans who resigned from civil and military services, organized these agency houses."

Banking in India, in the modern sense, originated in last decade of 18th century. The first bank was the "Bank of Hindustan", established in 1770 and it was fully foreign capitalistic bank and liquidated in 1829–32. After establishment of Bank of Hindustan, East India company established the "General bank of India" in 1786, but failed in 1791.

East India company also established three presidency banks. There were "Bank of Bengal",2806, "Bank of Bombay" in 1840 and "Bank of Madras" in 1843. The oldest bank in existence in India is the Sate bank of India (S.B.I.). It originated as the Bank of Calcutta in June 1806. In 1809, it was renamed as the Bank of Bengal in Calcutta. In 1921, all presidency banks were merged to form a new bank which is "Imperial bank of India". Imperial bank of India, which after India's independence, became the state bank of India.

For many years, the presidency banks acts as quasi central banks, as did there successors. The Reserve bank of India formally took on the responsibility of regulating the Indian banking sector from 1935. After India's independence in 1947, Reserve bank of India (RBI) was nationalized. This was the first revolution in Indian banking sector to get nationalization of Reserve bank of India on 1 January, 1949. To control the banking system in India, government made the Banking Companies Act, 1949, but subsequently change the name of Banking Companies Act, 1949 , as a Banking regulation Act, 1949. Later Imperial bank of India was nationalized by government and changed the name as the State bank of India on 1 July, 1955. And eight associate banks of State bank of India came in existence. These associate banks are - State bank of Partial, state bank of Bikaner, State bank of Jaipur, State bank of Hyderabad, State bank of Travencore, State bank of Maysore, State bank of Indore and State bank of Saurashtra.

By the 1960s, the Indian banking industry had become an important tool to facilitate the development of the Indian economy. At the same time, it had emerged as a large employer, and a debate had ensued about the nationalisation of the banking industry. Indira Gandhi, the then Prime Minister of India, expressed the intention of the Government of India in the annual conference of the All India Congress Meeting in a paper entitled "Stray thoughts on Bank Nationalization." The government of India nationalised the 14 largest commercial banks with effect from the midnight of 19 July 1969. These banks contained 85 percent of bank deposits in the country. A second process of nationalisation of 6 more commercial banks followed in 1980. The stated reason for the nationalisation was to give the government more control of credit delivery. With the second process of nationalisation, the Government of India controlled around 91% of the banking business of India. Later on, in the year 1993, the government merged New Bank of India with Punjab National Bank. It was the only merger between nationalised banks and resulted in the reduction of the number of nationalised banks from 20 to 19.

Government of India took many banking initiatives. These were aimed to provide banking coverage to all section of the society and every sector of the economy. The Industrial Credit and Investment Corporation of India Limited (ICICI) was incorporated at the initiative of World Bank, the Government of India and representatives of Indian industry, with the objective of creating a development financial institution for providing medium-term and long-term project financing to Indian businesses.

Nationalization of Banks

Nationalization of banks in India was an important phenomenon. Despite the provisions, control and regulations of Reserve Bank of India, banks in India except the State Bank of India or SBI, continued to be owned and operated by private persons. By the 1960s, the Indian banking industry had become an important tool to facilitate the development of the Indian economy. At the same time, it had emerged as a large employer, and a debate had ensued about the nationalization of the banking industry. Indira Gandhi, then Prime Minister of India, expressed the intention of the Government of India in the annual conference of the All India Congress Meeting in a paper entitled "Stray thoughts on Bank Nationalization." The meeting received the paper with enthusiasm.

It is the process of transforming private assets into public assets by bringing them under the public ownership of a national government or state. Banking system in India is dominated by nationalized bank. After independence, the first revolution in Indian banking sector to get nationalization of RBI on 1 January, 1949. To control the banking companies Act, 1949, but subsequently change the name of Banking companies Act, 1949, as a Banking regulation Act, 1949.

On 1 July,1955, Imperial bank of India was nationalized by government and changed the name as a State Bank of India. And 8 associate banks of State bank of India. These are State bank of Bikaner and Jaipur, State bank of Hyderabad, State bank of Partial, State bank of Travencore, State bank of Maysore, State bank of Indore and State bank of Saurashtra. The process of nationalization of Banks in India took place in 1969 by Mrs. Indira Gandhi (P.M. of India). The major objective behind the nationalization was spread banking infrastructure in rural areas and make available cheap finance to Indian farmers. 14 banks were nationalized in 1969. Before 1969, SBI was the only public sector bank in India.

The government had in February approach the merger of these five associate banks with SBI. Later in March, the Cabinet approved merger of BMB as well. SBI first merged State bank of Saurashtra with itself in 2008. Two years later, State bank of Indore was merger with it. Later five associates and the BharatiyaMahila Bank became part of the SBI on Saturday, 1 April, 2017, catapulting the country's largest lender to among the top 50 banks in the world.

The merger will also means that all SBI associate bank customers will become SBI customers and all associate bank employees will become SBI Employees. So all associate bank employees will be eligible for the same retirement benefits as SBI employees. SBI employees get 3 retirement benefits (Provident fund, gratuity and pension), while associate bank staff members get 2 retirement benefits.

Liberalisation in the 1990s

The second major turning point in this phase was Economic Liberalization in India. After Independence in 1947, India adhered to socialist policies. The extensive regulation was sarcastically dubbed as the "License Raj". The Government of India headed by Narasimha Rao decided to usher in several reforms that are collectively termed as liberalization in the Indian media with Manmohan Singh whom he appointed Finance Minister. Dr. Manmohan Singh, an acclaimed economist, played a central role in implementing these reforms.

In the early 1990s, the NarasimhaRao government embarked on a policy of liberalisation, licensing a small number of private banks. These came to be known as New Generation tech-savvy banks, and included Global Trust Bank (the first of such new generation banks to be set up), which later amalgamated with Oriental Bank of Commerce, UTI Bank (since renamed Axis Bank), ICICI Bank and HDFC Bank. This move,

along with the rapid growth in the economy of India, revitalised the banking sector in India, which has seen rapid growth with strong contribution from all the three sectors of banks, namely, government banks, private banks and foreignbanks.

The next stage for the Indian banking has been set up, with proposed relaxation of norms for foreign direct investment. All foreign investors in banks may be given voting rights that could exceed the present cap of 10% at present. It has gone up to 74% with some restrictions. The new policy shook the Banking sector in India completely. Bankers, till this time, were used to the 4–6–4 method (borrow at 4%; lend at 6%; go home at 4) of functioning. The new wave ushered in a modern outlook and tech-savvy methods of working for traditional banks. All this led to the retail boom in India. People demanded more from their banks and received more.

Currently (2007), banking in India is generally fairly mature in terms of supply, product range and reach-even though reach in rural India still remains a challenge for the private sector and foreign banks. In terms of quality of assets and capital adequacy, Indian banks are considered to have clean, strong and transparent balance sheets relative to other banks in comparable economies in its region. The Reserve Bank of India is an autonomous body, with minimal pressure from the government. The stated policy of the Bank on the Indian Rupee is to manage volatility but without any fixed exchange rate-and this has mostly been true. With the growth in the Indian economy expected to be strong for quite some timeespecially in its services sector-the demand for banking services, especially retail banking, mortgages and investment services are expected to be strong.

Current period

The Indian banking sector is broadly classified into scheduled banks and non-scheduled banks. All banks included in the Second Schedule to the Reserve Bank of India Act, 1934 are Scheduled Banks. These banks comprise Scheduled Commercial Banks and Scheduled Co-operative Banks. Scheduled Co-operative Banks consist of Scheduled State Co-operative Banks and Scheduled Urban Cooperative Banks. Scheduled Commercial Banks in India are categorised into five different groups according to their ownership and/or nature of operation:*.State Bank of India and its Associates*.Nationalised Banks*.Private Sector Banks*.Foreign Banks*.Regional Rural Banks. In the bank group-wise classification, IDBI Bank Ltd. is included in Nationalised Banks. By 2010, banking in India was generally fairly mature in terms of supply, product range and reach-even though reach in rural India still remains a challenge for the private sector and foreign banks. In terms of quality of assets and capital adequacy, Indian banks are considered to have clean, strong and transparent balance sheets relative to other banks in comparable economies in its region. The Reserve Bank of India is an autonomous body, with minimal pressure from the government.

State Bank of India (SBI) posted quarterly results that indicated the nation's lenders may see a slower build-up of bad loans, but questions remain on how quickly and smoothly they can get rid of $146 billion of such debt that has already piled up. SBI, the nation's top lender with a share of more than fifth of the banking assets, reported on Friday a lower-than-expected profit, but its bad loan additions during the three months to end-September slowed sharply and pushed the overall bad-loan ratio down. SBI, which has the biggest share of the soured loans, merged its five subsidiary banks with itself earlier this year, driving a jump in its non-performing loans as of June to almost 10 percent. That ratio eased to 9.83 percent at end-September, while the additions to bad loans during the quarter was nearly a third of the rise in the previous three months.

Bank of India, the market's sixth-biggest lender by assets which also reported on Friday, posted a better-than-expected 41 percent rise in second-quarter profit and a narrower bad-loan ratio. The banking sector faces a rise in provisions for loan losses after a central bank order to cover at least 50 percent of the loans to companies being sent to bankruptcy court. A dozen of the biggest loan defaulters are already at the bankruptcy court, while nearly 30 more could be headed there after December. SBI shares closed 6.3 percent higher in a Mumbai market that ended up 0.12 percent on Friday. The stock has gained about 30 percent in the past one month to be the second-best performer among the constituents in the main market index.

Conclusion

Banks have come a long way from the temples of the ancient world, but their basic business practices have not changed. The bank accepts deposits from general public who wants to save money and provide loans and advances to whom who need it. Banks issue credit to people who need it, but demand interest on top of the repayment of the loan. Although history has altered the fine points of the business model, a bank's purpose is to make loans and protect depositors' money. The reason behind this study is to provide insight into the Indian banking sector/ industry with focus on nationalization of Bank, both in retrospective and prospective perspectives. The study is build as a humble contribution to achieve the goal. Even if the future takes banks completely off your street corner and onto the internet, or has you shopping for loans across the globe, the banks will still exist to perform this primary function.

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CONTENTS

Principal

प्रलोभन से भी राष्ट्र के सुरक्षा–रहस्यो को शत्रु के हाथ न बेचे अथवा क्षणिक उत्तेजना में आकर हत्या या अन्य अपराध न कर बैठे। ऐसे दृढचरित्र दीर्घ साधना एवं अथक प्रयत्न द्वारा ही निर्मित हो सकता है। प्रत्येक युवक प्रतिदिन छोटी–छोटी शुभ कार्य करे। इन्हें दुहराने से उसकी इच्छाशक्ति भी बलवती होगी। प्रतिदिन सूर्योदय के पूर्व शैय्या त्याग कर भगवान का स्मरण करना, नित्य सत्साहित का पाठ करना, सत्य वचन कहना, नियमितता रखना, गरीब, असहाय औरतों की सहायता कर सकती है। अपनी छोटी–छोटी वासनाओं का त्याग करना आदि कुछ ऐसे कार्य है जिनके नित्य अभ्यास से महान चरित्र की नींव पड़ सकती है। (9)

स्वामी विवेकानन्द कोरे आदर्शवादी सैद्धान्तिक ही नही थे, बल्कि अत्यन्त व्यवहारकुशल एवं कार्यक्षम भी थे। उन्होंने चरित्र गठन के साथ ही साथ अर्थकारी शिक्षा पर भी बल दिया। इसके साथ ही स्वामी विवेकानन्द ने जितना युवको की शिक्षा पर बल दिया, उतना ही युवतियों की शिक्षा पर भी। उन्होंने युवक–युवतियों के लिए वौद्धिक, चरित्रकारी व आध्यात्मिक ज्ञान के साथ ही व्यावहारिक व तकनीकी ज्ञान एवं प्रशिक्षण पर बल देते हुए कहा कि "हमें तकनीकी शिक्षा तथा उन सब चीजों की आवश्यकता है, जिनसे उद्योग–धन्धो का विकास हो, ताकि लोग नौकरी की तलाश में भटकना छोडकर, अपने लिए धन उपार्जन कर सके और दुर्दिन के लिए बचाकर भी रख सके"। (10)

स्वामी विवेकानन्द ने विद्यार्थियों के शारीरिक विकास की ओर भी ध्यान आकृष्ट किया था। स्वस्थ एवं सबल शरीर मानव निर्माण की सर्वप्रथम आवश्यकता है। यह नियमित व्यायाम, पौष्टिक आहार एवं ब्रह्मचर्य द्वारा गढ़ा जा सकता है।

स्वामी विवेकानन्द के अनुसार "आज हमारे देश को जिस चीज की आवश्यकता है, वह है लोहे वी मांसपेशियों और फौलाद के स्नायु, दुर्दमनीय प्रचण्ड इच्छाशक्ति जो सृष्टि के गुप्त तथ्यों और रहस्यो को भेद सके और जिस किसी उपाय से भी हो, उद्देश्य की पूर्ति करने में समर्थ हो"। (11)

आज हम जिस संकट और संक्रमण के काल से गुजर रहे है, जहां अस्तित्व का संकट है, जीवन मूल्यों का संकट है, अपने पहचान का संकट है, वहां यह जरूरी है कि एक बार हम स्वयं को जानने के लिए, अपने राष्ट्र को जानने के लिए स्वामी विवेकानन्द के विचारों का मन्थन करें और उससे जो अमृत निकले, उसे अपनी नई पीढियों को वितरित करके उनके चरित्र को एक सार्थक और सकारात्मक दिशा देने में समर्थ हो सके। अतएव हमें चाहिए कि हम सभी शिक्षण संस्थाओं के द्वार न करें, जिससे अच्छे मनुष्यों का निर्माण हो और वे हमारे राष्ट्र निर्माण में योगदान दे।

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Impact of Micronutrient Intake on Weight Reduction in Women

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Abstract

Introduction: Excess body weight is the sixth most important risk factor contributing to the health burden of the world. Micronutrients (fat and water soluble vitamins, minerals and trace elements) although required in small amounts, are vital for important physiological functions. They play significant role in energy metabolism which may indirectly affect the body weight and body fat of an individual. Direct association of all micronutrients with adiposity has not been scientifically established but there are plausible mechanisms which might affect body weight.

Objectives: To study the impact of micronutrient intake on weight reduction in women undergoing a comprehensive weight reduction program in Jaipur city.

Methodology: Purposive sampling technique was used to enrol women in the age group of 20-60 years visiting a commercial weight reduction centre with the purpose of weight loss. Baseline data included 314 females with the BMI $\geq 25 kg/m^2$. Total 100 women participated in the study with 52 visiting a commercial weight reduction centre and 48 visited a Gymnasium. In the comprehensive study these subjects were assessed at both pre and post intervention stages for various parameters such as nutritional status - anthropometric indicators, body composition and diet recall.

Results: Micronutrients were found to have a significant impact on weight loss as well as on body composition changes in both the groups. Calcium, zinc, folic acid and vitamin B_{12} had significant correlation with amount of weight loss ($\Delta Wt.$).

Introduction: The risk functions for obesity (defined as the quantitative relation between degree of obesity throughout its range and the risk of health problems) have been used to define 'obesity' as an excess storage of fat in the body to such an extent that it causes health problems leading to increased mortality (Sorenson, Virtue and Vidal-Puigb 2010). Recent scientific research has linked obesity with presence of various micronutrient deficiencies such as calcium, magnesium, vitamin D, Vitamin B, and iron to name a few. Cause effect relationship with obesity and process of weight loss for each micronutrient has not been studied completely, till date. In the present study we have tried to establish an association between micronutrient intake and success in weight reduction.

Methodology: The study was conducted in Jaipur city. Purposive sampling technique was used to enrol women in the age group of 20-60 years visiting a commercial weight reduction centre (CWRC) with the purpose of weight loss. Baseline data included 314 females with the BMI $\geq 25 kg/m^2$. Success rate of any commercial weight reduction programme have been predicted to be 20%. Therefore, a sample size of 80 (40 in each group) women was computed, at 1% confidence interval and 10% confidence limit; for the comprehensive study on the basis of willingness to participate in the study. Total 100 women participated in the study with 52 visiting a commercial weight reduction centre and 48 visited a Gymnasium (GYM). In the comprehensive study these subjects were assessed at both pre and post intervention stages for various parameters such as nutritional status - anthropometric indicators, body

composition and diet recall. Anthropometricindicators such as height, weight, waist circumference (HC) and hip circumference (HC) were measuredusing standard WHO protocols. Body composition was assessed byOMRON HBF-362 body composition analyser based on biological Impedance analysis. The and nutrient intake was assessed by 24 hour foodrecall. Written consent was acquired from all participants and thestudy was approved by Sanjeevani ethical committee in Jaipur.

Results andDiscussions: Mean age of thewomen was 34.70 ± 10.15 years and mean height was 1.58± 0.07 m. Table 1 depicts the mean values of anthropometricindicators for the baseline group.

Table 1: MeanValues of Anthropometric Indicators for Women

Variable	Pre Intervention			Post Intervention			Difference Between Pre and Post Intervention	
	CWRC (n=52)	Gym (n=48)	t-test	CWRC (n=52)	Gym (n=48)	t-test	CWRC (n=52)	Gym (n=48)
Weight (kg)	– 12.05	74.38 ± 11.43	4.72**	75.68 ± 10.76	72.34 ± 10.43	4.71**	9.032**	4.32**
BMI (kg/m²)	31.58 ± 4.27	30.15 ± 5.38	1.39^NS	30.10 ± 3.86	29.35 ± 5.17	0.812^NS	9.28**	4.45**
WC (cm)	91.24 ± 7.97	88.52 ± 9.76	1.42^NS	87.66 ± 8.35	84.90 ± 9.29	1.50^NS	6.58**	4.30**
HC (cm)	107.71 ± 10.07	109.28 ± 7.65	0.87^NS	105.40 ± 9.52	106.13 ± 8.75	0.40^NS	6.30**	5.17**
WHR	0.85 ± 0.11	0.81 ± 0.06	2.50*	0.84 ± 0.05	0.80 ± 0.05	2.36*	4.32**	2.45*

*Significantat 5% **Significant at 1% level NS–Not significant

Meanweight loss of CWRC group was 3.75 ± 2.96 kgs and 2.03± 3.15 kgs for Gym group and the difference in weight loss wasfound to be statistically significant (t= 2.82; p<0.05). At preand post intervention stages no significant differences were observedin body mass index (BMI), waist circumference (WC) and waistto hip ratio (WHR) betweenthe two groups except for weight and WHR. There were significantreductions in all parameters within each group.

Table 2: Mean Mineral Intake for Women

Minerals	RDA	CWRC (n=52)			Gym (n=48)		
		Pre	Post	T	Pre	Post	Pre
Calcium(mg/d)	600.00	– 271.18	1207.58 ± 214.85	8.27**	1093.69 ± 273.52	1242.42 ±338.55	3.77**
T		7.89**	20.39**		12.50**	13.15**	
Iron(mg/d)	21.00	19.79 ± 7.21	14.78 ± 8.44	5.01**	15.87 ± 7.64	17.75 ± 9.76	1.70^NS
T		1.21^NS	5.31**		4.65**	2.31**	
Magnesium[mg/d]	310.0	503.00 ±103.6	358.06 ± 97.52	10.08*	330.82 ± 177.32	104.14 ± 42.17	8.56**
T		13.43**	3.55**		0.85^NS	33.82**	
Zinc(mg/d)	21.00	7.89 ± 2.31	5.65 ± 1.90	6.99**	4.67± 1.16	1.095 ± 2.10	21.35**
T		30.93**	28.26**		47.53**	45.67**	

*Significantat 5% **Significant at 1% level NS–Not significant

Table 2 presentsmean mineral intake of women visiting both the centres. Mean Calciumintake was significantly higher than the RDAs for both the groups inboth pre and post intervention stages. Further therewas asignificant increase in mean calcium intake in both the groups whencompared for pre and post intervention stages. Mean intakes of ironand zinc were significantly lower than RDA for both the groups inboth pre and post stages. Magnesium intakes were higher in CWRC groupas compared to Gym group and there was a significant reduction inpost intervention stage especially in Gym group.

Table-3represents mean vitamin intake for both the groups. Mean retinolintake had a significant increase for CWRC group whereas no suchchange could be observed in the Gym group. Mean intakes for all othervitamins had a change in both groups. Mean folic acid and vitamin B₁₂intakes were lower than the RDAs for both the groups.

Table 3: MeanVitamin Intake for Women

Vitamins	RDA	CWRC (n=52)			Gym (n=48)		
		Pre	Post	T	Pre	Post	t
Retinol(µg/d)	600.00	302.01 ± 123.41	1976.92 ± 682.90	17.69**	1251.25± 433.86	1252.28 ± 320.02	0.19^NS
T		7.41**	14.54**		10.40**	10.42**	
Thiamine (mg/d)	1	2.24 ±1.54	1.63 ± 0.99	2.82**	1.22 ± 0.53	0.55 ± 0.23	8.76**
T		5.73**	4.56**		2.99**	13.56**	
Riboflavin (mg/d)	1.10	1.12 ± 0.67	1.29 ± 0.45	1.83	1.04 ± 0.75	0.80 ± 0.24	2.22**
T		0.22^NS	3.04**		0.55^NS	2.57**	
Niacin (mg/d)	12	14.61 ± 4.06	11.09 ± 3.06	6.25**	9.98 ±2.51	5.50 ± 1.99	15.59**
T		4.64**	2.14*		5.56**	17.63**	
Folic Acid (µg/d)	200	267.94 ± 104.74	112.32 ± 87.65	10.71**	141.55 ± 95.27	83.32 ± 54.23	4.23**
T		4.68**	7.21**		4.25**	14.91**	
Vitamin C (mg/d)	40.00	162.97 ± 78.96	330.32 ± 112.34	15.28**	76.01± 42.37	78.01 ± 34.01	0.327
T		11.23**	18.64**		5.89**	7.74**	
Vitamin B12 (µg/d)	1.00	0.40 ± 0.19	0.42 ± 0.23	0.63	0.31 ±0.14	0.41 ± 0.17	4.08**
T		22.77**	18.18**		34.15**	24.04**	

*Significantat 5% **Significant at 1% level NS – Not significant

Association of Micronutrient Intake with Anthropometric Variables

Table 4 represents association of mineral intake with different anthropometric variables. Mean calcium intake was found to have an inverse association with body weight, fat percentage and visceral fat. Positive association was observed with weight loss, body fitness that increased with increase in calcium intake. Iron intake also had a significant association with BMI and body fat per cent and fitness. Magnesium had an inverse association with WHR, body fat per cent and promoted conservation of lean body mass. Zinc intake enhanced weightloss and reduced accumulation of body fat.

Table 4: Association of Mineral Intake with Anthropometric Variables

	Body Weight (kg)	Wt. Loss (kg)	BMI (kg/m²)	WC (cm)	WHR	BMR (kcal)	Fat%	% Fitness	Lean%	VF
Ca (Pre)	-0.180**	0.178*	-0.139	-0.010	0.074	-0.052	-0.360**	0.230**	-0.015	0.208**
Ca (Post)	-0.199**	0.140*	-0.222	0.102	-0.168*	0.333*	-0.334**	0.217**	0.066	-0.191**
Fe (Pre)	0.080	0.003	-0.144*	0.016	-0.029	-0.020	-0.163*	0.127	0.042	-0.200**
Fe (Post)	0.057	-0.082	-0.175*	-0.045	-0.127	-0.025	-0.225**	0.166*	-0.048	0.021
Mg (Pre)	-0.081	-0.082	0.012	-0.086	-0.139*	-0.133	-0.159*	-0.116	0.139*	-0.007
Mg (Post)	0.104	0.066	0.074	0.024	-0.078	0.011	-0.155*	-0.032	0.188**	0.129
Zn (Pre)	0.073	0.180*	-0.175*	-0.038	-0.098	-0.080	-0.230**	-0.091	-0.054	0.014
Zn (Post)	0.037	0.139*	0.065	-0.034	-0.110	-0.093	-0.140*	0.151*	0.069	0.018 / -0.004

*Significant at 5% **Significant at 1% level NS – Not significant

In a study based on 7569 individuals from the MONICA Study, a sample from the Danish Diet, Cancer and Health Study and the INTER99 study, with information on diet; 54 single-nucleotide polymorphisms (SNPs) associated with BMI, WC, or WHR adjusted for BMI; and potential confounders. A significant reduction in body weight (ΔBW) of −0.076kg (P = 0.021; 95% CI: −0.140, −0.012) per 1000 mg Ca. No significant association was observed between dietary calcium and change in waist circumference (ΔWC). However, a significant interaction between a score of 6 WC-associated SNPs and calcium in relation to ΔWC was found. Each risk allele was associated with a ΔWC of −0.043 cm (P = 0.038; 95% CI: −0.083, −0.002) per 1000 mg Ca (Larsen et al., 2014).

A cross-sectional study on adults (N = 2504); 1120 men and 1384 women) aged 18-74 years observed an inverse association between dietary magnesium intake and waist circumference. No other anthropometric indices have been reported in this study (Mirmiran et al., 2012). Lower magnesium intakes by obese women as compared to non-obese women have been reported by Jarvandi et al., (2011).

A total of 96 obese Chinese women (body mass index (BMI) 28 kgm⁻²) aged 18–55 years participated in a 26-week randomized, double-blind, placebo-controlled intervention study. Subjects were randomized into three groups, receiving either one tablet of multivitamin and mineral supplement (MMS), or calcium 162☐ mg (Calcium) or identical placebo daily during the study period. Body weight, BMI, waist circumference (WC), fat mass (FM), fat-free mass, resting energy expenditure (REE), respiratory

quotient (RQ), blood pressure, fasting plasma glucose and serum insulin, total cholesterol (TC), low-and high-density lipoprotein-cholesterol (LDL-C and HDL-C) and triglycerides (TGs) were measured at baseline and 26 weeks. A total of 87 subjects completed the study. After 26 weeks, compared with the placebo group, the MMS group had significantly lower BW, BMI, FM, TC and LDL-C, significantly higher REE and HDL-C, as well as a borderline significant trend of lower RQ (P=0.053) and WC (P=0.071). The calcium group also had significantly higher HDL-C and lower LDL-C levels compared with the placebo group (Li et al., 2010).

Table 5: Association of Vitamin Intake with Different Anthropometric Variables

	Body Weight (kg)	Wt. Loss (kg)	BMI (kg/m2)	WC(cm)	WHR (I)	BMR (kcal)	Fat%	% Fitness	Lean%	VF
Retinol (Pre)	-0.048 NS	-0.083 NS	-0.149*	0.029 NS	-0.006 NS	-0.121 NS	-0.141*	0.117 NS	0.082 NS	-
Retinol (Post)	0.019 NS	0.009 NS	0.050 NS	0.003 NS	-0.003 NS	-0.060 NS	-0.061 NS	0.041 NS	0.039 NS	-0.105 NS
Thiamine (Pre)	0.101 NS	0.086 NS	0.094 NS	-0.146*	0.131 NS	0.014 NS	0.002 NS	0.119 NS	0.123 NS	-0.073 NS
Thiamine (Post)	-0.088 NS	-0.090 NS	-0.015 NS	0.006 NS	0.008 NS	0.019 NS	0.017 NS	0.088 NS	0.066 NS	-0.034 NS
Riboflavin (Pre)	-0.189**	0.181*	-0.087 NS	-0.017 NS	0.000 NS	0.237**	-0.220*	-0.011 NS	-0.011 NS	0.237**
Riboflavin (Post)	0.132 NS	0.121 NS	0.087 NS	-0.152*	-0.144	-0.046 NS	-0.052 NS	0.199*	0.193*	0.188**
Niacin (Pre)	0.196**	0.179*	0.133 NS	0.139*	0.117 NS	0.116 NS	0.090 NS	0.069 NS	0.072 NS	0.071 NS
Niacin (Post)	0.128 NS	0.130 NS	0.025 NS	0.131 NS	0.135 NS	0.003 NS	0.007 NS	0.204**	0.209*	-0.126 NS
Folic acid (Pre)	-0.114 NS	0.143*	0.103 NS	0.027 NS	0.000 NS	0.279**	-0.264*	0.074 NS	0.015 NS	0.338**
Folic acid (Post)	0.147*	0.160*	-0.021 NS	0.056 NS	0.065 NS	0.069 NS	0.077 NS	0.209**	0.196*	-0.089 NS
Vitamin C (Pre)	-0.012 NS	-0.003 NS	-0.043 NS	-0.006 NS	0.003 NS	0.001 NS	0.010 NS	0.077 NS	0.085 NS	-0.066 NS
Vitamin C (Post)	0.079 NS	0.098 NS	-0.066 NS	-0.041 NS	-0.026 NS	0.097 NS	0.144*	-0.055 NS	-0.012 NS	0.139*
Vitamin B12 (Pre)	-0.256**	0.241**	-0.142*	-0.180*	-0.160	0.225**	-0.194*	-0.280*	0.255*	-0.023 NS
Vitamin B12 (Post)	0.119 NS	0.139*	-0.064 NS	-0.015 NS	0.002 NS	0.105 NS	0.109 NS	0.060 NS	0.063 NS	0.060 NS

*Significant at 5% **Significant at 1% level NS Not significant

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Table 5depicts association of mean vitamin intake with variousanthropometric indices. Pre intervention retinol intake has beenfound to have a negative association with BMI, body fat per cent andvisceral fat. Thiamine intake had a negative association with waistcircumference. Riboflavin intake had an inverse association with bodyweight, body fat per cent and visceral fat and positive associationwith weight loss and basal metabolic rate in pre intervention stage.In post intervention stage the riboflavin intake caused a decrease inWC, WHR and visceral fat and resulted in lean mass conservation andimprovement of fitness. Pre intervention niacin intake resulted inlower body weight, greater weight loss and lower waist circumference.Post intervention niacin intake resulted in improvement oflean massand body fitness.

In a similar case controlstudy conducted in China, a total of 123 patients with metabolicsyndrome (including central obesity) and 135 controls participated inthis study at the Health Examination Centre of Heping District. Therewere 4 major dietary nutrient patterns in this study: "vitaminB group", "protein and lipids", "vitamin Eand minerals" and "antioxidant vitamins" Afteradjustment for potential confounders, the highest tertile of thenutrient pattern factor score for the "vitamin B group"(odds ratio: 0.16; 95% confidence interval: 0.05-0.47) wasnegatively associated with metabolic syndrome compared with thelowest tertiles. The "vitamin B group" included thiamine,riboflavin and niacin in this study [Bian et al, 2013].

Initial folic acidintake resulted in greater weight loss, higher basal metabolic rate,lower body fat per cent and visceral fat. Higher post interventionfolic acid intake resulted in lower body weight, greater weight loss,higher lean per cent and fitness levels.Post interventionvitamin C intake was found to have negative association with body fatper cent and visceral fat. Johnston, (2005)has concluded in areview that vitamin C status is inversely related to body mass,individuals with adequate vitamin C status burn 30% more fat induring a moderate exercise bout than individuals with low vitamin Cstatus.

A study on womenaged 37±7.5 years (n=580) from 6 rural communities in Mexicowere evaluated. The prevalence of overweight and obesity was 36%(BMI>25 Kg/m^2) and 44% (BMI>30 Kg/m^2),respectively. Prevalence of zinc and vitamins C and E deficiencieswere similar in obese, overweight and normal weight women. No vitaminA deficiency was found. Vitamin C was negatively associated with BMI,waist-to-height ratio and leptin concentrations (p<0.05).Vitamin A was positively associated with leptin (p<0.05). Whenstratifying by BMI, % body fat and waist circumference, high leptinconcentrations were associated with lower zinc and lower vitamin Cconcentrations in women with obesity (p<0.05) and higher vitamin Aconcentrations in women without obesity (p<0.01) [Garciaet al., 2012].

In the present studypre intervention Vitamin B$_{12}$ intakes were found to haveinverse association with body weight, BMI, WC, WHR and body fatpercent and a positive correlation with weight loss, basal metabolicrate, lean per cent and body fitness. Post intervention vitamin B$_{12}$intake had a significant association with weight loss. In across-sectional and primary care-based study 976 patients (obesity:414, overweight: 212 and control: 351) were enrolled. The mean age ingroups of obesity, overweight and control were 35.9 ± 8.7,28.9 ± 6.3 and 33.1 ± 8.7, respectively (p = 0.142).Vitamin B$_{12}$ level was significantly lower in patients withobesity and overweight than healthy individuals (178.9 ± 25.2;219.8 ± 78.5 and 328.5 ± 120.5, p less than 0.001,respectively). Vitamin B$_{12}$ level was lower in patientswith Metabolic Syndrome (+/-) and IR (+/-), but insignificant (p =0.075 and 0.058, respectively). Significant and negative correlationwas observed between vitamin B$_{12}$ and BMI (r =-0.221,p=0.001). No significant difference was observed between obese maleand female patients (247.8 ± 89.1 versus 235.5 ± 89.3pg/ml, respectively, p=0.090) [Baltaci et al., 2013].

Conclusion:

In the present study it was observed that different micronutrients(vitamins and minerals) seem to play an important role in the processof weight reduction and most importantly have a significant impact onchanges in body composition. Some of these results have beensupported by other recent researches but not all. Also, themechanismfor these effects is not clear for each micronutrient buttheirimportance cannot be overlooked. Also, the deficiency causedduringthe weight reduction as a result of calorie restriction shouldbetaken care off. Assessment of pre-intervention intakes may alsohelpin predicting the success of a weight loss program.

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2017

Sustainable Development: Sociological Perspective

Dr. Sweety Mathur

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" Sustainability is the foundation for today's leading global framework for international cooperation development and its Sustainable Development goals (SDGs) the interdependencies of the economic, environmental and social justice elements of our world require new way of thinking about things and taking action that will truly create a future Where human Society and nature Coexist with mutual benefit and where the Suffering caused by poverty and natural resource abuse is eliminated.

Key Words: Social development, Sociological Sustainability, Social perspectives, Role, Social behavior.

Introduction:

Development: Change is a law of nature. society polity ,economy ,geography and culture-all undergo a ceaseless process of change .all structural categories like caste, family and market and culture categories like custom ,tradition, values ,ideologies, art and artifacts come under this process. Development , progress and evolution are different concept to denote different modes of change .the structural domains like cast ,family ,polity and bureaucracy and the change in cultural domains like style of life ,values and attitudes towards rituals and religious practices nation and nationality ,traditions and customs are examples of socio

cultural changes in society

What should be developed? Dimensions of development

Even if the development of a socio-economic system can be viewed as a holistic exercise an all-encompassing endeavour ; for practical purposes, in particular for policy making and development management, the focus of the agents aiming at development is almost always on selected parts of the system or on specific features

Economic development: i.e., improvement of the way endowments and goods and services are used within (or by) the system to generate new goods and services in order to provide additional consumption and/or investment possibilities to the members of the system.

Social development: people-centered development, where the focus is put on the improvement of the various dimensions affecting the well-being of individuals and their relationships with the society (health, education, entitlements, capabilities, empowerment etc.)

Sustainable development: development which considers the long term perspectives of the socio-economic system, to ensure that improvements occurring in the short term will not be detrimental to the future status or development potential of the system, i.e. development will be "sustainable" on environmental, social, financial and other grounds.

Territorial development: development of a specific region (space) achievable by exploiting the specific socio-economic, environmental and institutional potential of the area, and its relationships with external subjects.

How to develop: development paradigms

Development was very rarely considered to be a "god-given" condition of socio-economic systems, implying that policy makers at national and international level have always thought that some activities (or even refraining from carrying out any activity) were required to promote positive changes. However, countries as well as the international development community in different periods, have privileged specific ways of achieving development, adhering to a specific "**Development paradigm.**

Sociology of development: Sociology of development is a new branch of study. It originated with the post – second world war and postcolonial experiences of development in the newly emerged nations .the need of sociological analysis of development emanated from the realization of an interface of economy and society. Addressing the problems of development from the point of view of sociology may be called sociology of development
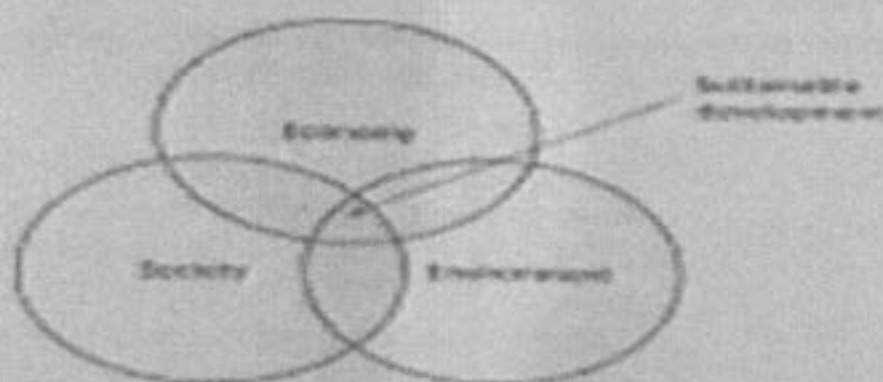
Social development perspective : The concept of social development, according to **M.S.A.Rao**, is inclusive of economic development but differs from it in the sense that it emphasizes the development of the society in its totality-including economic ,political, social and cultural aspects. - the sociologic perspective stresses the fact that the key actors are the human beings, whose social organization patterns are crucial for the identification of viable solutions to sustainable development problems. Sustainable development is objectives The minimal requirements for sustainable development are the following: - redimensioning economic growth for reasonable resource allocation and high production quality; - poverty eradication through meeting the essential needs of the population: job, food, energy and water supply, a place to live in and health; - acceptable population growth (controlled demographic increase) -

natural resource preservation and increase through maintaining ecosystem diversity and monitoring the impact of economic activities upon the environment; - technological shifting and the control of technological resources; - government decentralization, active involvement in the decision-making process; - corroborating national and international decisions regarding environment and development; - global unification of decisions on the environment and economy. The main concern of the sustainable development strategy is the human community in space and time and the creation of a cohesive system that is able to cover the costs generated by economic-social growth, pollution prevention and its negative effects. The paper analyses how the concept of sustainable development is defined, its principles and objectives, as well as the role and importance of the sociological dimension in creating a model of sustainable development. Any project should approach all three dimensions of sustainable development: environment, economy and society. The ecological dimension is concerned with sustainable consumption and production, natural resource preservation and management,
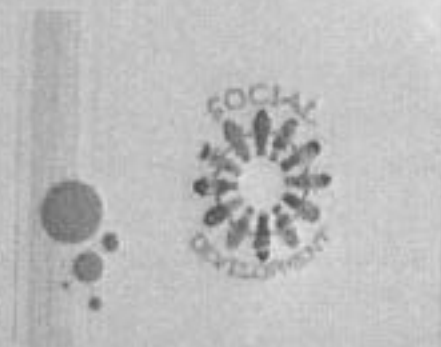
Sustainable development perspective: The approach of sustainable development refers to the method of development which may ,on the one hand ,bring about better standard of living and life changes and, on the other, the possibility of negative impact of the process of development may be minimal.

Sustainable development is the organizing principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which the economy and society depend. The desired result is a state of society where living and conditions and resource use continue to meet human needs without undermining the integrity and stability of the natural systems.
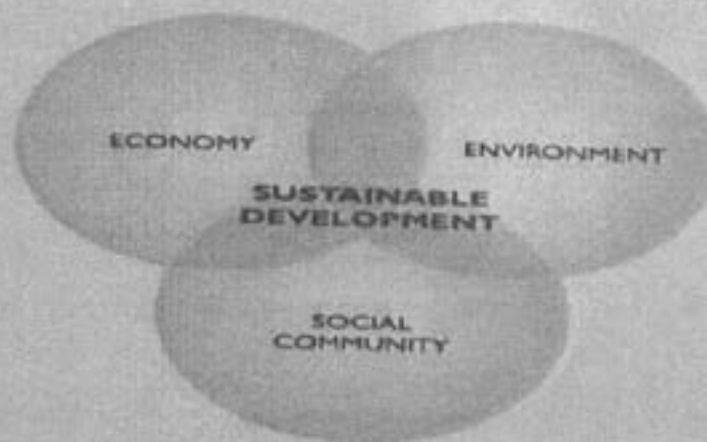
Role of Indian Traditions in Biodiversity Conservation

*Dr. Sunita Shekhawat
**Dr. Prerna Singh Lavania

To live in harmony with nature has always been an integral part of Indian culture. The natives have played a significant role in conserving the biodiversity in and around localities of their natural habitat. This has been several times reflected in our traditional practices and religious beliefs by our ancient cultures. The people had tremendous understanding of ecosystems and the factors which would sustain them. Plants not only serve as a source of edible food in the form of roots, tubers, rhizomes, seeds, fruits but also as agricultural and horticultural plants. Conservation of plants is on priority in their natural habitat due to their magico - religious belief of the natives as they are considered as habitat of god and goddess.

Environmental conservation is not a new concept. Historically, the protection of nature and wildlife was an ardent article of faith and very well reflected in the daily lives of people. It has also been enshrined in myths, folklore, religion, arts and Indian culture. The fundamental principles of ecology-the interrelationship and interdependence of all life so as to create homeostasis is well observed. It is also reflected in the ancient scriptural text, the Isopanishad,over 2000 years ago. It says, 'This universe is the creation of the Supreme Power meant for the benefit of all his creation. Each individual life-form must, therefore, learn to enjoy its benefits by forming a part of the system in close relation with other species. Let not anyone species encroach upon the other's rights.'

The Nature Worship is the age- long tradition in many religions in India.Living beings have always lived in harmony. This can be very well traced back 10,000 years old cave paintings at Bhimbetka in Central India. Different religions followed in India also speak the same. The tradition to worship trees, animals, forests, river, mountains and earth are basically the strategy to conserve the intrinsic relation between man and environment. One of the smartest traditional practice to conserve our surrounding is the creation of 'Sacred Grooves'. Sacred Groves are small patches of native vegetation, traditionally protected by local communities. The local communities in different Indian states are protecting and worshipping sacred groves since the emergence of civilization. Many sacred grove- areas are designated as sacred places of Gods and goddesses where people go for worship. The concept of Panchvati (a group of five Banyan trees: vati is derived from the Sanskrit word 'vat' meaning vat-vriksha or banyan tree) has been elaborated in many of Indian Epics. Sacred groves or sacred forests preserved with reverence have been part of Hindu and Buddhist culture. The holy books like Quran and Bible clearly reveal that nature and its components are created by God and humans are responsible of protecting it. Sacred Groove is basically a piece of land which may vary from about fifty hectares to few hundred square metres. These lands are spread all over India . In Kerala, several small jungles are dedicated to snakes i.e. Sarpakavu (Sarp= Snake, kavu=jungle). The celebrated Padmanabaswami temple in Thiruvanthapuram has Lord Vishnu reclining on a mighty serpent. These grooves serve an excellent example reflecting a fine balance of religious faith and nature conservation. Thus, very effectively preserving biological diversity. As a matter of fact, even rarest and endangered species can also be found here. Human civilization is under the obligation of nature so as to conserve the nature for our future.

There are also examples of sacred ponds attached to temples in many parts of India which consider their responsibility for the protection of certain endangered species of turtles, crocodiles, and the rare fresh water sponge. Many other animals are also worshipped as they are considered vehicles of gods and goddesses. Different water conservation strategies and traditions have been in practice in many parts of India. Some of those indigenous strategies are- Tanka and Kund in Rajasthan and Mizoram ; Bamboo drip system in Cherapunji, Eris in Tamil Nadu; Haveli in Madhya Pradesh; Apatani in Arunachal Pradesh; AharPyne system of water conservation in Bihar and adjacent West Bengal; Zabo system in Nagaland etc. The kund at Trayambkeshwar is considered to be the origin of the sacred Godawari river.

Some of the plants growing in Indian sacred groves which are protected by local communities are:

S.No	Name of plant	Uses
1	Buteamonosperma	Medicinal, Dye
2.	Cordiadichotoma	Food, Medicinal
3.	Ravuolfia serpentine	Medicinal
4.	Alstoniascholaris	Medicinal
5.	Helicteresisora	Medicinal
6.	Boswellia serrate	Medicinal
7.	Calotropis gigantean	Medicinal
8.	Carissa congesta	Medicinal
9.	Diopyros Montana	Medicinal
10.	Bambusaarundinacea(wild bamboo)	Miscellaneous

Source: Jain,S.K. Ethnobiology in Human welfare

Plant species are of extreme economic importance : as rhizomes of plants like *Acoruscalamus*, stem bark of *Bunchanialanzan*, stem and leaves of *Moringaoleifera*, *Achyrnthusaspera*, *Gynandropsisgynandra* and *Bombaxceiba* are being used as antidote of snake - bite and scorpion sting. Many plants and animals have been considered sacred by various communities in India. The peepal tree (*Ficusreligiosa*), The banyan tree (*Ficus 'bengelensis* and Khejdi tree (*Prosopis cineraria*) are the well-known examples in Rajasthan. Since, these are religiously considered as pious, so they are never cut. There are several other trees and plants that hold the same position as sandalwood tree, beetlenut, palm, neem, coconut palm, juniper, champa, lotus, tulsi, pepper, etc. This has made a significant contribution in the protection and propagation of various species of trees and plants in India. Even the plants and trees growing in temple premises uphold the same position and religious belief of not cutting extends here also.

Respect for nature is inherent in traditions and culture. It has been depicted that many Hindu gods and goddesses used animals as their mounts. Many animals are also considered sacred and worshipped by several Hindu and other communities. The peafowl, sacred to lord Karttikeya is never hunted, the blue rock pigeon is considered sacred to Saint Hazrat Shah lalal and is protected in the Bengal region. Even

rodents are considered sacred and are allowed to breed in the famous temple of goddess Karnimata in Rajasthan. The tiger and the cobra, though greatly feared, are afforded protection on religious grounds. In this has been vividly showed how the ancient culture and traditions of Indian society contributed to the conservation of natural ecosystems and the plants and animals that inhabited these.

Importance of plants and animals have also been depicted in our traditions and sculptural art. Paintings and potrays of sacred trees, mounts of gods and goddess have been depicted in stone and metal sculpture as a part of palaces and temples. All this clearly indicates our intention of conserving nature from time immemorial. The concept of keeping forest reserves was first developed by Kautilya. Even during the reign of Emperor Ashoka, it was inscribed everywhere in his kingdom, on rocks and pillars that, whosoever found destroying biodiversity or killing animals would be strictly punished. It is the first recorded measure on conservation anywhere in the worlds, surviving till date. Considering nature as a part of the family can be best exemplified by Bishnois in Khejri village, Rajasthan. They have a tradition of protecting wildlife including Black Buck and Khejri trees since 1451 or so. In 1730 AD, the then ruler of a native state had ordered the khejri (*Prosopis cineraria*) trees to be cut in order to bake lime for the construction of a fort. A strong collective protest from the local Bishnoi community against the king was made. 363 men and women, young and old, hugged the trees to prevent them being cut and were unfortunately, axed along with the trees. After knowing the tragic incidence, the ruler of the state sought pardon from the people and issued an order that no green trees should in future be cut in the Bishnoi village. This happened over two centuries ago when the world had scarcely become conscious of ecological consequences of the reckless felling of trees. (Man Mohan Singh,1990).

The love for nature and strong belief to conserve the nature was also vividly alive in contemporary times. Another successful conservation movements in India is the Chipko movement spearheaded by the womenfolk of Gopeshwar village in Garhwal in the Himalaya. Commercial felling of trees was effectively stopped by them. This eventually saved 12,000 sq.km. of a sensitive water catchment area to be deprived of trees. There was a similar Apiko movement in the southern state of Karnataka.

Presently, India is no exception to the global phenomenon of environmental degradation brought about by rapid industrialization, growing urbanization, intensive cultivation, and other developmental activities. This coupled with increasing biotic pressure has created an adverse impact on India's biodiversity. The prime areas of environmental concern today include,

(I) **Habitat Destruction**: Increase in human population density has endangered the survival of a number of plants and animals and has led to extinction.

(ii) **Pollution of air, soil and water**: Loss of biodiversity, rapid industrialization and urbanization is causing adverse climatic conditions which would, someday, lead to human race extinction also.

(iii) **Threat to natural living resources**: Use of advanced technology is on alits way threatening survival of wildlife, fisheries, etc,

(iv) **Problems associated with urbanization** - The policies to promote sustainable use of natural resources are seldom inadequate in remote rural areas. Law enforcement personnel are unable to fulfil the financial, material and training resources leading to pollution, slums and sanitation problems.

As a result, we have already lost some species of mammal, such as, the Indian cheetah and the Lesser Indian rhinoceros and two species of birds-the Pink headed duck and the Mountain quail-have become

during twentieth century alone. Eighty-one species of mammals, 38 species of birds, and 18 species of amphibians and repitles are now listed as 'rare' and 'threatened'. Among these are the tiger, leopard, Asiatic elephant, and all- the three species of the Indian crocodile. About 1500 species of plants are on the endangered list. If this continues, more species of flora and fauna would vanish causing environmental imbalance. India is a developing country. Economic development has to go in hands with nature conservation. A fine tuning between environment protection and policies and programmes of development is the need of the hour. At this juncture, we have to look back towards our age old glorious rich traditions of which environmental conservation was an integral part.

Protection of wildlife and natural resources as enshrined in Hindu religion and culture, has also been stressed in the Constitution of India. The Indian Constitution for the first time imposed the responsibility of protection of the environment upon the States by Forty Second Amendment Act, 1976. Article 48-A states that "The State shall endeavor to protect and improve the environment and to safeguard the forest and wildlife of the country." The Amendment also inserted Article 51-A in Part VI-A (Fundamental duty) in the Constitution, which says "It shall be duty of every citizen of India to protect and improve the natural environment including forests, lakes and wildlife and to have compassion for living creature." Therefore, Governments of different Indian states are under the responsibility to promote regeneration of forests and their protection with the help of action and rational participation of the local people.

Conclusion

Today, when people throughout the world are perturbed by the degradation of the environment and the disastrous consequences of this, traditional ethics of nature conservation could be looked upon as a source of inspiration and guidance for the future. Perhaps no other culture can provide such a profound variety of cultural practices and ecologically sound relationship with nature as the Indian. The Conservation of Forests and Natural Ecosystems Act of India, 1994, proposes to create a different category of forest "village forest", which would be virtually handed over to the village communities for management and maintenance with rights to the forest produce. This is to introduce the concept of "biodiversity conservation". Times immemorial, India always had rich traditional and indigenous knowledge, both coded and informal. In this light, Van –Panchayats have been organised in Uttar Pradesh for the management and conservation of forests. These are village level institutions members of which are elected at local level. These Van Panchayats are linked to the forest department for technical know-how and for planning strategies.

However, there is a urgent need to explore valuable germplasm. A periodical survey and evaluation of modern technology has shown that floral diversity has been conserved in the local eco -system. Ecological imbalance needs to be restored by conserving our precious biological diversity. This can be very well done by in-situ and ex-situ conservation. Ex-situ conservation of genetic material can be made in seed bank, botanical garden herbal garden, arborateum and conservation of ex-plants or organs in in-vitro as cryo-bank, genomic DNA, DNA library and DNA bank while in-situ conservation of genetic resources within their eco-system.

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IMPORTANCE OF PROFITABILITY ASSESSMENT

Dr. Tina Singh Bhadouria*

Abstract

Profitability assessment is a term that has been very popular since the times of industrial revolution in India. It indicates the earning capability of the business entity either in relation to total revenues or the assets being utilized. Profitability indicates the degree or the extent of profit earning capacity of a business venture. It shows the financial ability and tends to enhance the income earning capacity. We can say for business to be profitable, good use of finances of the business is a must. Finance is the life blood of an organization. It is an integral part of establishing, running and operation of a business. Sometimes it is not the shortages of funds but the mismanagement of funds which leads to the failure of the business. Therefore, for surviving in the dynamic economic environment optimum utilization of resources is the key to profitability, which ultimately is the main objective of any business enterprise.

Keywords: Profitability Assessment, Finance, Economic Environment, Resources, Earning Capacity.

Introduction

Profitability is usually defined as the ability of a given investment to earn a return from its use. Further, profitability of a concern indicates the financial ability and tends to enhance the income earning capacity. Profitability is a relative term and its measurement can be achieved by profit and its relation with the other objects by which the profit is affected. Profitability analysis reveals how the profit position stands as a result of total transactions made during the year. Profitability is made of two words; profit and ability. The word profit has been defined in numerous ways according to its use and purpose. The word ability means the strength of an organization to earn the profit. So we can say that profitability is the ability or the strength of an enterprise to earn profits.

Profitability is the profit making ability of a firm. It is mainly based on the concept of profit. The goal of an enterprise should not be the maximization of profit but the maximization of profitability. Profitability is a relative concept and to measure it, profit is to be related to some variables affecting the profit or relating to profit in some form or the other. Sam R. Goodman, has very justly termed, "Profit as a residual. It is a static historical term more geared to a reporting function than to decision making ". He further differentiates profits from profitability by saying that "Profit is an owner oriented concept and is tied into theownership shares of national income and provision. Thus whereas the accounting concept of profit measures what have been accumulated , the analytical concept of profitability is concerned with future accumulation of wealth".

The state of profitability is variable like the temperature and humidity of a day. The determination of profitability by an accountant or analyst can even be linked to temperature reading and study of humidity by a meteorologist. The efficiency of a business concern is generally measured by the amount of profit earned. The larger the profit the more efficient and profitable the business becomes. Profitability has been considered to a great extent to which management has been successful in efficiently utilizing the funds at its disposal or in other words how far the management has been successful in maximizing its profits or minimizing its losses, if any.

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The importance of profitability has been further heightened in the recent years as it helps in critical analysis and interpretation of the current and future profit earning capacities of the business enterprise. In the process of such analysis and interpretation certain methods are used to measure more accurately the trends in business profits as profit index of a business house is regarded as an indicator of its efficiency and effectiveness in achieving its goal of earning profit.

Today profitability analysis has stolen a march over other aspects, which are highlighted in the interpretation of financial statements, in developed and developing countries.

Financial analysis is more external than internal. Profitability analysis is internal as well as external. It is internal because its related to the analysis of internal operational working of a firm over a long period of time with a view to understand the profit trends so that management, on the basis of profit trends may evaluate its own economic performance. Profitability analysis is considered as external as it helps the external users of accounting information pertaining to a particular business concern viz, stockholders, potential investors, bankers and other creditors and numerous governmental agencies, in measuring its economic health by its net earnings. Its profit indices for a number of years serve as indicators of its business activity, which in turn, from the view point of the outsiders are the only reliable bases for the appraisal of effectiveness with which funds are used in the various segments of the enterprise.

Objectives

The basic objectives of the study are to evaluate the performance of different companies on the basis of following criteria:

- Fullfillment of targets fixed for the enterprises and contribution to national development.
- Success in reducing cost of production and increasing economic returns.
- To judge the profit earning capacity of the companies.
- To judge the financial strength and charges there in.
- To discover the factors which are responsible for lower profitability.
- To provide valuable information to prospective investors and collaborators.

Methodology

The data relating to the profitability position of the different companies have been collected mainly from their published annual reports and other documents, which have been obtained from their respective offices. To supplement the data from annual reports and accounts, other publications and political weekly and company news letters and notes have also been used and analysed. With the help of the data contained in the financial statements, different ratios have been calculated and then compared and interpreted.

Hypotheses

What are the factors, which are ultimately responsible for lower profitability? Did the units manage their financial resources in prudent manner ? Are the market conditions responsible for that? Is managerial efficiency responsible?

Description

Profitability of an undertaking may be measured by means of different techniques but ratio technique is one of the best and most understandable techniques to measure the profitability of any concern. Profit can be related mainly to sales and investment to determine profitability. An enterprise should be able to produce adequate profit on each rupee of sales. The evaluation of profitability in terms of investment is essential since the investor desires a satisfactory return. The accounting records and financial statements derived from different companies are based on set of different principles, assumptions and conventions, some of which make the reports both unrealistic and unreliable.

The profitability of the different companies have been measured by means of various techniques like ratio analysis, value added approach and some statistical techniques like standard deviation, co-efficient of variation, trend percentages, averages etc.

Significance of Profitability Assessment

- It helps in critically analyzing and interpreting the current and prospective earning capacities of the business corporations.
- It also helps the stakeholders of the business like bankers, investors, shareholders and other creditors and governmental agencies in maintaining its economic health by its net earnings.

- The indices of profits are considered as reliable indicators of the operational efficiency and organizational effectiveness of the firm in utilizing itsresources to earn satisfactory earnings.
- The profit index of a business house is regarded as an indicator of its efficiency and effectiveness in achieving its goals of earning profit.
- Profitability analysis owing to its empiricism or methods enables both official and unofficial agencies to measure the trends of profits to construct a number of indicators of business activity and to analyze, evaluate and interpret in right perspective the earning capacity of a business house.
- It is a significant aspect of financial appraisal of individual firm or industries and other institutions.
- It also makes sure that to use the funds entrusted to it by the owners to their maximum advantage.

Conclusion

Profit is the prime motive behind every economic activity. It is the main motivating force behind all kinds of business. Profitability, whereas is the ability of an enterprise to earn this profit. With profitability we measure the profit earning capacity or the return on our investment in the business Profitability of a business is the major force that attracts and stimulates the investors and creditor towards a business. There are a number of factors which need to be managed to increase the chances profitability of a business. Factors like controlling the costs, management of working capital and retained earnings, minimization of long term funds, lesser deviations in actual and standard cost of production effective utilization of raw materials, inventory management and TQM etc. should be applied wisely increase the profitability of the business. With the implementation of such factors only the companies c work more effectively, efficiently for the overall economic development of the country.

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संयुक्तांक

भाषा परिचय

अक्टूबर–मार्च, 2017

अनुक्रम

पुस्तक, पुस्तकालय और हम

— डॉ. सीता शर्मा 'शिताभ'

जिन्दगी में मित्र ना होते तो कैसा होता? या मित्रता ही ना होती तो कैसा होता? इतना ही नहीं कुछ ऐसे मित्र जिन्हें जब जी चाहे फोन उठाकर खूब सुना दो, और तो और; चाहो तो एक वर्ष या दो वर्ष बाद भी बात करो तो रिश्ते में वही उत्साह सहजता और मिठास हो, तो आत्मा हरी हो जाती है। रूकी जिन्दगी फिर से चलती सी जान पड़ती है और जब मित्र कभी विश्वास तोड़ दे तो कितनी असह्य वेदना होती है इसका अनुमान हर कोई नहीं लगा सकता।

क्या आपके पास कोई विश्वासपात्र मित्र है? यदि हाँ तो आप नसीब वाले हैं और यदि ना हो तो चिन्तित न हों क्योंकि इस धरा पर मानवी जगत में मानव द्वारा मानव के लिए रचित एक ऐसा मित्र मौजूद है जो सभी के लिए, सभी कहीं पूर्णतः लोकतांत्रिक है जो ज्ञान की मंदाकिनी का हिमालय है। यह मित्र "No Demand No Complain" वाला है। यह आपकी किसी बात का बुरा नहीं मानता। इसके व्यक्तित्व की सर्वोत्तम विशेषता है कि यह कभी भी आपके भरोसे को नहीं तोड़ेगा?

क्योंकि यह सिर्फ अपको देना जानता है, आपसे कुछ प्राप्त करने की कोई चाह इसकी नहीं रहती। इसके सान्निध्य से आप अच्छे सलाहकार हो सकते हैं। आप गत और आगत युगों की परिस्थितियों को जान सकते हैं और न सिर्फ स्वयं को अपितु औरों को भी जीवन दिशा देने में सहायक बन सकते हैं। इस मित्र की एक और विशेषता है – इसका गौरव अक्षुण्य है बस आवश्यकता है मानव द्वारा इसके संरक्षण की।

इसके मिलने का स्थान भी नियत है। यह स्थान दो हैं – एक स्थान पर जाओगे तो अर्थ की आवश्यकता होगी, वो तब जब आप इसे सदा के लिए अपने पास ही रखना चाहो और यदि आप जी चाहे तब इसकी संगत करना चाहो तो कोई चार्ज देय नहीं होंगे। यह स्थान सकारात्मक ऊर्जा का केन्द्र होता है यहाँ जाकर आप तनाव मुक्त हो जाते हैं। दिन-प्रतिदिन आप अपने ज्ञान कोष में वृद्धि हुई देख सकते हैं।

इतनी विशेषताओं से युक्त आखिर यह है कौन? और जहाँ इसकी संगत कर सके वह स्थान

कौनसा है? सम्भवतया अब तक आपने अनुमान लगा ही लिया होगा कि यह मित्र है पुस्तक और स्थान है- पुस्तकालय।

पुस्तकें हमारी सांस्कृतिक धरोहर को सुरक्षित रखती है और पुस्तकालय इन पुस्तकों को सुरक्षित रखता है, इसलिए किसी पुस्तक प्रेमी मनीषी ने इनके मर्म और महत्ता को कुछ इस तरह व्यक्त किया है :-

'पुस्तकालय से बढ़कर न कोई आलय।

ज्ञान की मन्दाकिनी का यह हिमालय।

इष्ट जिनकी पुस्तकें हो गई हैं...

देह उनकी देव नगरी मन शिवालय।''

यह सत्य है कि सिर्फ किताबी ज्ञान जीवन के लिए पर्याप्त नहीं, इसे जीने के लिए व्यावहारिकता आवश्यक है किन्तु यह भी सत्य ही है कि विश्व की विविध मानव सभ्यताओं की विरासत उनकी पुस्तकों में सुरक्षित है। कागज (पत्र) और कलम के विकास से पूर्व शिलांकित कृतियों के प्रमाण इतिहास में सुरक्षित हैं जिसमें हिन्दी साहित्य की प्रथम शिलांकित कृति – रोड़ा कृत राउलवेल (दसवीं शती) एक चम्पू काव्य है जो हिन्दी साहित्य में नख-शिख चित्रण परम्परा का आरम्भक है।

भारतीय संस्कृति के मूल तत्व आज भी यदि शेष हैं तो इसलिए कि यहाँ साहित्यिक धरोहर का विपुल भण्डार रहा है। हमारी संस्कृति को लगातार नष्ट करने के प्रयास विदेशी आक्रान्ताओं द्वारा लगातार किये जाते रहे। तक्षशिला, विक्रमशीला और नालन्दा जैसे विश्वविद्यालयों में संरक्षित हमारे ग्रन्थों को नष्ट करने के कुत्सित प्रयास किये गये। आज भी अग्रिस्नात आधे-अधूरे ग्रन्थ और पाण्डुलिपियां हमें हमारी पूर्व परम्परा से परिचित कराती हैं। तद्युगीन मनीषियों के मानस बल और अथक श्रम ने इन्हें पुनः सृजित व संरक्षित कर आर्य संस्कृति के प्राण तत्वों को पुस्तकीय

रूपों में स्थानन्तरित किया यही ग्रन्थ आज भी हमारी विरासतीय धरोहर है।

पश्चिमी सभ्यता के पास अपनी सनातन धरोहर के नाम पर ज्यादा कुछ शेष नहीं है। हम पीछे मुड़कर देखें तो सदियों की सनातन सांस्कृतिक परम्परा से हम आज के जीवन का अन्वेषण कर सकते हैं। इसलिए तो हम आज भी गर्व से कह पाते है कि

''यूनान, रोम, चीनी सब मिट गए जहाँ से

कोई तो बात है कि हस्ती मिटती नहीं हमारी

वर्षों रहा है दुश्मन दौर-ए जहाँ हमारा

सारे जहाँ से अच्छा हिन्दोस्तां हमारा''

जिस सभ्यता में कलात्मक विकास के साथ साहित्यिक उन्नयन रहा है वह सभ्यता जीवन्त है। आज भी प्राणवान है। उसमें चेतना का प्रवाह है। साहित्यिक सृजन के लिए इसीलिए सम्भवतया कहा गया है –

''अंधकार है वहाँ, जहाँ आदित्य नहीं है।

और मुर्दा है वह राष्ट्र जहाँ साहित्य नहीं है।''

यूँ तो विभिन्न विषयों के पुस्तकीय संसार का अपना अलग महत्व है किन्तु साहित्य में सभी विषय स्वतः समाविष्ट हो जाते हैं। चाहे विषयों के समावेश का प्रश्न हो अथवा भूत और भविष्य की संभावनाओं का प्रश्न इन सबके उत्तर स+हित्+य = साहित्य में मुखरित होते हैं। हित के साथ से युक्त अर्थात् कल्याणकारी है जो। 'सत्यं-शिवम्-सुन्दरम' से युक्त है जो यह साहित्य कभी इतिहास द्वारा तो कभी कल्पना द्वारा विभिन्न इतिवृत्तों में संवेदनाओं के समावेश द्वारा मानव मन मस्तिष्क को भरपूर आह्लाद व बौद्धिक सुख प्रदान करता है। इतना ही नहीं कभी-कभी त्रासदी चित्रण द्वारा कुण्ठित हृदयों का मानसिक उपचार भी करता है तो कभी वह समाज का प्रतिबिम्ब बनकर युगीन यथार्थ को अभिव्यक्त करता है। उसी साहित्य ने कभी महापुरुषों

को गढ़ा तो कभी महापुरुषों ने साहित्य को। इतिहास साक्षी है कि जिन व्यक्तियों ने पुस्तक और पुस्तकालय से नाता जोड़ा उन्होंने विद्वता के बड़े कीर्तिमान रचे हैं। समाज तथा राष्ट्र के साथ ही सम्पूर्ण मनुष्यता के मार्ग प्रशस्त किये हैं। उन्होंने व्यष्टि से समष्टि तक की यात्रा को सार्थक बनाया। जिन्होंने बलिदान का औचित्य और सही मानक प्रस्तुत किया। उन्हीं बलिदानों की नींव पर मानव सभ्यता का महल दैदीप्यमान हो रहा है। साहित्यकार रामवृक्ष बेनीपुरी के शब्दों में सच्चे बलिदान की परिभाषा उनके काव्य संग्रह में संग्रहीत आज तक हमें प्रेरित कर रही है -

बीज जब मिट्टी में मिल जाए वृक्ष तब उगता है हे मित्र!
कलम से स्याही गिरती जाए, पत्र पर उठता जाए चित्र।
नदी नद सब जल के भण्डार चढ़ा देते हैं अपना रक्त।
अहा! तब कहीं मधुरता बूंद, मेघ से पाते वर्षा भक्त।
सफलता पायी अथवा नहीं उन्हें क्या ज्ञात? दे चुके प्राण,
विश्व को चाहिए उच्च विचार यही केवल अपना बलिदान।

यह बलिदान कभी मनुज के प्राणों की आहुति लेकर तो कभी सुकर्मों द्वारा मनुष्यता में प्राण फूंक कर पूर्णता पाता है। इन्हीं बलिदानों की पृष्ठभूमि में पुस्तकीय संसार की भूमिका निस्संदेह रही है। दासता की जंजीरों में जकड़े एक भारतीय ने चार वेद और छः शास्त्रों के अध्ययन और चिन्तन से स्वयं को नरेन्द्र से विवेकानन्द सिद्ध किया और विश्व में भारतीय संस्कृति और धर्म का लोहा मनवाया। किसी ने पुस्तकों से प्रेरणा लेकर पुस्तकें

लिखीं तो किसी के व्यक्तित्व पर पुस्तकें लिखीं गयी। जीवन और पुस्तकों का अन्तःसम्बन्ध मानव सभ्यता की मूलविशेषता है। कभी व्यक्तियों की बुनावटों ने पुस्तकें रचीं तो कभी पुस्तकों ने व्यक्तित्व गढ़े। सदियों से यह गढ़न अनवरत चली आ रही है। इन्हीं पुस्तकीय प्रेरणाओं और सृजन से कोई सूर्यकान्त त्रिपाठी से 'निराला' बन गया तो कोई मोहनदास से महात्मा गांधी। गांधीजी का यह कथन कि उनके सम्पूर्ण व्यक्तित्व का आधार मानस की

दया धरम को मूल है, पाप मूल अभिमान
तुलसी दया न छांड़िए, जब लग घट में प्रान।

पंक्तियां रहीं, जो बालपन में उनकी माँ द्वारा उन्हें सुनाई जाती थीं। पुस्तकीय संसार की महत्ता को प्रतिपादित करती हैं। निःसन्देह पुस्तक और पुस्तकालय के प्रेम ने कितनी ही जिन्दगियों का रूख मोड़ दिया। संघर्षों में तपती जिन्दगियों को हौसला दिया और यह सिद्ध किया कि -

सिर पर चोटें पड़ने पर ही कुछ निर्माण हुआ करता है।
जब संघर्ष हुआ करते हैं, तब कल्याण हुआ करता है।

कवि कमलकार 'कमल'

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Gender discrimination in Indian Law: A distinct perspective

Ms. Mohita Chaturvedi Sharma*

The term gender has been used very vaguely in common language. Sociologically, gender is a term that refers to a social or a cultural distinction associated with the biological entity of an individual. Gender has also been differentiated by sociologist on the basis of former being a social classification of one's identity and presentation of self behavior and interaction with others. Use of gender and its relation with social construct becomes more apparent when it is compared across various cultures. The increase in number of gender studies in sociology has also led to a change in the conceptualization and usage of the term. The structure in all societies is influenced by the social interactions which govern them. These social interactions are made up of inter related and interdependent parts namely status and role. A status is a category or position a person occupies that is a significant determinant of how she or he will be defined and treated. The status of an individual can be either based on individual qualifications or can also be provided by birth, however it is necessary to mention here that every status whether achieved or ascribed is arranged in hierarchy, in accordance with the preferences of the society. A role on the other hand is the expected behavior associated with a status. Roles are performed in accordance with the social norms, which determine the privileges and responsibilities a status possesses. For example, the status of mother calls for expected roles involving love, nurturing, self-sacrifice, home-making, and availability. The status of father calls for expected roles of breadwinner, disciplinarian, home technology expert, and ultimate decision maker in the household. As key components of social structure, statuses and roles allow to organize the lives of members of society in consistent, predictable ways. When normative role behavior becomes too rigidly defined, the freedom of action is often compromised. These rigid

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definitions are associated with the development of stereotypes. The statuses of male and female are often stereotyped according to the traits they are assumed to possess by virtue of their biological makeup. The assignment of negative stereotypes can result in sexism, the belief that the status of female is inferior to the status of male. Sexism is perpetuated by systems of patriarchy, male-dominated social structures leading to the oppression of women. Interestingly, males are also not immune to the negative consequences of sexism, but females are more likely to experience it because the status sets they occupy are more stigmatized than those occupied by males. Not only did they create a divide among the genders, set societal preference of male or female but they also enforced certain ways of behaviors beyond which an individual was not expected to act. For example, in Indian society a man is the bread winner of the family, he is under constant pressure to not only his survival but also for those dependent on him. He is expected not only to earn but earn more than his wife; this is because the society associates power to his financial superiority to an ascribed dominance over his spouse. Similarly, ever since the child is born he or she is given gender specific socialization wherein certain behaviors are associated with a gender while some are not. Boys are expected to be strong, "boys don't cry" is what is commonly heard of. But this kind of an attitude only snatches an individual's right to be expressive and openly communicate his own fears and anxieties. This emphasizes the idea that gender specific roles are biologically determined, hence are not alterable. This perspective has perpetuated the belief that sexism in any form is an inevitable, inescapable fact of history. It has also contributed to the idea of either of the sex being a mediocre; hence justify the secondary status given to them. Thus, these gender stereotypes not only instigate discrimination but also affect individual personality.

Early sociological perspectives related to gender roles evolved from studies on the sociology of the family. These explanations centered on why men and women hold different roles in the family that in turn impact the roles they perform outside the family. To a large extent, this early work on the family has continued to inform current sociological thinking on gender roles. Sociological perspectives on gender also vary according to the level of analysis at which they operate. Macro sociological perspectives on gender roles direct attention to data collected on large-scale social phenomena, such as labor force, educational, and political trends that are differentiated according to gender roles. Micro sociological perspectives on gender roles direct attention to data collected in small

groups and the details of gender interaction occurring, for example, between couples and in families and peer groups.Functionalists emphasize that gender differences and the sexual division of labor contribute to social stability and integration. Feminist approaches reject the idea that gender inequality is natural. Liberal feminists explain gender inequality in terms of social and cultural attitudes, such as sexism and discrimination. Radical feminists argue that men are responsible for the exploitation of women through patriarchy—the systematic domination of females by males. Black feminists identify factors such as class and ethnicity, in addition to gender, as essential for understanding the oppression experienced by nonwhite women.

Gender is one of the most important dimensions of inequality, although it was neglected in the study of stratification for a long time. Although there are few societies in which women have more wealth and status than men, there are significant variations in how women's and men's roles are valued. Gender Inequalities refers to the obvious or hidden disparities among individuals based on the performance of gender. This problem in simple term is known as Gender Bias which in simple terms means the gender stratification or making difference between a girl and a boy i.e. a male or a female. There are many kinds of gender inequality or gender disparity such as natality inequality: In this type of inequality a preference is given for boys over girls that many male-dominated societies have, gender inequality can manifest itself in the form of the parents wanting the newborn to be a boy rather than a girl. Professional or Employment inequality: In terms of employment as well as promotion in work and occupation, Ownership inequality: In many societies the ownership of property can also be very unequal. Even basic assets such as homes and land may be very asymmetrically shared. This type of inequality has existed in most parts of the world, though there are also local variations. Household inequality: There are often enough, basic inequalities in gender relations within the family or the household, which can take many different forms. It is, for example, quite common in many societies to take it for granted that while men will naturally work outside the home, women could do it if and only if they could combine it with various inescapable and unequally shared household duties. This is sometimes called "division of labour," though women could be forgiven for seeing it as "accumulation of labour." The reach of this inequality includes not only unequal relations within the family, but also derivative inequalities in employment and recognition in the outside world. Also

the established fixity of this type of "division" or "accumulation" of labour can also have far-reaching effects on the knowledge and understanding of different types of work in professional circles.Interestingly, the concept of gender inequality and gender discrimination in law is very recent. Until the middle twentieth century women were legally subordinated to men in various ways. This was especially true in case of marriage, wherein legal identity of women were incorporated and consolidated into that of the husband. The identity of a woman was determined on the basis of her relation with the male members of the family. Thus, her individual identity and existence was completely lost. Women were similarly disadvantaged in within the workforce as well; it was always assumed that the women should be paid lower than men even for an identical work. This was justified as women were considered physically weaker than men, hence were not as productive. The jobs were also given gender preference and certain jobs were considered "fit "for women while others for men.

The latter half of the century however witnessed drastic changes in the traditional setup of the society. These changes also influenced the law and the judicial system of India. Various feminist groups, workers and social reformers worked tirelessly to provide for the basic civil rights to the women of the country. With the help of education and equal opportunity the women not only transformed their identity as an individual but were also successful in breaking the stereotype of being oppressed and weak, challenging the norms of the society in every sphere of their social existence. As stated earlier, with the change in society the legal system also witnessed changes. Various articles and laws were amended and new laws were implemented to enforce the idea of equality for women. However, with the increase in legal awareness and education the Indian society also witnessed the emergence of a new trend wherein the women used these laws to harass men. The number of false cases being registered in the non bailable offence under the Anti dowry act, for example shifted the attention of various scholars on the gender discriminating laws of IPC against men. Until now, the women were believed to be the victims of gender inequality and discrimination in law but in-depth study of the Indian Penal code highlights certain instances where the law is discriminatory against men.

To begin with, the Hindu Adoption and Maintenance Act 1956 state that if women petitions for divorce, the husband is bound to provide for her maintenance throughout her lifetime. Only the woman has the right to forego the alimony if she wishes to do so. However, it is equally important

to mention here that the men have no such rights provided in the Indian law; the husband is provided for maintenance but only during the proceeding and pendency of case and that too under special circumstances. Similarly, the act also provides for maintenance of a girl child until the girl is married however only talks of maintenance of a male child until he is 18 years old. After the age of 18, he is supposed to fend for himself. Discrepancies have also been seen in the case of section 497 of IPC which deals with the cases associated with adultery. Under this law, the male involved in a sexual act is considered a convict whereas the married woman is considered as a victim. Adultery can only be defined if the act is consensual, if so why only one party is being punished for the crime. Also, a woman can demand divorce on the grounds of adultery but men are given no such right in the Indian law. Ironically a society which has been predominantly male centric the absence of laws for sexual crime against men highlights the level of incongruity which is being witnessed in law. With the changes in society, social setup and a scenario where the changing traditional roles and statuses are evolving the need for such laws and the removal of such inconsistencies is gradually emerging.There are many provisions made applicable for the protection of the women, which has got recognition from our constitutional law. The biased nature of these laws is evident from that fact that unlike almost all laws in India the burden to prove innocence lies on the accused and this means as soon as the complaint is made by the aggrieved person/ wife, the result is that the husband and his family may be immediately arrested and will be considered as accused in the eyes of law. According to the Section 498-A of the IPC the wife and her parental family can charge any or all of the husband's family of physical or mental cruelty but genuineness of the case has to be looked into by the court as this section is cognizable, non-compoundable and non-bailable in nature.

Cases Filed under 498A and disposed of by Courts

Year	Total Cases pending trail up to that year	Convicted	Acquitted	Withdrawn	Total cases remaining at the end of year	Conviction Rate of Cases under 498A	Average Conviction Rate of all IPC crimes
2007	267600	6831	25791	6364	228614	21.2%	42.30%
2008	293416	7710	26637	7310	251759	22.7%	42.60%
2009	323355	7380	29943	7111	278921	19.9%	41.70%
2010	357343	7764	32987	6601	309991	19.6%	40.70%
2011	387690	8167	32171	7477	339902	20.6%	41.10%
2012	426922	6916	39138	8775	372706	14.4%	38.50%
2013	466079	7258	38165	8218	412438	15.6%	40.20%

(Source: National Crime record Bureau, https://data.gov.in/keywords/crime-india)

The above stated data shows that the number of acquittals has been growing each year under Section 498 A, which deals with cases associated with cruelty against women; such a situation has led to a change in stance not only by the government but also by the judiciary. It is now essential for the police to serve a show- cause notice in case of offences which have the prescribed punishment of less than 7 year. The stated instances show that the legal setup in India has certain loopholes because of which some members of the society suffer. The law serves as a protector and guarantor of human rights to all the members of the society. It ensures all are given a minimal degree of civil rights which provides for a respectable living standard irrespective of any difference.

Similar instances have also been seen in cases associated with Section 354 of IPC which deals with outraging the modesty of a woman. The section states that whoever assaults or uses criminal force to any woman, intending to outrage or knowing it to be likely that he will thereby outrage her modesty, shall be punished with imprisonment of either description for a term which may extend to two years, or with fine, or with both. The term "outraging of modesty" however, is itself open to multiple interpretations. To clarify the ambiguity associated with the above stated law, the court in 2007 offered some explanation; the Supreme Court has finally defined modesty. Its definition: "The essence of a woman's modesty

is her sex." The need to justify the law arise due to an increase in number of cases wherein the women used it to blackmail and trying to get monetary or other gains.

The demand for amendment in the legal system has been slowly rising. The number of cases where the males were framed and the law which is being made to protect the vulnerable has been misused by few to serve their vested interests has been going up steadily. Inequality between men and women can take very many different forms. Indeed, gender inequality is not one homogeneous phenomenon, but a collection of disparate and interlinked problems. The issue of gender inequality is one which has been publicly reverberating through society for decades. In order to examine this situation one must try to get to the root of the problem and must understand the sociological and legal factors that cause this distinction.

Article 14 of the Constitution of India guarantees the right to equality to all the citizens of India. A number of cases have been registered and recorded against the sexual, physical or mental abuse of male. It is not only females who face discrimination but males can face a similar form of oppression. Many females take the advantages of the rights given to her. False abuse the rights given to them and register false cases against the husband and his relatives. Males are sexually abused at work places. The number is increasing day by day. Men cannot be abused is the assumption of the society and that is why they are not ready to accept it. But many males have spoken up about their worst experience of sexual abuse at the work place. The society and law are doing injustice to the male society. In a country where everybody is treated equally and should have a dignified means of life, doing injustice to one section of society and justice to other is not acceptable in the country like India. Hence, a voice should be raised against the sexual abuse of both men and women and inequality should be eliminated from our country.

Indian Constitution provides for positive efforts to eliminate gender inequality; the Preamble to the Constitution talks about goals of achieving social, economic and political justice to everyone, and to provide equality of status and of opportunity to all its citizens. Article 15 of the Constitution provides for prohibition of discrimination on grounds of sex also apart from other grounds such as religion, race, caste or place of birth. Article 15(3) authorizes the Sate to make any special provision. Moreover, the Directive Principles of State Policy also provides various provisions which are for

the benefit of all individuals and provides safeguards against discrimination.Equality is not only restricted to a man or a women alone; it talks of similar standards of living for all in every sphere of life. To bring about a change in the outlook of the society it is essential to treat an individual as a human being rather than associating it with being a male or a female. The future generations need to socialize in such a manner that they respect all human irrespective of any difference. Along with this the law also needs to be reformed in accordance with the changes in the society, to protect against and to provide for equal living standards for all. A humanistic outlook in dealing with issues associated with gender inequality and discrimination is required to promote social wellbeing. The law which has been the same since the colonial era also needs to be reviewed and transformed and amended to ensure equivalent attitude of legal services towards all citizen.

CrossMark

Hierarchically designed PEDOT encapsulated graphene-MnO$_2$ nanocomposite as supercapacitors

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ABSTRACT

A hierarchically designed ternary nanocomposite of PEDOT:Grp-MnO$_2$ was synthesized as an electrode material for high performance supercapacitors. The binary composite of MnO$_2$ nanoparticles decorated over graphene sheets (Grp-MnO$_2$) were synthesized using a facile, one pot solvothermal method. Further, encapsulation of the binary composite was performed by wrapping with the conductive polymer layers of PEDOT. Structural morphology and oxidation states of Mangnese of the nanocomposite were studied using XRD, TEM, Raman spectroscopy and XPS. Supercapacitive behaviour of the nanocomposites was tested by using them as electrodes for electrochemical studies like cyclic voltammetry and charge-discharge. Highest specific capacitance value was found to be 213 Fg^{-1} for the PEDOT:Grp-MnO$_2$ (with the ratio of 1:3) with improved energy and power densities. AC impedance measurement was carried out to ascertain the pseudocapacitance arising from the redox reactions over the electrical double layer capacitance (EDLC) in the composite materials.

1. Introduction

Owing to the changing global scenario towards energy consumption, energy storage has become a primary focus in the world of scientific community. Therefore, the development of sustainable and renewable energy sources is urgently required [1,2]. For all portable electronics, batteries have been the principal choice for energy storage as they can store large amounts of energy in a lightweight and compact structure. However, Electrochemical Capacitors (ECs), also known as supercapacitors, emerged as a complementary energy and power source in the electronics market because of its high power density, fast charge-discharge rates, superior cycle lifetime, safe operation and a simple two-electrode 'sandwich' configuration and high reliability [3–7].

In a supercapacitor, an electrode with appreciable conductivity and a large surface area, accessible to the electrolytic dopant ions, holds the key to its high performance [8–11]. So far, carbon or carbon-based materials such as activated carbon, carbon aerogels, and carbon nanotubes (CNTs) have been extensively investigated as electrode materials for supercapacitors [12,13]. Since 2004, graphene has also immerged as potential carboneous material for supercapacitors, due to its large surface area, desirable electrical

and thermal conductivities, high mechanical stiffness and low manufacturing cost [14,15]. Graphene has attracted considerable attention from the physicists and chemists worldwide not only as energy storage and conversion materials [16,17] but as electromechanical resonators [18], ultrafast electronic and electromagnetic devices [19–22], in bioelectronics, drug delivery [23,24] and sensing [25–27].

The next generation ECs have evolved utilizing transition metal oxides (mainly RuO$_2$, Fe$_3$O$_4$, NiO, and MnO$_2$) as the electrode material for high performance supercapacitors. Due to high energy density, large charge transfer-reaction and pseudocapacitance, they can deliver both desirable power and energy densities.

However, intense interest in MnO$_2$ for battery and supercapacitor has been driven by its high theoretical pseudocapacitance value (1370 Fg^{-1}), low cost, natural abundance and environmental benignity, unlike other metal oxides such as NiO, RuO$_2$ and Co$_2$O$_3$. At high mass loading, agglomeration and poor conductivity of MnO$_2$ (10^{-5}–10^{-6} Scm^{-1}) [28–31] often results in limited performance and thus, hindered its wide applications. In order to overcome these limitations, hybrid nanocomposites of MnO$_2$ incorporated with conducting polymers (like Polyaniline, Polypyrrole, PEDOT) or carboneous materials (like CNTs, graphene)

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were extensively studied, such as CNTs/MnO₂ [32–34], graphene/MnO₂ [35,36], MnO₂/PPy [37], MnO₂/PEDOT [38] and many more [39–47].

The hybrid nanostructures not only benefit from the high conductivity of the carboneous materials or conducting polymers and the high specific capacitance of MnO₂, but from the synergistic effect between them. In order to utilize synergetic effect more effectively, the structure of a hybrid material should be coherently designed with the mass ratios of its components wisely chosen. Thus, the designing and fabrication of ternary hybrid electrode materials has emerged as an effective strategy to promote MnO₂ based high performance supercapacitors in recent research [29,45–47].

MnO₂ exhibits a very rich chemistry and can be synthesized in various crystalline and disordered shapes and sizes, with each of them exhibiting its characteristic physical and electrochemical properties [17,30,48]. Utilizing this fact about MnO₂ nanoparticle chemistry, Yan et al. [49] demonstrated a synthetic route for a ternary composite – MnO₂ nanosheet array/reduced grapheme oxide/PEDOT:PSS), where K-birnessite MnO₂ nanosheet arrays were grown in between graphene sheets, followed by its coating with PEDOT:PSS. Electrochemical studies provided a specific capacitance of 169.1 Fg⁻¹ at a current density of 0.2 Ag⁻¹ for MnO₂/rGO/PEDOT-PSS composite material. Similarly, in another work demonstrated by Yu et al. [29], conductive wrapping of graphene/MnO₂ (GM) was performed to introduce an additional electron transport path. 3D conductive wrapping of graphene/MnO₂ nanostructures with CNTs or conducting polymers led to substantial increment in the specific capacitance with values as high as ~380 F/g.

In the present work, we have utilized a new synthetic approach for the preparation of PEDOT wrapped graphene-MnO₂ ternary nanocomposite, in order to achieve enhancing the device performance of metal oxide-based electrochemical supercapacitors. So far, MnO₂ nanoparticles were synthesized ex situ followed by formation of composite with graphene sheets or PEDOT matrix for the synthesis of nanocomposites. In the present work, we have employed a solvothermal reaction between GO and MnO₂ microspheres to obtain a binary nanocomposite of Graphene-MnO₂ where innumerable MnO₂ nanoparticles generate in-situ and decorate over graphene sheets firmly due to the spiked-shaped MnO₂ microspheres having better anchoring properties. Subsequently, this binary composite was hierarchically upgraded to a ternary composite – Grp-MnO₂:PEDOT, by wrapping it with conductive layers of PEDOT where PEDOT being a conducting polymer offers a right balance of conductivity and charge storage. This offers better specific capacitance value and appreciable power and energy densities for composite in a broadened potential window of −0.6 to +0.6 V. This 3D wrapping approach offers a promising design and direction for optimizing the electrochemical properties of hybrid electrode materials for their encouraging applications in the energy storage devices.

2. Experimental

2.1. Materials

3,4-Ethylenedioxythiophene (EDOT) monomer and Graphite flakes were obtained from Sigma Aldrich. Poly-tetrafluoroethylene (PTFE) was obtained from Aldrich whereas acetylene black was obtained from Alpha Aesar. Hydrazine, KMnO₄, AgNO₃, Na₂H₂PO₂, (NH₄)₂S₂O₈ were the product of Merck.

2.2. Hierarchical synthesis of nanocomposites

2.2.1. Synthesis of Ag-nanoparticles and Ag-assisted MnO₂ microspheres

0.05 M, 40 ml NaH₂PO₂ solution was prepared in deionized water and was added to 0.5 M, 10 ml AgNO₃ solution slowly, under vigorous stirring. NaH₂PO₂ was used as a reducing agent to reduce AgNO₃ to Ag nanoparticles. The mixture was ultrasonicated in a thermostatic water bath at 50° C for an hour, before washing and collecting the yellow precipitates.

MnO₂ microspheres were synthesized by mixing a 0.1 M, 20 ml MnSO₄·H₂O solution with 0.1 M, 20 ml (NH₄)₂S₂O₈ solution. APS will oxidise MnSO₄ to MnO₂. To this added, 8 mg of dried Ag nanoparticles synthesized previously, making its concentration around 1 mM in the resultant reaction mixture. The reaction mixture was ultrasonicated in a thermostatic water bath at 50° C for an hour. The resultant brown precipitates were carefully centrifuged, repeatedly washed with water and dried at 50° C in vacuum oven.

2.2.2. Synthesis of Graphene-MnO₂ binary composite

First, graphene oxide (GO) was synthesized using improved Hummers' method [50]. Graphite powder was treated with KMnO₄ in the presence of H₂SO₄–H₃PO₄ acid mixture under vigorous stirring for 12 h. Once the reaction is complete, the resultant mixture was cooled to room temperature and treated with cold 30% H₂O₂ solution to nullify excess KMnO₄. GO suspension was carefully washed, collected and dried to obtain GO powder.

Different Graphene-MnO₂ nanocomposites were synthesized using the solvothermal technique. To prepare 1:1 composite of graphene and MnO₂, 200 mg of GO was taken in 80 ml ethylene glycol and dissolved well under ultrasonication. 100 mg of MnO₂ microspheres were added to the GO dispersion and again kept under sonication for an hour. After the addition of 0.02 M hydrazine solution (reducing agent) to the reaction mixture, the dark brown solution was transferred to Teflon lined steel autoclave for the solvothermal reaction at 180° C for 12 h. Once the reaction was complete, the black precipitate of graphene-MnO₂ (Grp-MnO₂) was filtered and washed repeatedly with distilled water followed by drying at 60° C.

2.2.3. Synthesis of PEDOT coated Grp-MnO₂ ternary composite

Grp-MnO₂ sheets were coated with the conducting polymer film, by dispersing the monomer in an alcoholic medium. MnO₂ embedded graphene sheets (100 mg) were first dispersed in 10 ml deionized water mixed with 2 ml ethanol and ultrasonicated for an hour. For a 1:1 composite, 100 μl of EDOT monomer dissolved in deionized water with concentrated H₂SO₄ (2 ml) was added to the above solution. The reaction mixture was again sonicated for an hour. To the reaction mixture, 15 ml (0.1 M) of APS was added as an oxidant at 10° C. The reaction mixture was stirred overnight at room temperature. The resulting precipitates (PEDOT:Grp-MnO₂) were centrifuged, washed thoroughly with water and dried at 60° C in vacuum oven.

2.3. Characterization

Morphological and physical characterizations of MnO₂ microspheres and its nanocomposites were carried out using transmission electron microscope (FEI model Tecnei G2 20S with 200 kV accelerating voltage and resolution of 0.2 nm), powdered X-ray diffractrometer (Philips PW 1710) with Cu Kα (λ = 1.5406° A) radiation and Raman spectrometer (Lab Ram HR 800 (Horiba Jobin Yvon spectrometer) with the laser power of 17 mW at the operating wavelength of 632.8 nm. XPS core-level spectra were taken with an Omicron Multiprobe spectrometer (Omicron

NanoTechnology GmbH.) fitted with an EA125 hemispherical analyzer. A monochromated Al Kα X-ray source operated at 150 W was used for XPS. The analyzer pass energy was kept fixed at 40 eV for all the scans.

2.4. Electrochemical measurements

In the electrochemical studies, electrodes were prepared using following procedure: ~85 wt% electroactive materials (i.e. pure MnO$_2$ microspheres, Grp-MnO$_2$ and PEDOT:Grp-MnO$_2$ composites) were mixed with ~10 wt% acetylene black (AB) and ~5 wt% polytetrafluoroethylene (PTFE) to form a thick uniform pest. This pest was then compressed on a stainless steel mesh having the surface area around 1 cm^2. The prepared electrode meshes were dried for 6 h at 60 °C under vacuum. The total weight of the active material in the electrode is usually ~ 8 mg.

Electrochemical measurements of the samples were performed using cyclic voltammetry (CV) (AUTOLAB-30 potentiostat/galvanostat). A platinum electrode and a saturated Ag/AgCl electrode acted as counter and reference electrodes respectively in a three-electrode electrochemical cell. All CVs measurements were performed between −0.6 and 0.6 V making an operating window of 1.2 V at different scan rates. Two-electrode system, having identical electrodes of same electroactive material, was used for galvanostatic charge–discharge cycling and electrochemical impedance studies. Constant current density 1 mA cm^{-2} has been employed for charging/discharging the cell in the voltage range −0.6 to 0.6 V. The discharge capacitance (C) is estimated from the slope of the linear portion of the discharge curve using the expression.

$$C = I(dv/dt) \tag{1}$$

$$C_s = 2C/m \tag{2}$$

where, m is the active mass of the single electrode and C$_s$ represents specific capacitance of the electrode. As an important parameter, power density (P$_d$) and energy density (E$_d$) have been usually used to characterize the electrochemical performance of electrochemical capacitors. To demonstrate the operational characteristics, the energy density (E$_d$) of the capacitor can be expressed as:

$$E_d = 1/2\, C_s V^2 \tag{3}$$

Hence the power density (P$_d$) was calculated as:

$$P_d = E_d/t \tag{4}$$

where, t indicates the discharge time (s). The coulomb efficiency (η) was evaluated using the following relation, where t$_c$ and t$_d$ are the time of charge and discharge respectively:

$$\eta = (t_d/t_c) \times 100\%$$

Electrochemical impedance spectra (EIS) were taken out at open circuit potential over the frequency range 10 kHz to 10 mHz with a potential amplitude of 5 mV. All the electrochemical experiments (i.e. CV, charge–discharge, EIS) were performed in an electrolyte containing 1 M LiClO$_4$ in acetonitrile.

3. Results & discussions

Silver nanoparticles-assisted MnO$_2$ microspheres were grown from MnSO$_4$, using Ammonium peroxodisulphate (APS) as oxidant
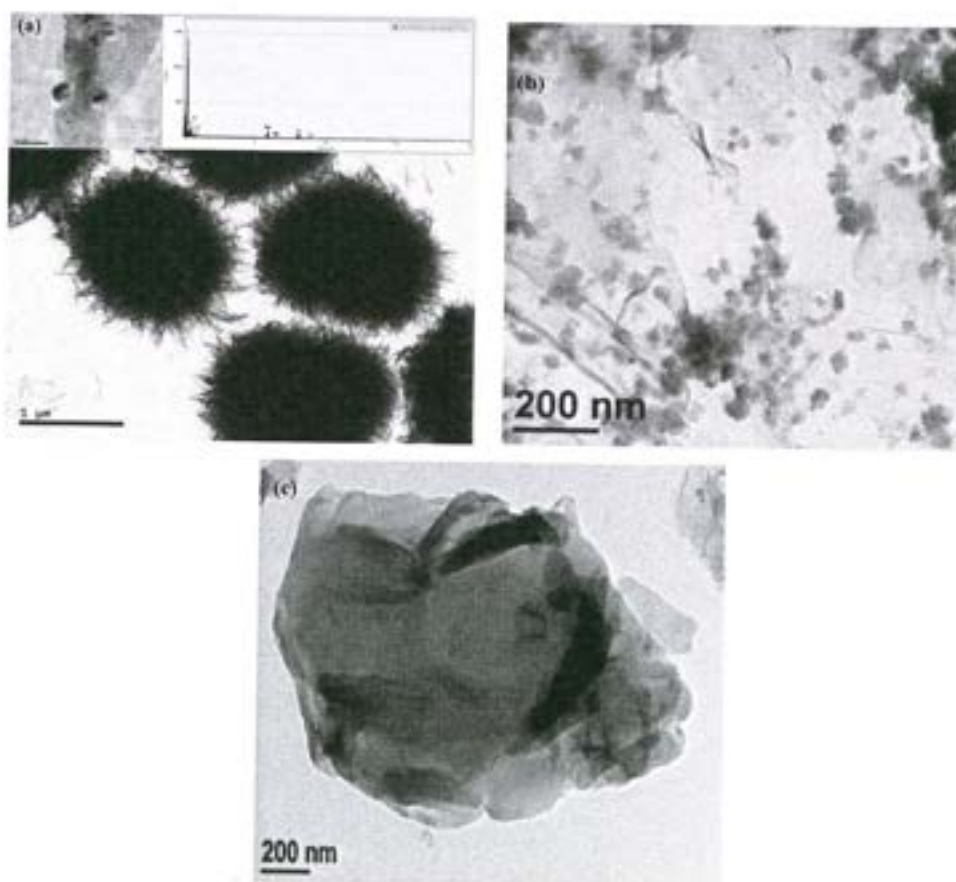
Fig. 1. TEM images of (a) MnO$_2$ microspheres with the inset images of EDAX showing Mn peak and high resolution TEM image for a fringe (spike) of the microsphere showing MnO$_2$ crystal lattices; (b) MnO$_2$ embedded graphene sheet; and (c) PEDOT coated Grp-MnO$_2$.
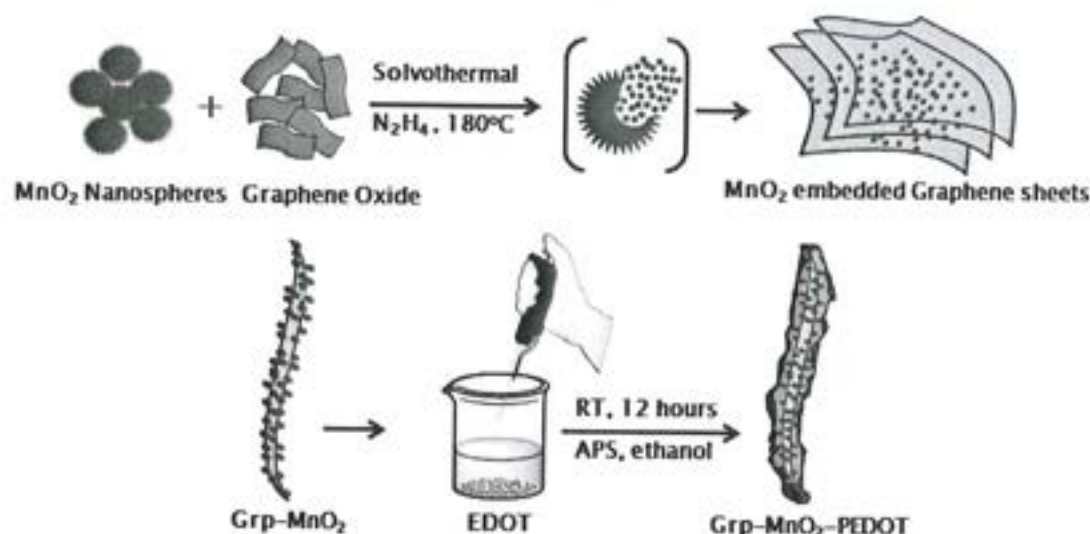
Scheme 1. Stepwise synthesis of Grp-MnO₂ and PEDOT:Grp-MnO₂ nanocomposites.

under sonication. TEM images (Fig. 1) indicate that MnO_2 microspheres are in agglomeration form of nanocrystals, as reported by Meng et al. [51]. Ag-nanoparticles assisted in the minute growth of MnO_2 nanowires around the large crystallite, making it look like a spiked-shaped MnO_2 spheres.

The first step of our hierarchical approach is the *in-situ* generation and distribution of MnO_2 nanoparticles on the graphene sheets. With a presumption that these spiked-MnO_2 microspheres would adhere to the surface of the graphene oxide sheets better than any other shape or structure, graphene oxide (GO) solution was mixed with a relevant amount of MnO_2 microspheres. Once the oxide gets anchored on the GO sheets, the GO-MnO_2 solution was transferred to the Stainless Steel coated Teflon autoclave and allowed to stand at 180 °C for 12 h in the presence of hydrazine (0.02 M), converting it to the Graphene-MnO_2 composite solvothermally. In the second step of this hierarchical route, a 3D conductive wrapping of polymer PEDOT was performed over the binary nanocomposite – Grp:MnO_2 in order to enhance the interconnectivity and electrochemical activity, (as shown in Scheme 1). Requisite amounts of binary composite was dispersed in an alcoholic solution of EDOT monomer and stirred overnight for its polymerisation in the presence of APS as the oxidant. Polymer layers of PEDOT encapsulate the graphene-MnO_2 surface, forming a 3D structure. These binary and ternary nanocomposites were further characterized to understand their physical and electrochemical behaviour.

3.1. Transmission electron microscopy

The spiked-MnO_2 microspheres were synthesized and characterized under transmission electron microscope to establish their shape and structure (Fig. 1a). When MnO_2 microspheres were incorporated with graphene sheets and exposed to high pressure and temperature in an autoclave, the microspheres burst open releasing hundreds of spiked-MnO_2 nanoparticles spreading over the graphene sheets, very clearly seen in the TEM images (Fig. 1b). Further, the TEM image of the ternary composite showed the 3D-conductive layer of PEDOT polymer encapsulating the binary Grp-MnO_2 sheets (Fig. 1c).

3.2. X-ray diffraction studies

The X-ray diffraction studies were carried out for the three samples: graphene sheets, MnO_2 nanoparticles embedded

graphene sheets (Grp-MnO_2) and PEDOT coated Grp-MnO_2 composite as shown in Fig. 2.

The XRD plot for graphene sheets shows a broad hump between the 2θ values of 24–26°, representing the typical characteristic of chemically synthesized few-layered graphene [52]. In the XRD plot of Grp-MnO_2, the 2θ value of 25.16° shows the broad peak for graphene and along with that, it shows some characteristic peaks representing crystalline MnO_2 nanoparticles. The 2θ values at 24.26°, 31.36°, 37.52° and 41.42° represent the 200, 310, 211 and 301 planes of the MnO_2 crystal lattice. After the 3D conductive wrapping of PEDOT, the XRD plot of the ternary composite shows the dominance of the amorphous nature. PEDOT as well as graphene shows an overlapping broad hump at 2θ value of 25.46°. The latter part of XRD plot depicts few peaks for MnO_2 as found in the binary composite [53].

3.3. Raman studies

Raman spectroscopic studies were carried out in order to establish the characteristics of graphitic nature at each step of nanocomposite formation. The Raman spectra (Fig. 3) for all the three samples: graphene, Grp-MnO_2 and PEDOT:Grp-MnO_2 nanocomposite showed D and G peaks at 1340 cm⁻¹ and 1590 cm⁻¹ respectively, significant for the pristine graphitic nature.
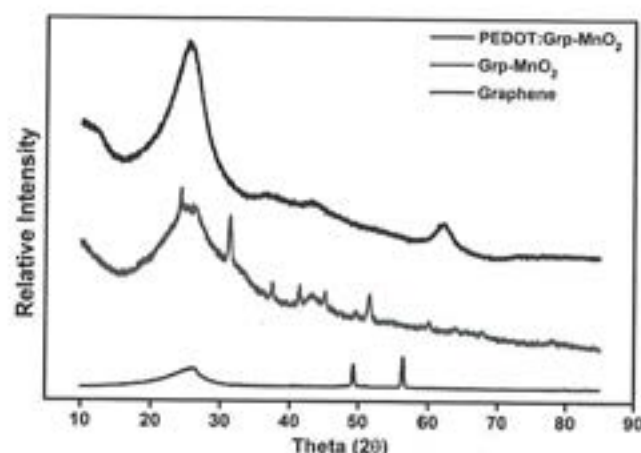
Fig. 2. XRD plots for graphene, Grp-MnO₂ and PEDOT:Grp-MnO₂.
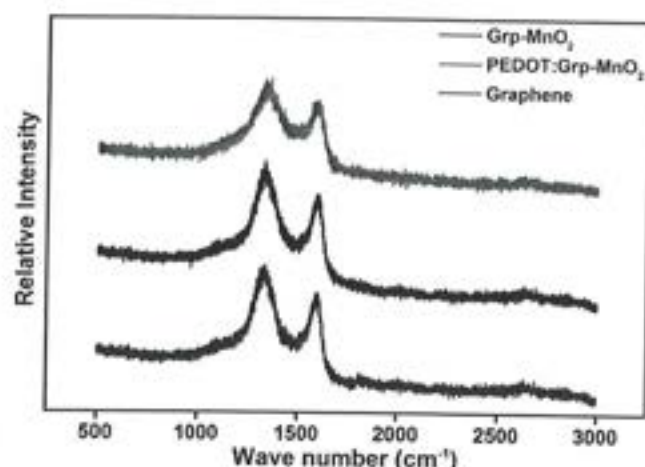
Fig. 3. Raman spectra of graphene, Grp-MnO$_2$ and PEDOT:Grp-MnO$_2$.

The spectra do not show any major changes either in the peak positions or in their intensities for all the samples. This exhibits that graphene has not lost its graphitic characteristics at any step of the synthesis, even after incorporation of MnO$_2$ nanoparticles and PEDOT polymer within the graphene sheets.

3.4. XPS studies

In order to assess the exact valence states of the manganese in the nanocomposite samples which is required to determine their contribution towards the pseudo-capacitance, X-ray photoelectron spectroscopic studies were carried out with Grp-MnO$_2$ and PEDOT: Grp-MnO$_2$ (1:3) nanocomposites The characteristic spectrum of Mn2p$_{3/2}$ for Mn^{+4} in both the nanocomposites are compared in Fig. 4. The de-convolution of the original spectrum shows the presence of two different chemical environments in both the composite materials. The lower energy peak at 640.9 eV for Grp-MnO$_2$ sample and 640.5 eV for PEDOT:Grp-MnO$_2$ sample corresponds to Manganese in 2$^+$ valance state, whereas the higher energy peak at 642.5 eV for Grp-MnO$_2$ sample and 641.9 eV for PEDOT-Grp-MnO$_2$ sample corresponds to Manganese in 4$^+$ valance state. The ratio of the Mn^{4+}/Mn^{2+} in manganese oxides of the composite materials was estimated from the area under the curves are 0.70 and 1.77 for Grp-MnO$_2$ and Grp-MnO$_2$-PEDOT respectively, which revealed the presence of Mn^{4+} in Grp–MnO$_2$ and Grp-MnO$_2$-PEDOT with a percentage of 41% and 64% compared to 100% in pure MnO$_2$ nanoparticles.

During the synthesis of binary nanocomposites, some part of manganese were reduced from 4$^+$ state to 2$^+$ state due to the presence of hydrazine used for the conversion of GO to RGO as evident from the XPS data., APS was used for the oxidative polymerisation of PEDOT from EDOT monomer as oxidant for the synthesis of ternary nanocomposites. During this polymerization, APS also leads to partial oxidation of manganese from 2+ state to 4+ state, resulting increase in the content of Mn^{+4} of in the nanocomposite.

Hence, this difference in percentage ratio of Mn^{4+}/Mn^{2+} in two composite samples can be attributed to the difference in the chemical environments (hydrazine in the binary and APS in the ternary step) present during the synthesis. Contribution towards pseudo-capacitance of the two samples would differ accordingly, on the basis of the Mn^{4+}/Mn^{2+} ratios in the nanocomposite. As Belanger et al. suggested that Mn^{4+} is the most active component responsible for the pseudo-capacitive nature of MnO$_2$ as it exhibits Mn^{4+}/Mn^{3+} redox behaviour [30]. XPS studies also showed (in Fig. 4) that the higher concentration of Mn^{4+} component in the
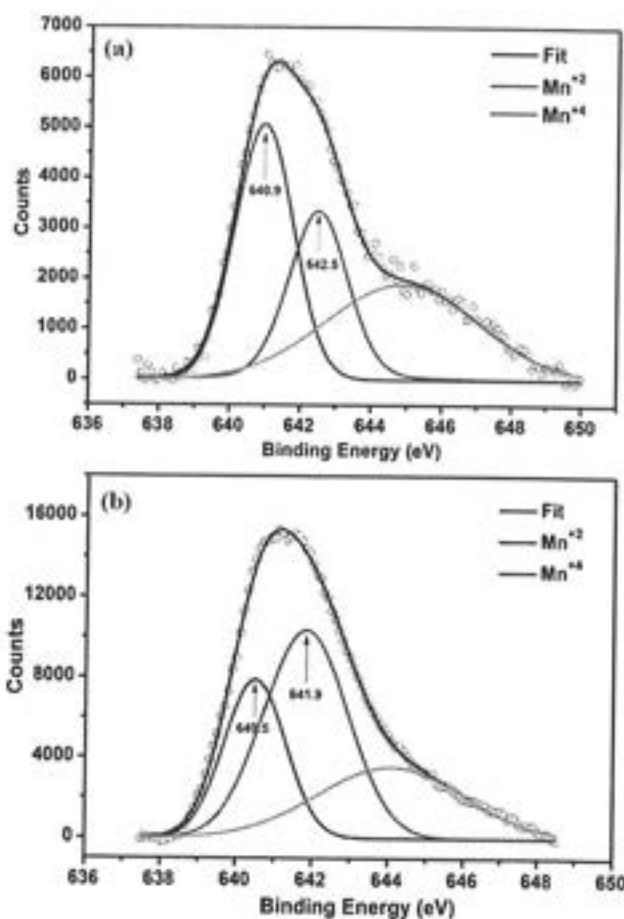
Fig. 4. XPS spectra for (a) Grp-MnO$_2$ and (b) PEDOT:Grp-MnO$_2$ (1:3) nanocomposites.

ternary nanocomposite as compared to the binary nanocomposite is responsible for higher specific capacitance value of the former.

PEDOT:Grp-MnO$_2$ (1:3) composition was used as a typical sample for ternary nanocomposite for XPS analysis.

3.5. Electrochemical studies

3.5.1. Cyclic voltammetric studies

Typical cyclic voltammograms (CV) of all the samples, at a scan rate of 20 mV s^{-1} over the voltage range +0.6 to and − 0.6 V in acetonitrile containing 1 M LiClO$_4$ electrolyte, are shown in Fig. 5. LiClO$_4$ has been used as the electrolyte, because Li$^+$ ions, being the smallest ion, offers better ion movement through the non aqueous solvents. Cyclic voltammograms for all the samples are nearly semi-rectangular in shape with oblique angle, which indicates the good capacitative behaviour of the electrodes suitable for charging and discharging at a constant rate.

The current density of the CV curves for the PEDOT:Grp-MnO$_2$ ternary nanocomposite electrode shows larger values compared to those of the pure MnO$_2$ or Grp-MnO$_2$ binary electrode, indicating higher specific capacitance resulting from the synergistic contribution of electrochemical double-layer capacitance of graphene-PEDOT and the pseudo-capacitance of MnO$_2$. Moreover, the CV curves of the electrodes exhibit nearly a mirror image of current response for the oxidation-reduction half cycles indicating an excellent reversibility.

Different compositions for PEDOT:Grp-MnO$_2$ composites were studied to observe the effect of conductive wrapping density over the binary nanocomposite. The CV curve corresponding to the
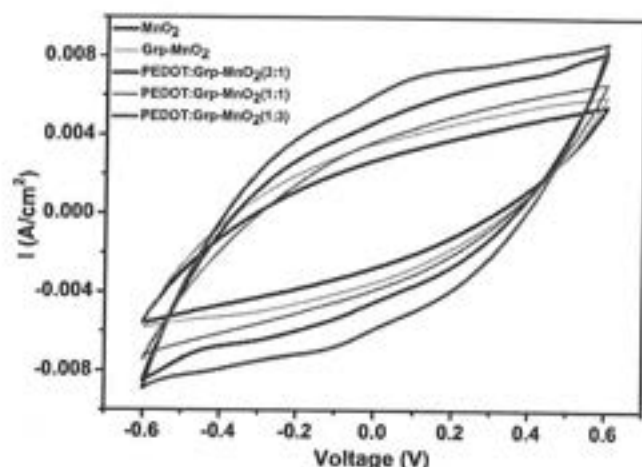
Fig. 5. Cyclic voltammograms for the MnO_2, Grp-MnO_2 and PEDOT:Grp-MnO_2 compositions at a scan rate of 20 mV/s in 1 M LiClO$_4$.

loading of 30% PEDOT as PEDOT:Grp-MnO_2 (1:3) shows better capacitance than that of other two. This implies that an optimal amount of PEDOT layer wrapping over the graphene sheet is essential for getting the better performance of the electrode.

Since the scan rate makes a direct impact on the diffusion of Li$^+$ into the electrodes, the cyclic voltammograms of PEDOT:Grp-MnO_2 composite (1:3) was studied well at different scan rates of 5, 10 and 20 mVs^{-1}, as shown in Fig. 6 At high scan rate, the Li$^+$ ions will mainly approach the outer surface of the electrode while at low scan rate the cations can approach the deep pores of the electrodes and has more contribution towards total capacitance value.

3.5.2. Galvanostatic charge-discharge studies

Fig. 7 represents the galvanostatic charge–discharge curves of MnO_2, Grp-MnO_2 and PEDOT:Grp-MnO_2 nanocomposites. Specific capacitances of different electrode materials were compared at a constant current density of 1 mAcm^{-2}. The specific capacitance of the electrode materials can be calculated from galvanostatic charge–discharge curve using the Eqs. (1) and (2). The galvanostatic charge-discharge curves of MnO_2 microspheres show the specific capacitance of 71.4 Fg^{-1} at a current density of 1 mAcm^{-2}. But after the fragmentation of the MnO_2 microspheres into
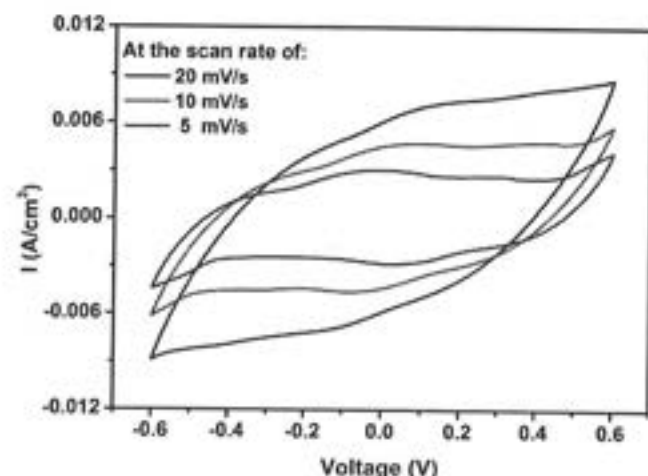
Fig. 6. Cyclic voltammograms for PEDOT:Grp-MnO_2 (1:3) at various scan rates of 5, 10 and 20 mV/s in 1 M LiClO$_4$.
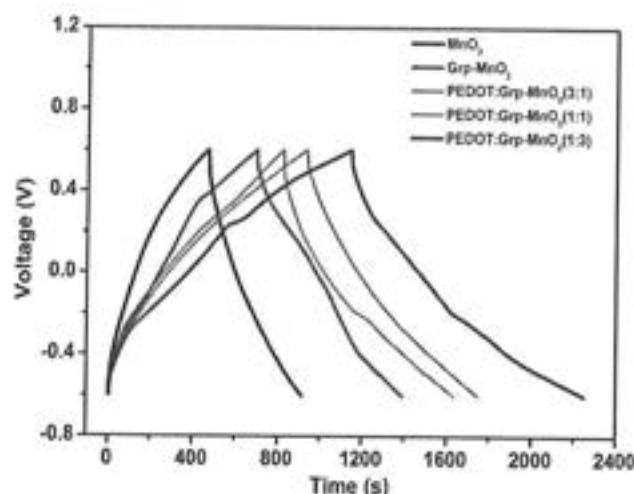
Fig. 7. Charge-discharge curves for the MnO_2, Grp-MnO_2 and PEDOT:Grp-MnO_2 at a constant current density of 1 mA/cm^2 in 1 M LiClO$_4$.

nanoparticles, the specific capacitance for Grp-MnO_2 composite showed a significant increase with the value of 135 Fg^{-1} due to better surface area exposure of MnO_2 nanoparticles over the vast graphene sheets. It can be seen that the charge–discharge profiles are quasi-symmetric and curved lines which enumerate the pseudo-capacitive behaviour of the material. The value of specific capacitance obtained by charge–discharge and CV technique were found to be comparable.
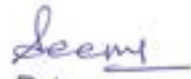
After the wrapping of conductive PEDOT layerover the Grp-MnO_2 nanocomposite, PEDOT polymer offered a synergistic effect through better inter-connectivity within MnO_2 nanoparticles and graphene, resulting in a significant increase in the value of capacitance of the electrode. In order to understand the effect of optimum coating of polymer layer required over Grp-MnO_2 composite, the specific capacitance value of three different compositions are measured for the PEDOT:Grp-MnO_2 nano-composite, based on the composition ratio of PEDOT: (Grp-MnO_2) as 3:1, 1:1 and 1:3. The respective values are found to be 145 Fg^{-1}, 151.5 Fg^{-1} and 213 Fg^{-1}. This suggests that 1:3 composition ratios in the ternary composite, i.e with 30% PEDOT loading over MnO_2 embedded graphene sheets, is found to be the optimum loading for best supercapacitor performance.

The energy density (E_d) and the power density (P_d) of the capacitor are also calculated for all the electrode materials using the relations in the Eqs. (3) and (4) respectively. The energy density of pure MnO_2, Grp-MnO_2 and PEDOT:Grp-MnO_2 (1:3) are 14.3 Whkg^{-1}, 27 Whkg^{-1} and 45.6 Whkg^{-1} respectively. The power densities further calculated for the three samples was found to be 115 Wkg^{-1}, 135.2 Wkg^{-1} and 159.7 Wkg^{-1} respectively.

3.5.3. Electrochemical impedance analysis

One of the principal methods examining the fundamental behaviour of electrode materials for supercapacitor is electrochemical impedance study. Nyquist impedance spectra of pure MnO_2 microspheres along with all the composites over a frequency range of 10 kHz–10 mHz with a potential amplitude of 5 mV are shown in Fig. 9. The total impedance of the supercapacitor comprises of electronic and ionic contributions. The electronic contribution comes from the intrinsic electronic resistance of the particles and the interfacial resistance between electrode and current collector. The ionic contribution comes from the ionic (diffusion) resistance of ions moving in small pores.

The typical EIS plot is composed of a semi-circle at high frequencies, which is related to Faradaic reactions and the linear
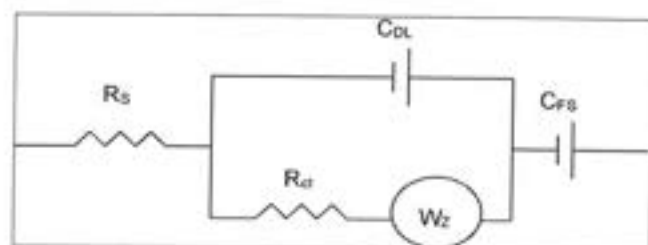
Fig. 8. Schematic representation of Randles equivalent circuit.
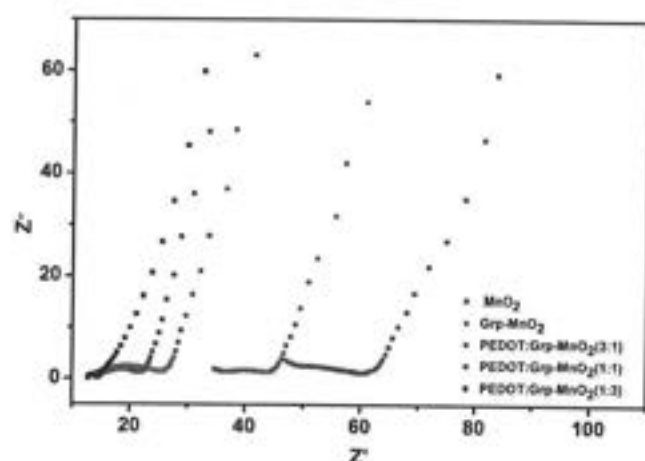
Fig. 9. Nyquist plots for the MnO$_2$, Grp-MnO$_2$ and PEDOT:Grp-MnO$_2$ over a frequency range of 10 kHz–10mHz with a potential amplitude of 5 mV.
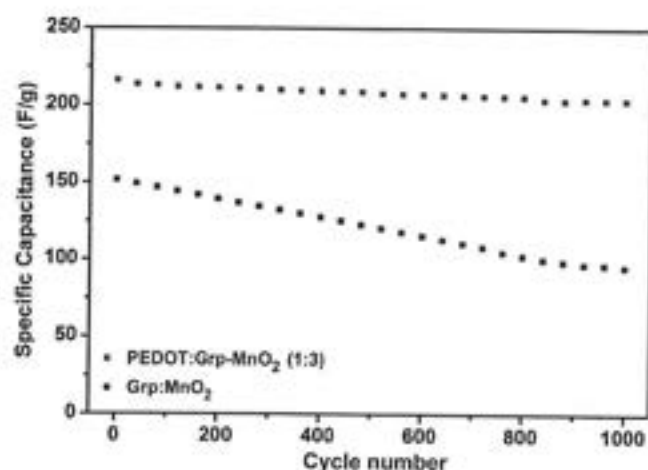
Fig. 10. Cyclic stability of PEDOT:Grp-MnO$_2$ vs. Grp-MnO$_2$ for 1000 cycles.

curve at the low frequency region that can be attributed to the diffusion controlled process in the electrolyte. The high-frequency intercept of the semi-circle on the real axis represents the solution (electrolyte) resistance (R$_s$), and the diameter of the semi-circle (Z')

represents the charge-transfer resistance (R$_{ct}$) over the interface between the electrode and electrolyte. Electrochemical impedance spectra were analyzed using semi-quantitative fittings programme supplied (AUTOLAB-30) based on the Randles equivalent circuit modelling shown in Fig. 8.

Where, the internal resistance R$_s$ is in series with the electrical double layer capacitance (C$_{dl}$) at the interface of electrode and electrolyte. C$_{dl}$ is in parallel with the charge transfer resistance (R$_{ct}$) and Warburg impedance (W$_Z$). The Warburg impedance is a result of the frequency dependence of ion transport in the electrolyte. The above set is in series with pseudo-capacitance (C$_{FS}$), which is used to account for the faradaic reaction.

The smaller Warburg region for the PEDOT:Grp-MnO$_2$ (1:3) than that of MnO$_2$ or Grp-MnO$_2$ (in Fig. 9) clearly indicates less obstruction of the ion movement and a lower ion diffusion resistance, thus implies a better charge propagation and ion response of the composite. Also, the semicircle in the high frequency range is minimum for the PEDOT:Grp-MnO$_2$ (1:3) composite, which corresponds to a smaller charge transfer resistance (R$_{ct}$) caused by the Faradic reactions and the double-layer capacitance (C$_{dl}$) on the electrode surface.

In brief, the MnO$_2$ nanoparticles embedded graphene sheets, constructed a moderate network for ions and electrons flow, where PEDOT:Grp-MnO$_2$ composites (especially with the composition ratio of 1:3) constructed a highly conductive 3D current collector and provided an open architecture for fast transportation of ions and electrons throughout the whole electrode matrix.

To understand the cyclic stability of the electrode material for its commercial use, the discharge capacitances were recorded at a current density of 1 mAcm^{-2} for 1000 cycles. PEDOT:Grp-MnO$_2$ (1:3) nanocomposite showed a slight decrease in its specific capacitance value (~11%) over 1000 cycles compared to first cycle (Fig. 10).

For the better understanding of the work, Table 1 summarizes the values obtained for the specific capacitance, energy and power densities calculated for various compositions (% loadings for MnO$_2$PEDOT and graphene) in the samples.

Hence, the obtained results suggest that the ternary composite would serve as a better electrode material for symmetric super-capacitor cell, in a wide operating voltage window of 1.2 V, as compare to binary Grp-MnO$_2$ or MnO$_2$ nanoparticles.

4. Conclusions

A hierarchically designed ternary nanocomposite – PEDOT:Grp-MnO$_2$ was synthesized in order to harness their synergistic properties and enhance the electrochemical behaviour. To understand the optimum loading of conducting polymer over MnO$_2$ embedded graphene sheets, three different compositions for PEDOT:Grp-MnO$_2$ (3:1, 1:1 and 1:3) were synthesized. The samples were characterized using XRD, TEM and Raman spectra, to establish their morphology and chemical environment. Cyclic voltammetric plots were nearly semi-rectangular in shape with oblique angle, depicting the good capacitative behaviour of the electrodes suitable for charging and discharging at a constant rate

Table 1
List of Specific Capacitance, energy and power density values for various compositions of samples.

Sample	% MnO$_2$	% Graphene	% PEDOT	Sp. Cap. (F/g)	E$_d$ (Wh kg^{-1})	P$_d$ (W kg^{-1})
MnO$_2$	100	–	–	71.4	14.3	115
Grp-MnO$_2$	20	80	–	135	27	135.2
P:G-MnO$_2$ (3:1)	6	24	70	145	–	–
P:G-MnO$_2$ (1:1)	10	40	50	151.5	–	–
P:G-MnO$_2$ (1:3)	14	56	30	213	45.6	159.7

over the wider voltage window of 1.2 V. Comparative XPS studies for the Grp-MnO$_2$ and PEDOT-Grp-MnO$_2$ (1:3) sample suggested the possible mechanism for the improvement in the supercapacitive behaviour of the ternary nanocomposite. The ratio of the Mn^{4+}/Mn^{2+} in manganese dioxide of the composite materials, estimated from the area under the curves, were found to be 0.70 and 1.77 for Grp-MnO$_2$ and PEDOT-Grp-MnO$_2$ (1:3) respectively. Charge–discharge as well as AC impedance studies performed in 1 M LiClO$_4$ electrolyte at a constant current density of 1 mA cm^{-2} suggested that PEDOT:Grp-MnO$_2$ (1:3) ternary nanocomposite was the best suitable electrode material for supercapacitor having the highest value of (213 Fg^{-1}) as compared to MnO$_2$ microspheres (71.4 Fg^{-1}) and Grp-MnO$_2$ (135 Fg^{-1}). Furthermore, the energy and power densities were calculated to be 45.6 Whkg^{-1} and 159.7 Wkg^{-1} respectively, for the best ternary nanocomposite. Also, the cyclic reversibility and stability of the ternary composite showed a very small attenuation over 1000 cycles in the widened operation window of 1.2 V, hence making the ternary composite – PEDOT:Grp-MnO$_2$ (1:3) – a promising, safe and cost-effective electrode material in the future development of supercapacitor applications.

Acknowledgements

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Clinical Implications of Single-Cell Microfluidics for Hematological Disorders

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Label-Free and Nondestructive Separation Technique for Isolation of Targeted DNA from DNA–Protein Mixture Using Magnetic Au–Fe$_3$O$_4$ Nanoprobes

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ⓢ Supporting Information

ABSTRACT: The interest in DNA–protein-based diagnostics has recently been growing enormously, which makes the separation process of DNA or protein from a cell extract extremely important. Unlike the traditional separation process, a novel approach is in demand which can nondestructively isolate the target biomolecules without sacrificing the other components in the mixture. In this study, we have demonstrated a new and simple separation technique by using well-established bifunctional Au–Fe$_3$O$_4$ nanocomposites as the separation nanoprobes to efficiently isolate the specifically targeted nanomolar concentrated DNA over 70% from its associate DNA–protein mixture in the presence of a magnetic field. The sensing accuracy of both as-separated DNA and protein are quantitatively examined by UV–vis spectroscopy, and then qualitatively validated by gel analysis. Results obtained in this study clearly demonstrated that this newly developed separation procedure not only provides the efficient separation for the targeted DNA but can also maintain the bioactivity of as-separated protein and DNA solutions. The superiority of this technique can open an avenue to establish a label-free and nondestructive platform for a wide variety of biomolecule separation applications.
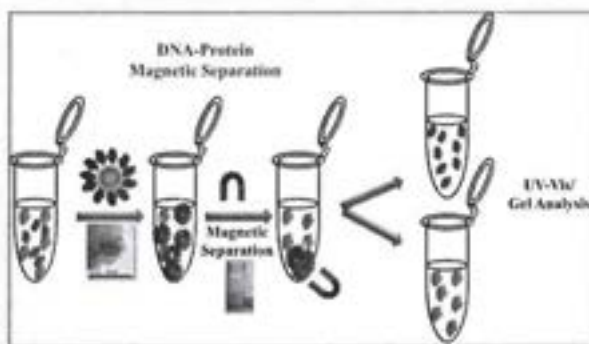
Magnetic nanocomposites containing two or more different nanoscale functionalities have been extensively employed due to their wide variety of potential applications.[1−4] With the controlled synthesis and proper modification, these nanocomposites can exhibit novel physical and chemical properties that will be essential for biomedical applications, especially the highly sensitive and selective sensors and separators.[5−8] Among them, Au nanoparticles and their various nanocomposites with iron oxides have been widely used for sensitive biodetection as well as separation of DNA and proteins.[3] This is not only because of the soft acid–soft base interaction between gold and thiol groups of various biomolecules, which are capable of specifically recognizing biological substances, but also due to their exceptional optical properties and biocompatibility.[9,10] More recently, applications of Au–Fe$_3$O$_4$ nanocomposites to disease diagnosis,[11,12] magnetic resonance imaging,[13] targeted drug delivery,[14] DNA separation,[15] and protein separation[16] have been reported because of the uniqueness of these suitably synthesized and bifunctionalized magnetic gold–iron oxide nanocomposites.

Extraction of purified proteins and DNA from different cell components is a very crucial and demanding procedure for biological applications. Therefore, the separation and purification of proteins, DNA, or RNA in a nondestructive process has become highly essential in proteomics and genomics. Generally, in most of the biological laboratories, the target of interest, such as DNA, RNA, and proteins, is isolated and purified from the cell extract after sacrificing the other cell components by gel electrophoresis for proteins[7] or DNA extraction protocol for DNA and RNAs.[17] Sometimes, it would be equally important to maintain the bioactivity of other cell components in the cell extract as the same as the target of interest for further analysis.[18] For DNA–protein mixtures, the cell extract of the targeted species usually contains severely degraded DNA, which is not applicable for the most commonly used polymerase chain reaction (PCR) methods for gene sequencing. To overcome this limitation, nondestructive methods with short-chained oligomers as probe are thus urgently needed to effectively separate targeted DNA fragments and/or proteins without damaging the other cell component. More recently, a

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nondestructive protein separation technique using Ni^{3+} as the probe, after tagging with six histidine residues as the label in their protein of interest, has been developed.[2] Among many current protocols, metal–chelate affinity chromatography is one of the most frequently used techniques for separating recombinant proteins,[19–21] where an NTA-attached resin is employed to immobilize nickel ions (Ni^{2+}) for the separation of recombinant proteins that are engineered to have six consecutive histidine residues (6× His). Although these processes are completely nondestructive, the labeling of target biomolecules is usually needed and takes a relatively long operational time, making the separation process tedious and hectic. Moreover, the bioactivity of DNA after the protein separation is seldom examined and validated. To obtain all the separated bioactive components, therefore, a new and simple nondestructive method should be developed for targeted DNA, which is almost unexplored in biocomponent separation techniques in DNA–protein mixtures. This makes the separation process free from the hectic histidine prelabeling methodologies.

According to the requirement of our present work, we needed such kind of bifunctional material which can specifically bind with DNA through an easy process. Thus, gold becomes an automatic choice due to its thiol conjugation property. In addition, the probe also requires strong magnetic property for separation, where the Fe_3O_4 is the most reliable and well-studied in recent science. Successful combination of these two materials, $Au–Fe_3O_4$, therefore comes in our mind to serve as the desired bifunctional nanocomposite. The magnetic $Au–Fe_3O_4$ nanocomposites can be used as the binder and carrier to anchor the short-chain thiol-conjugated oligomers as well as single-stranded DNA (ssDNA) to build the desired nanoprobe. It can possess the unique optical property, biocompatibility, and superparamagnetic property inherited from the individual components, and all of these properties would highly enhance the potential applications.[22–24]

The main purpose of this study is to develop a nondestructive separation technique for the isolation and identification of DNA from the associated DNA–protein mixture by $Au–Fe_3O_4$ nanocomposites. Lysozyme was chosen as the target protein for DNA–protein separation because of its excellent stability at the relatively high annealing temperature of 71 °C.[25] Scheme 1 shows the fabrication of $Au–Fe_3O_4$-based nanoprobes and the separation procedures of DNA–protein mixtures. The $Au–Fe_3O_4$ nanocomposites are synthesized by coprecipitation followed by the citrate reduction. The nanocomposites were then incubated in the thiol-linked ssDNA solutions to form the nanosensing probes via gold–thiol chemistry.[26] The bifunctional $Au–Fe_3O_4$ nanocomposites possess the following advantages: (1) the Au nanoparticles on the Fe_3O_4 surface can strongly bind with thiol-linked ssDNA to build a robust DNA nanoprobe, (2) the nanoprobe can easily capture the targeted DNA from a solution containing DNA–protein mixture by shortening the enrichment time and achieving a high recovery efficiency, and (3) a very simple and rapid magnetic separation of DNA from the mixture of DNA–protein can be conveniently performed using an external magnetic field. The separation procedures are successfully applied to human serum samples also, spiking with the same protein and DNA concentrations. To the best of our knowledge, this is the first report on a label-free nondestructive separation process of DNA from a DNA–protein mixture in serum using simple magnetic nanoprobes. To establish the

Scheme 1. (A) Schematic Illustration of the Preparation of the DNA Separation Nanoprobes [Nanoprobe 1(NP-1) and Nanoprobe 2 (NP-2)] and (B) Diagram of the DNA–Protein Separation by the Synthesized Nanoprobes (NP-1 and NP-2)
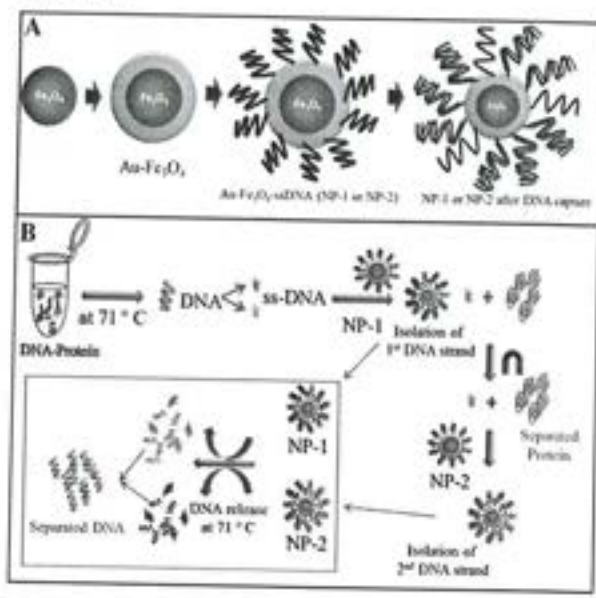
efficiency of the process, the as-separated DNA and protein are validated by gel electrophoresis and Bradford assay. We believe that the nondestructive nature of this proposed method can open an avenue to establish a new platform for a wide variety of biomolecule separation applications in the near future.

■ EXPERIMENTAL SECTION

Chemicals. All the chemicals were of analytical grade and were used as received without further purification. Lysozyme protein and different oligomers for the preparation of DNA protein mixture solution were purchased from Sigma. Chemicals for the synthesis of Fe_3O_4 and $Au–Fe_3O_4$ nanocomposites including $FeSO_4$, $FeCl_3$, and $HAuCl_4$ were all supplied by Sigma-Aldrich. Trisodium citrate was purchased from Merck. Deionized water was used throughout the experiments unless otherwise mentioned.

Preparation of Fe_3O_4 Nanoparticles. For the preparation of Fe_3O_4 nanoparticles, the standard procedure of coprecipitation was followed.[27] In brief, $FeCl_3$ (anhydrous) and $FeSO_4 \cdot 7H_2O$ at a molar ratio of 1:2 were dissolved in deionized water under nitrogen atmosphere and stirred for 30 min using a magnetic stirrer. A total of 1.5 mol of NH_4OH was added slowly to increase the pH up to 8, and then the mixture continued to react for another 2 h. The resulting Fe_3O_4 nanoparticles were centrifuged, dried, and purified repeatedly by magnetic separation to eliminate unreacted compounds. The Fe_3O_4 nanoparticles were then dried under vacuum at 60 °C and stored for further analysis.

Preparation of $Au–Fe_3O_4$ Nanocomposites. For the preparation of $Au–Fe_3O_4$ nanocomposites, 0.25 g of the synthesized Fe_3O_4 nanoparticles was added into 25 mL of boiling water under vigorous stirring conditions. After 10 min, 35 μL of 2 mM $HAuCl_4$ and 300 μL of 100 mM trisodium citrate were added into the mixture. The whole solution was boiled and stirred for 15 min until the color changed from black

to red.[28] Then, the mixture was centrifuged and washed with distilled water for several times and finally with ethanol. The resulting product was vacuum-dried and collected. As a control, Au nanoparticles were also synthesized from $HAuCl_4$ by the standard reduction process using trisodium citrate as the reducing agent in the absence of Fe_3O_4 nanoparticles.

Characterization of Au–Fe₃O₄ Nanocomposites. The transmission electron microscopy images and energy-dispersive X-ray spectroscopy (EDS) spectra were taken by using a JEOL JEM-2010 transmission electron microscope (TEM) at 200 kV. Powder X-ray diffraction (XRD) analysis of samples was conducted using a PANalytical diffractometer operating with a radiation source of Cu Kα filtered through a graphite monochromator (λ = 1.54 Å) at 40 kV and 30 mA. The scanning range was from $20°$ to $80°$ 2θ with a 0.05° step width and a 30 s counting time for every step. Magnetic measurements were carried out on a superconducting quantum interference device (SQUID) magnetometer of a Lakeshore-7400 vibrating sampling magnetometer having sensitivity of the order of 10^{-6} emu. In addition, the optical properties of Au nanoparticles and Au–Fe₃O₄ nanocomposites were determined by a Jasco V650 UV–vis spectrophotometer (Tokyo, Japan). The hydrodynamic diameters of Au–Fe₃O₄ nanocomposites in aqueous solutions were determined by dynamic light scattering (DLS) with a Zetasizer Nano ZS (Malvern Instruments Ltd., U.K.).

Preparation of DNA Solution. A calculated amount of Tris buffer was added to a DNA container to get the concentration of 1 mM. The DNA concentration was further diluted to 2 μM to serve as the stock solution for the experiment. Exact concentrations of the DNA solutions were further verified by the absorption value at 260 nm in UV–vis spectra.

The following 51 mers DNAs (oligonucleotides) (Sigma, Germany) were used in this study:

ssDNA-1: 3'-HS-TGT-CTC-GTA-ATC-GCG-TTC-CAC-TAA-AAA-GAA-GAA-CGC-GAT-AAC-GTC-CTC-TTG-5'.

ssDNA-2: 3'-HS-ACA-GAG-CAT-TAG-CGC-AAG-GTG-ATT-TTT-CTT-CTT-GCG-CTA-TTG-CAG-GAG-AAC-5'

Target DNA:

5'-TGT-CTC-GTA-ATC-GCG-TTC-CAC-TAA-AAA-GAA-GAA-CGC-GAT-AAC-GTC-CTC-TTG-3'
3'-ACA-GAG-CAT-TAG-CGC-AAG-GTG-ATT-TTT-CTT-CTT-GCG-CTA-TTG-CAG-GAG-AAC-5'

Preparation of Lysozyme Protein and DNA–Protein Solutions. A protein solution was prepared by dissolving 21.13 mg of lysozyme protein in 2 mL of 10 mM Tris buffer. The exact concentration of protein was determined from the absorption of UV–vis spectra at 280 nm. The DNA–protein mixture was prepared by adding 2 μM of 1 mL target DNA (having no thiol group at the end) into 2 mL of the above-prepared lysozyme protein solution under well-mixed conditions. This mixture can be mimicked to the simplified cell extract solution, and the optical property of the DNA–protein mixture was further examined by using UV–vis spectra that showed a peak at 268 nm.

Designing the Sensor Probes (Nanoprobes). Two nanoprobes, nanoprobe 1 (NP-1) and nanoprobe 2 (NP-2), were prepared by conjugating Au–Fe₃O₄ nanocomposites with DNA 1 and DNA 2, respectively:

Nanoprobe 1 (NP-1): Au–Fe₃O₄-3'-HS-TGT-CTC-GTA-ATC-GCG-TTC-CAC-TAA-AAA-GAA-GAA-CGC-GAT-AAC-GTC-CTC-TTG-5'.

Nanoprobe 2 (NP-2): Au–Fe₃O₄-3'-HS-ACA-GAG-CAT-TAG-CGC-AAG-GTG-ATT-TTT-CTT-CTT-GCG-CTA-TTG-CAG-GAG-AAC-5'.

The above-mentioned nanoprobes were fabricated by incubating 1 mg of Au–Fe₃O₄ nanocomposites into two different solutions containing 1 mL of 10^{-6} M thiol-linked ssDNA-1 and ssDNA-2, and then allowed to settle for 10 min to form NP-1 and NP-2, respectively. The solution was separated by putting a magnet at the bottom of the container to recover the magnetic Au–Fe₃O₄-based NP-1 and NP-2.

Separation of DNA–Protein Mixture. To separate the target DNA from the DNA–protein mixture, the mixture was first incubated at the melting temperature of duplex DNA, 71 °C, for 10 min to completely denature double-stranded DNA (dsDNA) according to the recommendation from the manufacturer. In addition, the melting points for different mixtures of duplexes were practically measured by UV–vis spectroscopy. The different duplexes of ssDNA were mixed in equimolar ratio (1 μM), and the UV scan is monitored in the temperature range of 50–95 °C. After the melting of dsDNA, NP-1 was added to the mixture and the solution was gradually cooled down to room temperature to obtain the maximum binding with the first strand of DNA. The NP-1 attached with DNA was then magnetically isolated by applying an external magnet. Since the ssDNA can either bind with NP-1 or reform to its native dsDNA form, the separation process of the first strand from the mixture was magnetically repeated for five times with fresh NP-1 to get the maximum separation efficiency. In each cycle, the quantity of reformed original DNA decreased to half of its portion because of the equal possibility of the first strand to bind to NP-1 or to the second strand of the original DNA.

After five cycles of separation with NP-1, supernatant was then incubated with complementary NP-2, and then the second strand of target DNA was separated magnetically. The rest of the solution containing protein only was cooled down slowly to retain its native state. Then, the complementary ssDNA onto NP-1 and NP-2 was dispersed separately in the buffer solutions and heated to 71 °C for desorption to obtain the free ssDNA in the solution. Subsequently, these ssDNAs were recaptured to each other to form the original dsDNA. The UV–vis measurements were performed at each separation step to determine the obtained concentration of DNA and protein in solution.

Analysis of Separated Protein. Bradford protein assay was carried out to detect the presence as well as bioactivity of lysozyme.[29] The polyacrylamide gel electrophoresis (PAGE) was performed to examine the purity of the separated protein by preparing 6% polyacrylamide gel [37.5:1, acrylamide/bis(acrylamide)] in 1× Tris/borate/EDTA (TBE) buffer solution at pH 8.3.[30] The parent DNA protein mixture, separated lysozyme protein (molecular weight of 14.3 kDa), and the residues of isolated DNA (where no protein was expected to be present) were blotted in the gel with the addition of three supporting lanes [bare nanoprobe as negative control, pure lysozyme as positive control, and a standard protein marker, SM 0431 (Thermo Scientific Pierce)]. In addition, each solution was analyzed using UV–vis spectroscopy to confirm the results.
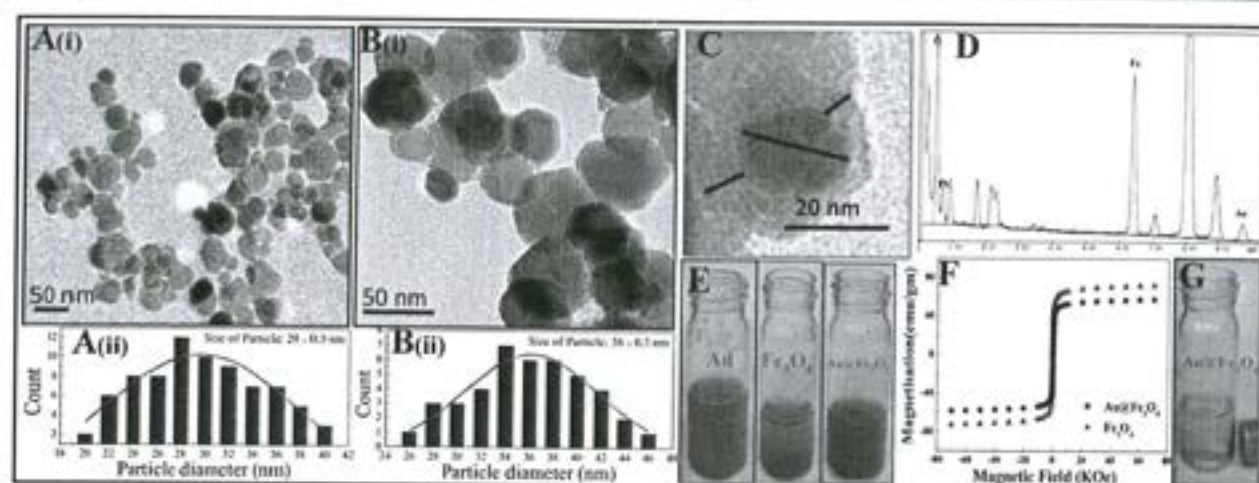
Figure 1. Characterizations of Au−Fe₃O₄ nanocomposites: TEM images of (A(i)) Fe₃O₄ nanoparticles and (B(i)) Au−Fe₃O₄ nanocomposites with their corresponding particle size distribution profile in panels A(ii) and B(ii), respectively, (C) HR-TEM image of Au−Fe₃O₄ nanocomposites, (D) EDS spectra of the Au−Fe₃O₄ nanocomposites, (E) color comparison among Au solutions, as-synthesized Fe₃O₄ nanoparticles, and Au−Fe₃O₄ nanocomposites, (F) magnetic property measured by SQUID, and (G) magnetic behavior by external magnetic field of Fe₃O₄ nanoparticles and Au−Fe₃O₄ nanocomposites.

Analysis of Separated DNA. The purity of the separated DNA was further analyzed in the 15% polyacrylamide DNA gel electrophoresis and stained with EtBr.[31] The stock DNA solution along with different negative and positive controls (bare nanocomposites, NP-1, and NP-2) were also examined to verify the separation process. An ultra-low-range DNA ladder from 10 to 300 bp (SM 1211, Sigma) was used as the DNA marker.

DNA−Protein Mixture in Human Serum. The applicability of the nondestructive separation technique was examined in human serum. An amount of 2 mL of 75% human serum, diluted with PBS buffer containing 200 μg/mL BSA, 0.5 M NaCl, 500 μg/mL dextran, and 0.5% Tween 20, was spiked with 2 μM of 1 mL target DNA and lysozyme protein solution to prepare the 1:1 mixture of DNA and protein. The separation of DNA from DNA−protein mixture in human serum was performed using the above-mentioned procedure in deionized water.

RESULTS AND DISCUSSION

Characterizations of Au−Fe₃O₄ Nanocomposites. The Au−Fe₃O₄ nanocomposite is already well-established as an excellent probe for biomolecule detection and magnetic separation over the past decade, as presented in Table S1. However, the Au−Fe₃O₄ could fulfill the requirements of the current work for the thiolated DNA capture and magnetic separation property; we have synthesized it followed by a coprecipitation process for the new application of nondestructive separation. The morphology as well as magnetic property of Au−Fe₃O₄ nanocomposites was examined first. Parts A(i) and B(i) of Figure 1 show the typical TEM images of bare Fe₃O₄ nanoparticles and Au−Fe₃O₄ nanocomposites, respectively. The Fe₃O₄ nanoparticles are in the range of 20−40 nm with an average diameter of 29 ± 0.5 nm. After treatment with HAuCl₄, the diameter of the resulting nanocomposites increases up to 26−46 nm with mean particle size of 36 ± 0.5 nm [Figure 1B(ii)], presumably due to the formation of a shell layer of Au onto the surface of Fe₃O₄ nanoparticles. As shown in the high-resolution transmission electron microscopy (HR-

TEM) image, the core−shell type Au−Fe₃O₄ nanoparticle with a 5−8 nm layer of Au on the 20 nm Fe₃O₄ nanoparticle is clearly formed (Figure 1C). During the preparation procedure, the gold precursor (HAuCl₄) was first adsorbed onto the surface of Fe₃O₄ nanoparticles, and then reduced to Au nanoparticles in the presence of mild reducing agent, which can generate a shell layer of gold instead of individually separated Au nanoparticles onto the surface of core Fe₃O₄. The incorporation of Au in the nanocomposite is also identified from EDS spectra (Figure 1D) and clearly shows the peak of Au along with that of Fe. In addition, the color of as-prepared Au−Fe₃O₄ nanocomposites is totally different from that of the pure gold and Fe₃O₄ solution (Figure 1E). The original colors of Fe₃O₄ nanoparticles and Au solutions are gray-brown and red-purple, respectively, while the resulting nanocomposite of Au−Fe₃O₄ turns into reddish brown, clearly indicating the successful fabrication of Au−Fe₃O₄ with the inherited colorimetric characteristic property of gold nanoparticles.

The hydrodynamic diameter as well as the dispersivity of Au−Fe₃O₄ nanocomposites was determined by DLS, and then compared with that of as-prepared Fe₃O₄ nanoparticles. As shown in Figure S1, the hydrodynamic diameters of as-prepared Fe₃O₄ nanoparticles are in the range of 250−520 nm with the mean diameter of 372 nm. The polydispersity index (PDI) is 0.331. After addition of the Au shell, the mean hydrodynamic particle size of Au−Fe₃O₄ decreases to 178 nm with a PDI of 0.243, clearly indicating that coating with the Au layer onto the core Fe₃O₄ surface can minimize the agglomeration and the particle size, due to the successful coating of gold. Several studies have synthesized the homogeneously dispersed Fe₃O₄ and Au−Fe₃O₄ in aqueous solution and found that the particle sizes of Fe₃O₄-based nanomaterials increase obviously when transferred to aqueous solution.[32−34] A previous study has found that the hydrodynamic diameters of Au@Fe₃O₄ yolk−shell nanoparticles increased from 8−15 nm in nonaqueous solutions to 256−468 nm in aqueous solutions.[34] In this study, our Au−Fe₃O₄ nanocomposites are in the range of 110−300 nm with mean diameter of 178 nm, clearly showing that the gold coating can reduce the magnetic effect as well as

agglomeration of Au—Fe$_3$O$_4$ core—shell nanocomposites, which is quite satisfactory for the separation application.

Magnetic measurements of the as-prepared Fe$_3$O$_4$ and Au—Fe$_3$O$_4$ nanocomposites show a high value of magnetic moment at room temperature (300 K), and the saturation magnetizations of as-prepared Fe$_3$O$_4$ nanoparticles and Au—Fe$_3$O$_4$ nanocomposites are 71.7 and 58.6 emu/g, respectively (Figure 1F). The strong magnetic moment of Au—Fe$_3$O$_4$ nanocomposites makes the magnetic separation effective under the external magnetic field. As shown in Figure 1G, particles are accumulated on the wall within a few seconds upon placement of a magnet besides the vials containing Au—Fe$_3$O$_4$ nanocomposite suspensions, leaving the rest of the solution transparent, which is in good agreement with other Au—Fe$_3$O$_4$ nanocomposites with various morphological characterizations.[34–36]

The optical property and crystallinity of Au—Fe$_3$O$_4$ nanocomposites were further characterized by UV—vis spectroscopy and XRD, respectively. Figure 2A shows the UV—vis absorption
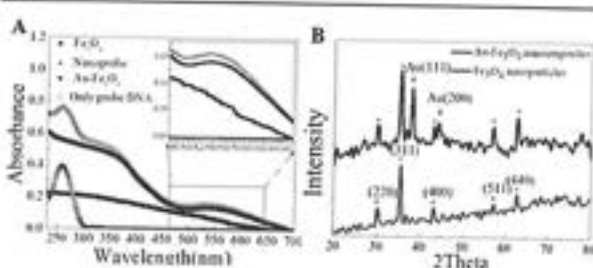
Figure 2. (A) UV—vis spectra of bare Fe$_3$O$_4$, probe DNA solution, Au—Fe$_3$O$_4$ nanocomposites, and DNA-attached Au—Fe$_3$O$_4$ nanocomposites (nanoprobes) and (B) XRD patterns of Fe$_3$O$_4$ and Au—Fe$_3$O$_4$ nanocomposites. * means the standard XRD peaks of Fe$_3$O$_4$.

spectra of the as-synthesized Fe$_3$O$_4$ nanoparticles and Au—Fe$_3$O$_4$ nanocomposites. The 0.2 mg/mL aqueous Au—Fe$_3$O$_4$ nanocomposites show a broad absorption peak at 530 nm, which represents the typical surface plasmon resonance (SPR) peak of Au.[37,38] However, no obvious SPR absorption peak is observed for the as-prepared Fe$_3$O$_4$ nanoparticles, proving again the successful incorporation of Au on the Fe$_3$O$_4$ nanoparticles. In addition, the optical property of a pure 1 μM DNA solution was examined, and a distinct peak at 260 nm is characterized. After the successful synthesis of nanoprobes (NP-1 and NP-2) by combining Au—Fe$_3$O$_4$ with ssDNA probe, two distinct peaks at 260 and 530 nm are clearly observed, indicating the successful attachment of DNA on the gold-coated nanoprobe surface.

Figure 2B shows the XRD patterns of Au—Fe$_3$O$_4$ nanocomposites along with that of bare Fe$_3$O$_4$ nanoparticles. The position and relative intensity of all the diffraction peaks are matched well with standard Fe$_3$O$_4$ nanoparticles (JCPDS no. 85-1436).[39] After coating with Au nanoparticles, peak positions of Fe$_3$O$_4$ remain unchanged compared with those of as-synthesized Fe$_3$O$_4$ nanoparticles. In addition, two distinct sharp peaks of Au at 38.18° and 44.09° 2θ, which can be assigned as (111) and (200) planes in the Au—Fe$_3$O$_4$ nanocomposites, are observed.[10] The diameter of Au—Fe$_3$O$_4$ nanoparticles, calculated from the (111) plane reflection using the Scherrer formula, is 35 nm, which is perfectly corroborated with the results of TEM images.

Separation of DNA and Protein. The DNA portion in DNA—protein mixtures was annealed by heating to 71 °C followed by the addition of NP-1 and NP-2 in sequence, as described in the Experimental Section. In addition, the actual melting temperatures of duplexes are determined by the derivative of UV absorption spectra. As shown in Figure S2, the duplex of target DNA is slowly deformed to its single-stranded form during the melting process and the peak intensity increases rapidly, and then reaches the maximum absorption intensity at 71 °C. When ssDNA-1 and ssDNA-2 are physically mixed, the maximum absorption intensity occurs at 71.5 °C, clearly showing that 71 °C is the optimized melting point of the target DNA duplex.

Figure 3 shows the UV—vis spectra of the DNA—protein mixture before and after the separation of DNA by nanoprobes.
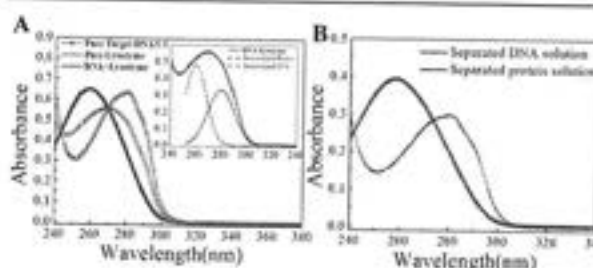
Figure 3. UV—vis spectra of (A) target DNA, pure lysozyme protein, and stock DNA—protein mixture (inset is the deconvoluted spectra of individual DNA and protein from DNA—protein mixture) and (B) separated DNA and protein solutions after separation with nanoprobes.

In addition, spectra of stock DNA—protein solution are deconvoluted by a Gaussian method to obtain the contribution of the individual DNA and protein in the mixture. As shown in Figure 3A, pure lysozyme protein (blue) has a sharp peak at 280 nm because of the presence of tryptophan in the protein moiety, while the pure target DNA gives a peak at 260 nm (red). After mixing lysozyme protein with DNA solution, a broad hump at 268 nm (black) is observed. It is noteworthy that the intensity of DNA at 260 nm is too high compared to that of protein solution, which partially masks the peak contribution of protein at 280 nm in the DNA—protein mixture spectrum. Therefore, the 268 nm DNA—protein hump is deconvoluted to obtain the individual contribution of DNA (dashed violet line) and protein (dashed black line) in the mixture solution (shown in the inset of Figure 3A). From this deconvolution, we ideally find that the optical density (OD) of the DNA—protein mixture of 0.55 contains protein solution with an OD of 0.34 and DNA solution with an OD of 0.48.

The Au—Fe$_3$O$_4$-based NP-1 and NP-2 can obtain the quantitatively excellent separation efficiency of DNA from the DNA—protein mixture. As shown in Figure 3B, the protein in the supernatant solution (blue) gives a sharp peak at 280 nm with an OD of 0.3 after separation with both nanoprobes. The dsDNA solution, recombined from the ssDNA of NP-1 and NP-2 (deep green), also gives a sharp peak at 260 nm with an OD of 0.39. It is noteworthy that the peak intensities of protein and DNA solutions after separation decrease slightly when compared to those of previously deconvoluted peaks of the pristine mixture. However, the total peak areas under the curve before and after the separation remain almost the same, clearly indicating the complete separation of target DNA by NP-1 and

NP-2. The concentration of DNA is calculated by the ratio of the absorbance at 260 nm divided by the reading at 280 nm for the DNA before and after separation. In both cases, the ratio is found to be near 2.0, which indicates the good quality of the DNA. It is noteworthy that the NP-1 and NP-2 can be further recycled and reused for another separation process only for similar DNA.

The sensitivity of the nanoprobe is one of the important indicators to evaluate potential applications for real samples, which can be obtained by the comparison of the areas of DNA and protein before and after the separation. Figure S3 shows the UV–vis spectra of DNA–protein mixtures with various concentrations of DNA and lysozyme before and after the separation. It is clear that the nanoprobe developed in this study can successfully separate more than 70% of the DNA when the initial DNA concentration is 2 μM. The separation efficiency decreases to 55% with the decrease in DNA concentration to 100 nM. It is noteworthy that the identification of separated DNA becomes difficult when the initial DNA concentration goes down to 10 nM, which indicates that the separation sensitivities of the nanoprobes are restricted in the range of several tens of nanomolar to micromolar DNA. Since the DNA concentration in a cell extract is usually in the micromolar range, the separation sensitivity found in this method is good enough for its practical application. Previous studies have shown that biomolecules including DNA, RNA, and peptide nucleic acid could be isolated from the different oligomeric mixtures by synthesized magnetic nanoparticles.[40] However, the labeling of analytes for effective recognition is needed, which makes the separation process complicated. In this study, the procedure developed is label-free, which is the main advantage over those previously reported methods. In addition, the melting temperature of 71 °C is confirmed here for the DNA denaturation step. Therefore, this technique can give the best results for thermally stable proteins, which can maintain their bioactivity at relatively high temperature.

Identification of the Separated Protein. The Bradford protein assay (Coomassie blue G-250) was used as an instant method to examine the existence and activity of the separated protein. In the presence of protein, the color of Coomassie blue G-250 solution will turn from the originally brown color into a blue color, while the solution in the absence of protein will leave the color of Coomassie blue G-250 unchanged.[41] As shown in Figure 4A, the blank control of buffer solution only shows the brown color (vial 1), and then turns into blue when pure protein solution is analyzed (vial 2). In addition, blue color is also observed for DNA–protein mixture (vial 3) as a positive control. After the separation of DNA from the mixture, a prominent blue color of the extracted protein solution (vial 4) and the nearly colorless of DNA solution (vial 5) confirm the successful separation and the retained bioactivity of protein.

Polyacrylamide gel electrophoresis is further carried out to examine the purity of the separated protein from the DNA–protein mixture. As shown in Figure 4B, SM 0431 marker is used here as a standard protein marker in lane 1. Bare Au–Fe₃O₄ nanocomposite solution containing neither protein nor DNA is used as the negative control (lane 2). In addition, the original 2 μM lysozyme protein solution (lane 3) is spotted as a positive control. After the gel electrophoresis, the DNA–lysozyme protein mixture is also marked at the same position in lane 4. It is noteworthy that the intensity of the mixture solution is slightly lighter than that of the pure protein solution
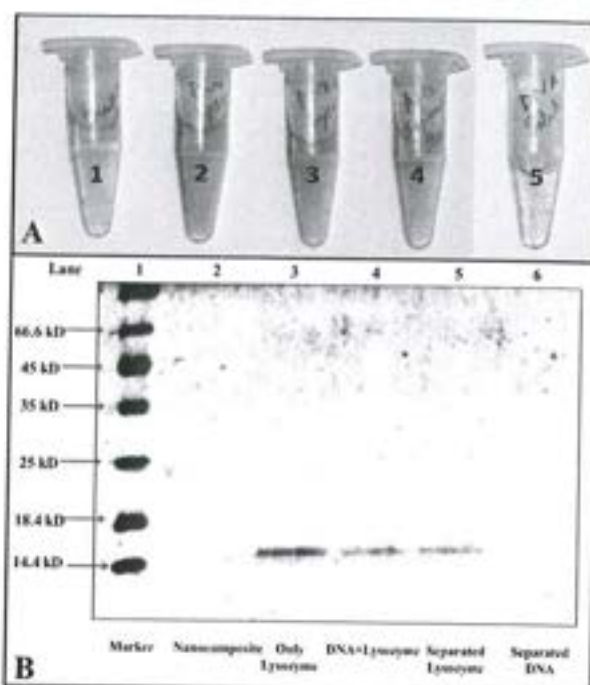
Figure 4. (A) Bradford protein assay of the separation efficiency of DNA–protein mixture: vial 1, the Coomassie blue G-250 solution; vial 2, 2 μM lysozyme protein solution; vial 3, stock solution of 2 μM lysozyme protein and 2 μM DNA mixture; vial 4, separated protein solution after complete DNA separation; vial 5, DNA solution after separation. (B) SDS–PAGE analysis of the separated protein: lane 1, protein marker; lane 2, bare Au–Fe₃O₄ nanocomposite solution; lane 3, pure lysozyme protein solution; lane 4, DNA and lysozyme protein mixture solution; lane 5, separated lysozyme protein solution; lane 6, residual DNA solution in the absence of protein.

(lane 3) due to the fact that the presence of DNA molecules dilutes the concentration of protein solution. After the magnetic separation of DNA from the mixture, the remaining solution gives the almost same position compared to lane 4, indicating the presence of the protein in the solution (lane 5). As the protein gets separated from the mixture, its concentration remains low when compared to that of pure lysozyme, which leads to a faded spot at lane 5. In addition, the DNA solution after separation is run for gel electrophoresis and no spot is found in lane 6, clearly demonstrating that the nanoprobes have completely bound to both ssDNA at 71 °C without any protein contamination. These results clearly indicate that 14.3 kDa lysozyme protein can be effectively separated and collected from the mixture. The similar results between the Bradford protein assay and SDS–PAGE protein gel electrophoresis again confirm the successful separation of protein from the DNA–protein mixture by functionalized nanoprobes (NP-1 and NP-2) through a completely non-destructive process.

Identification of the Separated DNA. The separation process and the efficiency were again cross-checked from the characterization of the separated DNA solution. In order to monitor the activity and purity of the separated DNA, gel electrophoresis with 15% polyacrylamide was used (Figure 5). Lane 1 in the Figure 5 (starting from right) corresponds to the marker DNA ladder, SM 1211, which is preferable for 10–300 base pair short-oligonucleotides DNA, whereas lane 2 contains pure duplex DNA as positive control, which gives a sharp band
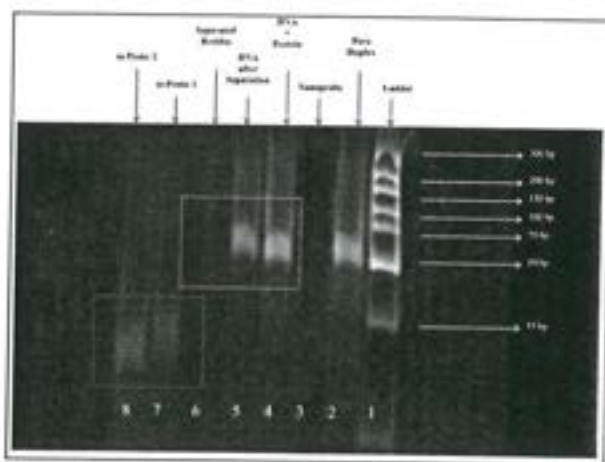
Figure 5. DNA polyacrylamide gel electrophoresis: lane 1, marker lane; lane 2, pure DNA duplex as positive control; lane 3, nanoprobes as negative control; lane 4, DNA–protein mixture; lane 5, separated DNA solution; lane 6, separated protein solution; lanes 7 and 8, probe DNA 1 and DNA 2. Images were scanned in the same session with identical settings. Images were cropped and adjusted for color balance and brightness using Adobe Photoshop.

Figure 6. UV–vis spectra of separated DNA and lysozyme from DNA–protein mixture in human serum after using the separation technique developed in this study. The inset is the deconvoluted spectra of individual DNA and protein from DNA–protein mixture in human serum.

nearly at 55 bp. Lane 3 shows the bare Au–Fe₃O₄ nanocomposite solution as a negative control. The separation procedures are mainly analyzed in lanes 4–6 (yellow box). After mixing the duplex DNA with the lysozyme protein solution, the same band located at the almost similar position in lane 4 is observed when compared to that of pure duplex DNA (lane 2). The separated DNA solution from the DNA–protein mixture also produces a similar spot position in lane 5, confirming again the successful separation of DNA from the mixture. The supernatant protein solution after the DNA separation is also run in the gel (lane 6), where the blank lane proves the complete separation of DNA from DNA–protein mixture. Since the DNA molecules were separated by copious numbers of washing and magnetic process, some portions of DNA may be lost after separation, and therefore, the peak intensity in the separated DNA band would be reduced slightly.

For additional investigation, we have also run the two ssDNA probe solutions (NP-1 and NP-2) into the gel in lanes 7 and 8 (green box) as the control. The faint bands show almost double the distance with respect to that of dsDNA. Since the nanoprobes are single-stranded, they travel almost double the distance in the gel because of the half molecular weight. In addition, the band intensity reduces largely, attributed presumably to the poor intercalation of EtBr into the single strand of nanoprobes. The DNA gel analysis proves that the developed separation technique is highly efficient for the separation of DNA with a target DNA from the DNA–protein mixture solution by a nondestructive process. The bioactivity of DNA and protein, shown by UV–vis and gel analysis, distinctly corroborates with each other, confirming the success of separation of our developed technique.

Separation of DNA from DNA–Protein Mixture in Human Serum. To evaluate the applicability of nondestructive separation technique in real samples, DNA–protein mixture was spiked into human serum followed by the same procedure of deionized water to isolate DNA. The UV–vis spectra of the DNA–protein mixture as well as separated DNA and protein in human serum were carried out to elucidate the separation efficiency. As shown in Figure 6, the NP-1 and NP-2
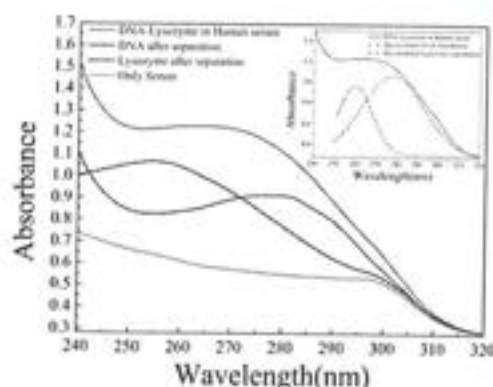
nanoprobes can specifically attach the target DNA from the DNA–protein mixture in human serum matrix. The separated DNA shows a clear peak at 260 nm, while the protein in the supernatant of human serum gives a characteristic peak at 280 nm after separation with both nanoprobes. Compared with the DNA and protein peak intensity before and after the separation in deionized water (Figure 3), the peaks in the human serum are relatively broad with low intensity. However, the areas under the peaks of separated protein (57.34% of the total peak of DNA–protein) and DNA (39.11%) in deionized water are almost corroborated with the deconvoluted peak area of the individual protein (54.31%) and DNA contribution (42.61%) of the DNA–protein mixture (inset of Figure 6). This result clearly indicates that the human serum does not show much matrix effect on the label-free and nondestructive separation technique developed in this study, which can be applicable to the real serum sample for DNA separation from complex DNA–protein solutions.

■ CONCLUSIONS

In this study, we have demonstrated a new class of separation technique using well-established magnetic Au–Fe₃O₄ nanocomposites for isolation of DNA from a mixture of DNA–protein. The Au–Fe₃O₄ nanocomposite conjugated with thiol-linked ssDNA leads to a significantly improved performance on nondestructive DNA separation compared to the conventional separator of biomolecule separation. For optimization of the separation protocol, thermally stable lysozyme protein of 14.3 kDa and a specific sequence of 51 mers bases DNA are used. We have demonstrated this separation technique as a primary footstep in a very important and widely used biological DNA–protein separation process as a nondestructive approach. The effective separation measured by UV–vis spectra is double-checked by two-way gel analysis (DNA and protein gels). Most importantly, this process not only provides the efficient separation but can also maintain the bioactivity of biomolecules after separation. To develop the potential use in separation assays for cell extracts, the separation process was optimized in human serum sample and found excellent efficiency which can open a new avenue to the biotechnological and biomedical fields for isolation of precious cell extracts without loss of any cell components. Efforts are being made to modify the present system to eliminate the denaturation step by some other factors

instead of heating in order to apply this technique to the less thermally stable proteins as well as the long-lengthened DNA as the platform for a general pathway of cell components separation.

■ ASSOCIATED CONTENT

ⓢ Supporting Information

The Supporting Information is available free of charge on the ACS Publications website at DOI: 10.1021/acs.analchem.7b03095.

> Comparative table of Au–Fe$_3$O$_4$ applications, DLS of bare Fe$_3$O$_4$ and Au–Fe$_3$O$_4$ nanocomposites, melting temperature analysis of DNAs, and separation of different concentrations of DNA from DNA–protein mixtures by UV–vis spectra (PDF)

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Notes

The authors declare no competing financial interest.

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Research Article

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Blue Green Algal Flora of Alwar (Raj) India

Ritu Jain* and P. K. Jain

Abstract
The present treatise reports 7 taxa, representing 5 families from three orders Chamaesiphonales, Pleurocapsales and Stigonematales, collected from district Alwar of Rajasthan State. All of these are first report from Alwar. Whereas, 5 of these are first reports from the State of Rajasthan.

Keywords
Algae, Chamaesiphonales, Pleurocapsales and Stigonematales

Introduction

Alwar is among the greener areas of otherwise dry state of Rajasthan. Luxuriant growth of algae can be witnessed during rainy and winter seasons. The algal flora is dominated by blue greens. It is followed by green algae. Extensive survey of Blue greens was undertaken and over 290 taxa were isolated and studied. Among blue greens, order Nostocales was the most dominant followed by Chroococcales. Earlier Jain *et. al.* (2011, 2012) reported 53 taxa of Chroococcales from Alwar. There was poor representation of Chamaesiphonales, Pleurocapsales and Stigonematales. *Westiellopsis prolifica* was the single member of Stigonematales. Two genra *Dermocarpa* and *Stichosiphon* with one species each represented Chamaesiphonales. Pleurocapsales included two families i.e. Pleurocapsaceae with a single genus *Myxosarcina* with two species and Hyellaceae with two genera *Hyella* and *Hydrococcus* with one species each.

Materials and Methods

Algal samples were collected fortnightly. Most of these samples were studied in living state. Samples were preserved in 4% formalin. Identification of taxa was based on Cyanophyta by Desikachary (1959).

Observations

Following species from the three orders namely, Chamaesiphonales (Family Dermocarpaceae),

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Pleurocapsales (Family Pleurocapsaceae &and Hyellaceae) and Stigonematales (Family Stigonemataceae) were identified

Dermocarpa flahaultii Sauvageau

Desikachary, Cyanophyta, p. 174-175, pl. 33, figs. 18-19, 1959.

Plate 1, Fig 1.
Place of Collection: Jaisamand (On *Oedogonium*)

Plants in groups, forming a layer, oval or spherical, without stalk; sporangial wall upto 3 μm thick, irregularly lamellated; endospores many, spherical, 3-4 μm broad, sporangia 18-26 μm in diameter.
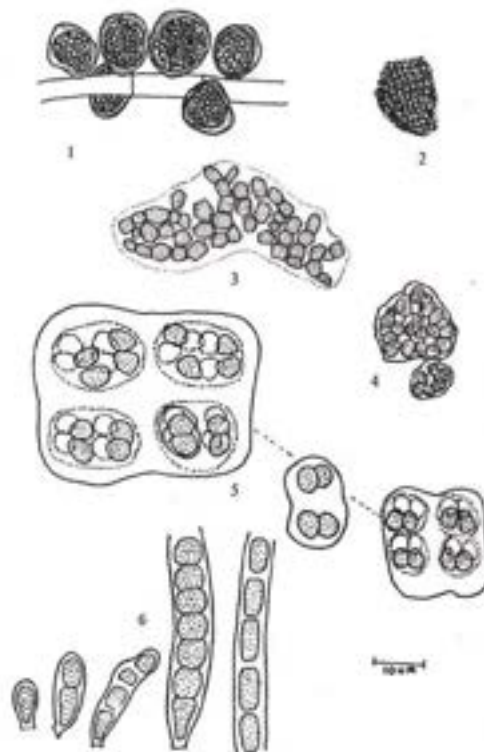
Plate 1. (Figs 1-6). 1. *Dermocarpa flahaultii* 2. *Myxosarcina burmensis* 3. *Hydrococcus rivularis* 4-5. *Myxosarcina spectabilis* 6. *Stichosiphon sansibaricous*

Stichosiphon sansibaricous (Hieron) Drouet et Daily

Desikachary, Cyanophyta, p. 176-177, pl. 32, figs. 9-13 and pl. 33, figs. 8-10, 1959.

Plate 1, Fig 6

Place of collection – Jaisamand

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rivularis. Westiellopsis prolifica of the Stigonemataceae of the order Stigonematales was the other member from Alwar.

The members of these orders from other parts of Rajasthan include *Myxosarcina concinna* from Sambhar lake (Subbaramiah 1972). From Jodhpur, Srivastav and Nigam (1979) reported *Haplalosiphon welwitschii*, *H. intricatus*, *Westiellopsis prolifica* and *Stigonema hormoides*. Nigam (1980) added two more members *Hapalosiphon flagelliformis* and *H. hibernicus*. From Udaipur, Gupta and Kumar (1968) reported *Hapalosiphon luteols*. Further Gupta (1972) added *Camptylonema lahorense* to the flora of Udaipur. *Myxosarcina burmensis* was reported from Jodhpur as well as Udaipur.

A comparison of the flora of Alwar and other parts of Rajasthan reveals that only two taxa *Westiellopsis prolifica* and *Myxosarcina burmensis* reported from Alwar were also reported form other parts of the state. Five members from Alwar namely *Dermocarpa flahaultii*, *Stichosiphon sansibaricous*, *Myxosarcina spectabilis*, *Hyella caespitosa* and *Hydrococcus rivularis* are the additions to the flora of Rajasthan. No species of *Hapalosiphon*, *Stigonema* and *Camptylonema* were recorded from Alwar. Both the species of *Myxosarcina* have widely been reported from different parts of India also.

From among the members reported from Alwar *Myxosarcina spectabilis* & *M. burmensis*, have been widely reported from different parts of the country. *Stichosiphon* is represented by S. *sansibaricous*. This has also not been reported from any other part of Rajasthan. There are a few reports of its occurrence from U.P. (Pandey and Pandey 1982, Chaturvedi et.al. 1990) and Andman and Nicobar (Prasad and Srivastava 1986), but *Dermocarpa flahaultii*, *Hydrococcus rivularis* and *Hyella caespitosa* have been scantily reported. Bongale and Bharati (1980) reported *Dermocarpa flahaultii* from the cultivated soils of Karnataka but at Alwar it was found attached to *Oedogonium* species. *Hydrococcus rivularis* was reported by Somshekhar (1984), Bongale and Bharati (1980) from Karnataka. Another alga rarely reported is *Hyella caespitosa*. It was reported by Srinivasan (1946) from Mahabalipuram and by Bongale and Bharati (1980) from cultivated soils of Karnataka.

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श्रीकृष्ण एवं चाणक्य का राजनीतिक प्रबंध कौशल :
शासन व्यवस्था के विशेष संदर्भ में

राजेश कुमार चौहान
सह आचार्य
राजनीति विज्ञान विभाग
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शोध-आलेख सार

महापुरुष श्रीकृष्ण और आचार्य विष्णुगुप्त चाणक्य दोनों ही राज्य और प्रजा के हित की दृष्टि से सद्कर्म एवं राजतंत्र को प्रबल करते थे जो कुछ परम्परागत था, निरंकुशता से रहित हो, जिसमें विजिगीषु राजा अन्य सब राज्यों को जीतकर एक विशाल और समृद्ध समाज की स्थापना करे एवं अधार बने अन्य राजाओं का संरक्षण प्रदान करे उनका उन्मूलन कदापि न करे तो न्यायबद्ध राजाओं का उन्मूलन नयबद्ध करे तथा अन्य राजा जब भी धर्म न अपनी देख रेख में करवाते हुए समस्त प्रजा का कल्याण करे। अतः दोनों की दृष्टि से राजनीति का लिए सद्कर्म और सामर्थ्यता के लिए कठोर राजतंत्र ही सर्वोत्तम शासन प्रणाली है। दोनों महापुरुषों की सम्मत इस शासन प्रणाली को अपनाकर आज के शासक भी कुराजनीति को निर्धारित करते विश्व शांति कायम कर सकते हैं और अपनी-अपनी राज्य को अराजकता की स्थिति से सुरक्षित कर सकते हैं।

मुख्य-शब्द : राजनीतिक प्रबंध कौशल।

हम अपने देश भारत पर के प्राचीन इतिहास का अध्ययन करते हैं तो हमें गर्व होता है कि इस देश की दस्तूरण ने सदा और श्रीकृष्ण जैसे जगत भारती वीर इस्लाम क्रांतिकारी सांस्कृतिक और राजनैतिक नेता महाकवि ....

HbA1c-Glycated Hemoglobin: Perfect Tool to Curb the Diabetes

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Editorial

Millions saw the apple fall but Newton asked Why...!!

Bernard Baruch has very well said this quote as these questions are the basis of science and knowledge. Medical science is not different from it too. In routine day to day practice of medicine we come across with lot many emerging diagnostic techniques and newer modalities. After period of time, all the pros and cons of these techniques could be possible.

Diabetes is not a disease but a syndrome, which virtually involve all parts of the body. Incidence of diabetes is increasing constantly as the stress factor, diet and the life style of common people have been grossly changed in the present scenario. According to International Diabetes Federation- South East Asia (IDF-SEA) region data, 425 million people have diabetes in the world and 82 million people in the SEA Region; by 2045 this will rise to 151 million. There were over 72 million cases of diabetes in India in 2017 [1]. Therefore the world need good diagnostic tool for diabetes mellitus (DM) which is not only helpful in early diagnosis of the disease but also has significant role in evaluation of maintenance of therapy and progression of disease so that complications associated with the disease could be anticipated in time. In 2011 the WHO advocated the use of HbA1c for the diagnosis of type 2 DM and in 2012 UK guidance followed suit [2,3].

Diabetes may be diagnosed based on plasma glucose criteria, either the fasting plasma glucose (FPG) or the 2-hour plasma glucose (2-h PG) value after a 75 gram oral glucose tolerance test (OGTT) or HbA1C criteria [4,5]. It is recommended by American Diabetes Association (ADA) that the HbA1C test should be performed by the certified methods from the National Glycohemoglobin Standardization Program (NGSP). These methods should be standardized to the Diabetes Control and Complications Trial (DCCT) reference assay. The HbA1C has several advantages compared with the FPG and OGTT, including greater convenience (fasting not required), greater preanalytical stability, and less day-to-day perturbations during stress and illness [6].

Normal adult hemoglobin consists predominantly of HbA (97%), HbA2 (2.5%) and HbF (0.5%). HbA1 amounts approximately 6% of total HbA, which is further fractionated to HbA1a1, HbA1a2, HbA1b and HbA1c. These fractions are defined by their electrophoretic and chromatographic properties. HbA1c (~5% of total HbA) is the most abundant of these fractions. HbA1c is formed by glycation of the N-terminal valine of the beta chain of hemoglobin where glucose ultimately forms aldimine (Schiff base) before undergoing an Amadori rearrangement to form a more stable ketoamine. All this is a non-enzymatic reaction occurring within red blood

cells constantly and resulting in an increased negative charge of the molecule. The more glucose is present in the blood stream during the lifetime of the red blood cells, the higher the concentration of HbA1c.

The HbA1c is typically performed every three monthly with the notion that the concentration of glycated hemoglobin changes with the life span of the red blood cells which is approximately 120 days. It is therefore used as a clinical tool for monitoring of glycemic control in people with diabetes [7,8]. But in our opinion, this tool should be used on monthly basis to assess its trend as we have noticed significant changes in its value with oral hypoglycemic drugs in established Type 2DM patients.

Analytical methods of HbA1c include high-performance liquid chromatography (HPLC), affinity chromatography, immunoassay, enzymatic assays and capillary electrophoresis. Most commonly HPLC methods (Tosoh, Bio-Rad, and ARKRAY/Menarini) are being used in all over the world. For diagnosis of the diabetes mellitus, the ADA criteria for HbA1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay [6]. A person without diabetes with his/her HbA1c test level ranging between 4% to 5.6% is considered normal; between 5.7% to 6.4% indicates a high risk of diabetes or pre-diabetes.

Although the HbA1c estimation helps a lot in diagnosis and evaluation of the adequate treatment patient, some limitations associated with its estimation are as follows:

Factors that Interfere with HbA1c Measurement: Genetic variants (e.g. HbS trait, HbC trait), elevated fetal hemoglobin (HbF) and chemically modified derivatives of hemoglobin (e.g. carbamylated Hb in patients with renal failure) can affect the accuracy of HbA1c measurements. The effects vary depending on the specific Hb variant or derivative and the specific HbA1c method [9]. When selecting an assay method, laboratories should take into consideration characteristics of the patient population served, (e.g. high prevalence of hemoglobinopathies or renal failure).

Factors that affect interpretation of HbA1c Results: Any condition that shortens erythrocyte survival or decreases mean erythrocyte age (e.g. recovery from acute blood loss, hemolytic anemia) will falsely lower HbA1c test results regardless of the assay method used [10]. HbA1c results from patients with HbSS, HbCC, and HbSC must be interpreted with caution given the pathological processes, including anemia, increased red

cell turnover, and transfusion requirements, that adversely impact HbA1c as a marker of long-term glycemic control. Alternative forms of testing such as glycated serum protein or glycated albumin should be considered for these patients.

In developing countries like India, iron deficiency anemia is a major health issue particularly in females. It is associated with higher HbA1c and higher fructosamine [11]. Alternative measures of glycemic assessment (e.g. glucose monitoring) must be used in the presence of significant iron deficiency anemia, at least until the iron deficiency has been successfully treated.

The role of HbA1c estimation in diabetic subjects with renal disease is not very established. Few studies suggest HbA1c underestimates glycemic control in diabetic patients on dialysis and that glycated albumin is a more authentic indicator of glycemic control [12,13]. Further studies are needed to clarify the role of HbA1c in diabetic patients with chronic renal failure.

In 2014, the WHO estimated the global prevalence of DM to be 9% amongst adults over 18 years and predicted it to be the 7th most common cause of death by 2030. Approximately 90% of all cases of diabetes are type 2 DM. majority cases of DM amongst adults are estimated to be undiagnosed, the detection of the condition and adequate glycemic control is crucial to managing the course of the disease as treatment and therapies need to be adjusted in order to minimize micro- and macrovascular complications including nephropathy, neuropathy and retinopathy. HbA1c proved to be a good diagnostic tool with few limitations to diagnose frank diabetes and to alert pre-diabetes conditions. It helps in monitoring the different treatment modalities.

HbA1c testing in most part of the world is commonly recommended once in a three month. Even after extensive review of literature, Canadian agency recommended that HbA1c testing is typically done twice yearly in well controlled patients and four times yearly in poorly controlled individuals [14]. But we noticed that if it is carried out on monthly basis, an early peak and troughs of the HbA1c levels can be easily detected and by that we can accordingly increase or decrease the anti-diabetic treatment. Thereby, we can avoid unnecessary delay of two months of effective treatment that in turn saves patients from further complications of diabetes which can otherwise be avoidable. Thus, to the best of our knowledge, first time in world literature, we strongly recommend monthly estimation of HbA1c in individuals who have established DM and their baseline HbA1c is

above 7% with or without overt complication. We also recommend more research data to come forward to further enlighten the issue..

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Gender Differences and Political Deliberations on Social Media

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Social media has emerged as an arena for political deliberation. Facebook, Twitter, and WhatsApp are major platforms where political debates/deliberation take place. This study was undertaken to investigate if attitude and perception towards these online platforms for political deliberation differs for male and female. For this purpose, a quantitative study was conducted using a structured questionnaire among 400 students of a private university. The finding suggests that males are more likely to be involved on political deliberation on social media than their female counterparts. Also male students value social media as an arena for political deliberation more than their female students.

Keywords: Gender differences, political deliberation, social media

Research studies have suggested that "deliberative democracy" is one of the most dominant approaches to study the online political discourse (Hindman, 2008; Freelon, 2010). It emphasizes on rational and critical political discussion for an ideal form of democracy. For such rational and critical political discussion, Internet is, ideally, the most powerful tool for a thriving democratic county like India: It could be a force which can change old power structures by facilitating as a platform for critical and rational political deliberation. It could be a place for unbiased political discussion where the most logical argument would not only win in the end but also appreciated. However, this is an ideal situation which is far from reality. The participants, involved in political debates on social media, hardly follow the logical approach where rational and critical arguments are well presented in polite manner. It was expected that rise of information technology will ensures that citizens are not only well informed about the economic and political affairs but also cherish the power of logic and reason in their political deliberation. However, the reality is far from what was expected. Political discussion on social media is often characterized by impolite behavior (Hmielowski et al., 2014; Anderson et al., 2014), trivial fights, uninformed opinions and withdrawing from public discussion forums to "echo chambers" where existing views get reinforcement (Stroud, 2010; Colleoni et al., 2014).

Despite the rise of political discussion on social media, studies have shown that people are very conscious about the content they post, like or share online (Silfverberg et al., 2011; Uski, 2015). Research studies have also evidenced that some individuals avoid online political discussions because they don't want to be seen as "too political" and/or are afraid that it will hurt their social image among their network (Rainie & Smith, 2012; Storsul, 2014; Gearhart & Weiwe, 2015). Further, literature on political participation and

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gender have evidenced that men are more likely to be politically associated with a party (Coffe & Bolzendahl, 2010), devote more time to read, watch, and discuss politics (Verba et al., 1997). On the contrary, women are more likely to be involved in political consumerism, boycotting the purchase of certain products, than their counterparts (Stolle et al., 2005).

Thus, measuring and comparing attitudes of male and female towards the political discussion on social media becomes important for better understanding of political discourse on online social media platforms. Though there are difference amongst researchers about the relationship between attitude and behavior, however there is consensus that attitude has significant influence on behavior and vice versa (Holland et al., 2002; Wicker, 1969). If someone is not sure about the relevance and importance of political deliberation on social media, it is very likely that person will not participate on political deliberation on social media. That person would see the exercise futile and wastage of time and energy. Further, it has also to be noted that attitudes are often have some degree of ambiguity. Attitudes are rarely measured on dichotomous scale. For a large variety of aspects our attitudes cannot be simply measured on positive or negative side. Similarly, attitudes towards political deliberation on social media cannot be measured on dichotomous scale. The study uses Likert scale to measure the perception and attitude of males and females for political deliberation on social media.

Political deliberation on social media is emerging field of research with limited focus on possible gender differences. There is no consensus amongst researchers whether there are gender differences for online political participation. Research studies have reported mixed results in this field. Some research studies have evidenced gender differences in online political participation, while others reported no gender differences. For instance, Bakker and De Vreese (2011) evidences significant gender differences for visiting official websites of government and websites of politically parties. The same study also reports gender differences for offline political participation such as writing letters to political leaders, participating in political protests, approaching an elected official for seeking solutions or personal or social problems, and political deliberation.

Verba et al. (1995) opine that active political participation, be it voting for a political party, discussing and debating political issues and persuading others to vote/support for a political party or cause, is a way for an individual to contribute to the political system that influence her/him directly. However, political participation is not equal across different demographic variables (Tolbert & McNeal 2003; Oser et al., 2013). There especially appears to be a divergence between the participation of male and female (Verba et al., 1997; Coffe and Bolzendahl, 2010). Women are less likely than men to post political statuses and are less likely to share political orientation information on their Facebook profile (Miller et al., 2015).

In the light of the above discussion, the study attempts to examine the following research questions: Does attitude towards using online platforms for political deliberation differ for male and female students, and how is the online political discussion perceived by different gender.

Literature Review

There is no consensus on the definition of social media. It is very recent phenomenon and there are different web based and mobile based platforms acting as media i.e. peer to peer media, peer to peer network, social web pages etc. However, researchers agree on certain features of social media such as user generated content, operation through virtual communities and networks. Bechmann and Lomborg (2012) note that social media is:

"often associated with new digital media phenomena such as blogs, social network sites, location-based services, microblogs, photo- and videosharing sites, etc., in which ordinary users (i.e. not only media professionals) can communicate with each other and create and share content with others online through their personal networked computers and digital mobile devices".

Bechmann and Lomborg (2012) also highlight three major characteristics of social media i.e. deinstitutionalized communication; user is an active producer of content; and communication is interactive. Further, there are many concepts that have been used interchangeably in the academic discussion such as the concept of net, Internet, cyberspace & online space (Dahlgren, 2009). This study considers social media as any online public space that serve as a platform for political deliberation. However, the main focus of the study is Facebook, Twitter, and Whatsapp, given their significantly large number of subscribers. Other platforms such as blogs, Instagram and online discussions forums are also taken into consideration for the study. Social media has emerged as the most favorite platform for political participation as it offers great opportunities for larger public to be involved in political discussion. So it is argued that online political deliberation should be studied separately from political participation though it has close association with offline political participation (Krueger 2002; Dimitrova et al., 2011). Oser et al. (2013) categorize political participants into three categories i.e. those who participate primarily online, those who participate primarily offline and those who are active both ways online and offline. Oser et al. (2013) also find that young people are more likely to participate online than offline.

Although, online and offline political participation is different, yet research suggests that during election time, higher online participation on social media correlates with higher offline participation (Dimitrova et al., 2014). This suggests that deliberation on social media is a meaningful contribution for political parties. Further, research studies also provide evidences in support of the argument that online political participation increases voting (Tolbert & McNeal, 2003; Teresi & Michelson, 2015).

However, how much funds should be devoted in online promotion in order to get significant returns in terms of offline participation is a matter of debate. The current concerns related with online political participation are associated with what political scientists see as "slacktivism". Kristofferson et al. (2014) define slacktivism as "a willingness to perform a relatively costless, token display of support for a social cause, with an accompanying lack of willingness to devote significant effort to enact meaningful change."

It has been shown that here are more female users of Facebook than male users (Pew, 2013), and female use Facebook for communication more than their male counterparts who use Internet more for information searches (Jackson et al., 2001). Considering the more women use social media for communication, it can be argued that social media can act as a platform for women to express their political opinion and participate in political deliberation. Further, apart from political participation, social media also provide opportunity to politically participate in other forms such as promoting certain cause and gathering support using www.change.org, signing online petitions and influencing policy measures as was evidenced in the case of opposing "Free Basics" offered by Facebook.

Ideally social media should provide a platform to all for voicing expressing their opinions freely. However, that is far from the truth. Today, social media is a place where conflict could lead to trolling and harassment (Biber et al., 2002; Lindsay & Krysik, 2012).

It appears that major political parties have their own dedicated online activists those who defend their political party very aggressively and tries to silence every dissent voice by harassing and using abusing languages as evidenced by case of Gurmehar Kaur. This further raises issues about the way personal or social interaction on social media could influence the way in which users, particularly female, participate politically on social media.

Methodology

As outlined in the introduction, the aim of this study is to investigate whether attitude towards using online platforms for political deliberation differs for male and female students and how is the online political discussion perceived by different gender. This study uses quantitative approach for testing following two hypotheses.

HO_1: There is no significant difference in the attitude of male and female students towards political deliberation on social media

HO_2: There is no significant difference in the perception of male and female students towards political deliberation on social media

Primary data was collected using a standard questionnaire which is administered to 400 students of undergraduate and postgraduate program using quota sampling method. There were 50 per cent male and 50 per cent female students and there were 50 per cent undergraduate and 50% postgraduate students in the selected sample.

Findings and Analysis

To carry out descriptive and inferential statistical analysis data were analyzed with the help of statistical software SPSS. Descriptive statistics were analyzed to test the basic assumptions of multivariate data analysis. Further, to test the mean differences between attitude and perception of the male and female students towards political deliberation on social media, data was analyzed on univariate and multivariate level. Item-wise comparisons were made using ANOVA and thereafter MANOVA was applied to test the significance of mean difference between attitude and perception of male and female students for political deliberation on social media.

Table 1, MANOVA - test of group differences on attitude towards political deliberation on social media

Variables	Female		Male		Univariate F test	
	Mean	SD	Mean	SD	F	Sig. P<
I find it important to participate in political discussion online	2.96	1.15	3.48	0.88	50.51	.000
I think that conversations on social media can have an actual impact on politics and current affairs in general.	2.63	1.07	3.19	0.75	77.88	.000
I enjoy good political debates online	2.08	1.20	3.49	1.18	352.44	.000
I am annoyed by people who always want to discuss politics online	2.67	0.68	3.24	0.71	126.25	.000

Multivariate test of significance

Pillai's Trace	0.338	
Wilks' Lambda	0.666	Exact F = 105.645 with 4 df P < .001
Hotelling's Trace	0.532	

Table 2. MANOVA- test of group differences on perception towards political deliberation on social media

Variables	Female		Male		Univariate F test	
	Mean	SD	Mean	SD	F	Sig. P<
I think social media is a good place to discuss politics	2.83	1.14	3.37	0.94	52.97	.000
On social media citizens have equal possibilities to take part in political discussion	2.58	1.23	3.09	0.95	42.93	.000
On social media, everyone's opinion is equally valued	2.55	1.08	3.07	0.99	45.65	.000
It is easy to follow politics through social media.	2.25	1.04	2.99	1.23	85.98	.000

Multivariate test of significance

Pillai's Trace	0.134	
Wilks' Lambda	0.866	Exact F = 30.92 with 4 df P < .001
Hotelling's Trace	0.152	

Table 1 shows the results for group difference on "Attitude towards Political deliberation on social media". Multivariate tests were found significant. Therefore the first null hypothesis that "There is no significant difference in the attitude of male and female students towards political deliberation on social media" is rejected. The univariate F- statistics were also found significant ($\alpha = 0.95$) for all items.

Table 2 shows the results for group difference on "Perception towards Political deliberation on social media". Here too, multivariate tests were found significant; hence second null hypothesis that "There is no significant difference in the perception of male and female students towards political deliberation on social media" is also rejected. The univariate F-statistics were found significant ($\alpha = 0.95$) here also for all items.

The above findings indicate that there exist significant difference as regards to perception and attitude of male and female students towards political deliberation on social media. The findings are in support the earlier findings regarding divergence in political participation of male and female (Verba et al., 1997; Coffe & Bolzendahl, 2010; Miller et al., 2015).

Conclusion

This study was an attempt to investigate the attitude and perception of young male and female students towards political deliberation on social media. The study finds that male students are more likely to use social media for political deliberation and they value social media as an arena for political deliberation more than their female counterparts. Social media was expected to act as a platform which could level the playing field for

female's political participation; however findings of this study don't conform to the said purpose. These negative attitudes and perception of female students could be possibly explained by past research findings that caution about uncivilized behavior on social media (Papacharissi, 2004).

Every research study has certain limitations. Apart from the general limitations of quantitative approach using survey method, this study has two major limitations. First, the sample is skewed for education and income in comparison to the general population of India. All participants are students of graduate and postgraduate program of a private university. Second, the sample has not been selected randomly and thus findings could not be generalized to all undergraduate and post graduate students. Future research should focus on exploring the relationship between gender and online political participation in the presence of online conflicts on social media. The research instrument in this study attempts to lay the groundwork and it has great scope for further improvement.

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भारतीय लोक संगीत के सामाजिक संदर्भ

डॉ. प्रभा बजाज*

संस्कृति के निर्माण में सामाजिक तत्वों की भूमिका का प्रमुख स्थान रहा है। संस्कृति का सम्बन्ध मूलतः समाज से ही होता है। तथा समाज से ही संस्कृति की झलक मिलती है। समाज का क्षेत्र व्यापक होने से इसके तत्व भी व्यापक तथा विस्तार लिये हुए है। समाज की लगभग सभी घटनाओं का वर्णन इसमें निहित है। सामाजिक रीति-रिवाज, संस्कार, पारिवारिक जीवन के विभिन्न पहलू तथा सम्बन्ध संदर्भ इत्यादि इसके प्रमुख अंग कहे जा सकते हैं। भारतीय लोक संगीत में भी इन सामाजिक तत्वों की उपलब्धता तथा चित्रण सजीव रूप से दृष्टिगोचर होती है। यहाँ के लोक संगीत लाला लाजपतराय के उस कथन की सत्यता को उजागर करते हैं जिसमें उन्होंने यह कहा था कि "लोक गीतों में सामाजिक तथा नैतिक आदर्शों का स्पष्ट रूप से उद्घाटन प्राप्त होता है। अतः ये लोकगीत उन तिजोरियों की तरह हैं जो इन आदर्शों को अपने आप में समाहित किये हुए हैं।"[1]

भारतीय संस्कृति के सम्पूर्ण तथ्य लोक में इतने रच-बस गये हैं कि उन तत्वों को लोक से अलग करना उनकी प्राणवतता को छीन लेना है। जन मानस अपनी सभी प्रकार की भावनाओं की अभिव्यक्ति चाहे वह प्रसन्नता का अवसर हो या विषाद का कटु अनुभव अथवा फिर जन आवेश हो, लोकगीत के माध्यम से करता है। यही लोकगीत वाद्य और लोक नृत्यों के साथ मिलकर एक अद्भुत लोक संगीत को जन्म देता है। लोक वाद्य और लोक नृत्यों को विषयांतर के भय से छोड़ दें तो लोकगीत ही हमारे संस्कृति के संवाहक है, एवं संस्कृति के कभी न सूखने वाले स्रोत के रूप में दिखाई देते हैं।

भारतीय संस्कृति में संस्कारों को उन्नायक तत्वों में प्रमुख माना है। संस्कार का अर्थ है– पवित्रीकरण, अर्थात् वह क्रिया जिसके करने से मनुष्य पवित्र हो जाता है। पवित्रता के लिये ये संस्कार जन्म से पूर्व ही अनुष्ठित होते हैं।[2] गर्भाधान से लेकर मृत्यु तक सोलह विभिन्न संस्कार माने गये हैं। जिनमें से जन्म, विवाह, तथा मृत्यु प्रमुख हैं, "मनुष्य के जीवन में मुख्य प्रभावशाली ये तीन ही घटना हैं। इन तीनों से मानव जाति की सभी संभावनाएँ ओत–प्रोत हैं। वह इन घटनाओं की उपेक्षा किसी भी देश अथवा परिस्थिति में नहीं कर सकता है। इसी से अधिकांश लोकगीत के वर्ण्य विषय सम्बन्धित है।"[3]

उपर्युक्त कथन की पुष्टि डॉ. श्यामचरण दुबे के इस कथन से की जा सकती है– "मानव की प्रायः प्रत्येक संस्कृति में व्यक्ति के जीवन के विभिन्न संक्रमण कालों का विशेष महत्व होता है। जन्म, विवाह एवं मरण इस प्रकार तीन मुख्य स्थितियाँ हैं। जिनके आस–पास मानव समूह विश्वासों रीति-रिवाजों और व्यवहार प्रकारों का एक ऐसा

असिस्टेंट प्रोफेसर एवं विभागाध्यक्ष, संगीत विभाग, कानोडिया पी.जी.महिला महाविद्यालय, जयपुर, राजस्थान।
दिनकर, डॉ. रामधारी सिंह – संस्कृति के चार अध्याय पृ.सं. 653
The real history of the country and its moral and social ideals are so much looked up in these folk songs – Lala Lajpat Rai (adopted from Kavita Komudi by Tripathi) Part-5, Page-77.
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जटिल ताना–बाना बुन लेता है कि उनके वास्तविक स्वरूप को समझे बिना उस संस्कृति का पूर्ण चित्र प्राप्त ही नहीं किया जा सकता।[4]

भारत में प्रत्येक संस्कारों पर विशेष रूप से प्रचलित गीत हमारे समाज में दिखाई देते हैं। पुत्र जन्मोत्सव मनाने की प्रथा अन्य स्थानों की तरह यहाँ पर भी काफी धूम–धाम से प्रचलित है। गर्भाधान से लेकर यज्ञोपवीत संस्कार तक के गीत इसके अन्तर्गत आते हैं। विवाह संस्कार विषयक गीतों में सगाई से लेकर बेटी की विदाई तथा वधु के गृह प्रवेश तक के गीतों एवं मनुष्य जीवन के अन्तिम संस्कार–मृत्यु संस्कार विषय के गीत भी सम्पूर्ण भारत में प्राप्त होते हैं। अवसरानुकूल गाये जाने वाले इन विविध लोकगीतों में संस्कृति का सहज रूप में प्रकटीकरण देखा जा सकता है।

यदि भारत में पारिवारिक संदर्भ में गाये जाने वाले लोकगीतों की बात करें तो लोक जीवन और लोक संस्कृति से जुड़ा होने के कारण आत्मानुभूति की सम्वेदना, सरसता की विद्यमान्यता से लोकसंगीत का प्रभाव अलग ही दिखलाई पड़ता है। लोक जीवन और संस्कृति का पूरा वैभव इनमें प्रतिबिम्बित होता है। सम्पूर्ण भारत का लोक संगीत भी इस विचार से अनूठा है।

भारत वर्ष कृषि प्रधान देश रहा है। इन दोनों के लिए ही एक से अधिक आदमियों की आवश्यकता होती है सम्भवतः इसी कारण यहाँ संयुक्त परिवारों की परम्परा रही है। चूल्हे भले ही अलग–अलग बन गये हो, परन्तु कृषि और पशुओं के कार्यों में परस्पर सहयोग और साझे की व्यवसायी ही देखी जाती है। इसी कारण संयुक्त परिवार व्यवस्था में एक ओर जहाँ ऐसे सम्बन्ध पोषित होते हैं, जिनका आधार सहज स्नेह तथा शाश्वत अपनत्व होता है, वहीं दूसरी ओर परस्पर व्यंग्य, कटाक्ष, स्वार्थ, आलस और अहंकार के कारण इनके अपनत्व में दरार पड़ जाती है। ऐसे सम्बन्ध होते हैं पहले प्रकार के स्नेहिल, प्रेममय और वात्सल्य पूर्ण सम्बन्धों में पिता–पुत्र, पिता–पुत्री, माता–पुत्र माता–पुत्री, भाई–बहन, पति–पत्नि एवं देवर–भाभी आदि के सम्बन्ध हैं। दूसरी तरह के सम्बन्धों में परस्पर कटुता और तनाव की स्थिति बनी रहती हैं। जैसे– सास–बहू, ननद–भाभी, देवरानी–जिठानी आदि के सम्बन्ध। सांस्कृतिक और अन्य अवसरों पर एवं ऋतु परक लोकगीतों में इनका यथार्थ यथावत रूप देखा जा सकता है। नीम और मिश्री का कड़वापन और मिठास इन पारिवारिक सम्बन्धों की निजी विशेषता है यही भारतीय लोकगीतों में रची बसी है।

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CONTENTS

IMPACT OF GOODS AND SERVICES TAX ON BANKING SECTOR

Dr. Ranjula Jain*
Shweta Bansal**

ABSTRACT

GST is one of the most crucial tax reforms which were to be implemented from April 2010, but it came in force from July 2017due to differing interests and political issues. This idea of GST was firstly introduced by Vajpayee government in 2000. More than 150 countries have implemented GST so far. GST is a detailed inter- disciplinary tax system that has seamlessly unified the economy into a single national market. This tax includes all indirect taxes which were previously implemented by states and central government like VAT, Service tax, etc. It is expected that it will remove the cascading effect of tax and will contribute in the substantial development and growth of country.

KEYWORDS: GST, Substantial Development, Indirect Tax, Crucial Tax Reforms, VAT, Service Tax.

Introduction

In India, introduction of GST is a revolutionary change since 1947. GST was introduced as The Constitution (one hundred and first amendment) Act 2017 following the passage of constitution 122nd Amendment Act Bill was introduced in the Lok Sabha by Finance Minister Arun Jaitley on 19th December 2014. GST was first introduced by France in 1954 and now it is followed by 140 countries. As the name suggests this tax will be levied on all goods and services at each stage of value addition. The GST has replaced several former taxes which were levied by central and state government like: service tax, value added tax, central excise duty, surcharge, octroi, etc. GST is expected to be a critical reform in spurring growth in the economy. Experts say that GST has given an improved way of tax collection which will help in removing all the tax barriers between states and bring country under an umbrella of single tax rate. The emergence of GST has separated India from other emerging markets as it will ensure long-term growth in Indian economy. The introduction of GST is making India one market, making business processes more efficient. GST was implemented with the Moto "One Nation, One Tax ".Most of the countries followed unified GST

While a dual GST system (i.e. where tax is imposed by central and states both) is followed by some countries like Brazil, Canada. In India also dual system of GST is followed including Central goods and services tax (CGST) and State goods and services tax (SGST). To consider and examine the interstate transactions of goods and services Integrated goods and services tax (IGST) is introduced. Under GST, goods and services are taxed at the point of supply at following rates: 0%, 5%, 12%, 18% and 28%.For rough precious and semi precious there is a special rate of 0.25% and 3% for gold. In addition a cess of 22% or other rates on top of 28% GST applies on few items like aerated drinks, luxury cars and tobacco products. There are certain goods like petroleum products and alcohol which are not in the ambit of GST. There are certain activities or services which are classified as "neither good nor services" under schedule 3rd of the GST:

- Servicer by an employee to the employer in relation to his employment
- Court/tribunal services including district court, high court and supreme court

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- Duties performed by Members of Parliament, Panchayats, State legislature, Municipalities And other local authorities, chairperson/member/director in a body established by the govt. or a local body and who is an employee of same
- Services of a funeral, burial, crematorium or mortuary including transportation of the decreased
- Sale of land and sale by building
- Actionable claims (other than lottery, betting and gambling)

There are some common objectives/benefits which are aimed by GST are:

- Increase in the tax base for strict adherence
- Cutting extra tax slabs for avoiding classification complexity
- To Put all the states in equal proportions
- Making easy process of tax administration and compliance
- Making value chain more strong to make availability of input credit
- Better control on leakage

Despite of the benefits of GST there are still challenges in front of the implementation of GST. These are:

- It is very hard to assume what will be the exact impact of GST in coming future.
- Mistakenly double registration could increase compliance and cost
- Lack of knowledge or awareness among common people
- Resistance to change
- Shortage of required skilled staff
- Adding No proper channel gates for controlling the tax evading parties

Under GST Tax paid on input is deducted from the tax payable on the output produced. This input credit sets off operations through the manufacturing and distribution stage of production.

Impact on Banking Sector

Banking sector is one of the most important sector in India. Banks have always been a huge pillar of the Indian economy. In formation of Monetary policy of any country Banks play a very crucial role. It contribution to GDP is around 7.7%. Banks provide different types of services to customers like Debit Card, Credit Card, Internet Banking, Cheque Clearance , NEFT, RTGS, IMPS, Funds Transfer, Demand Draft, Demat Account, Wealth Management services, Home Loans, Savings Account, Personal Loan, etc. For the financial services sector GST has lead to vital transformation on financial products, information technology system, a shift from centralized to state compliance. The services provided by head office to the branches are also covered under GST. It is also said that GST Council have taken bank branches all in separate entities making extra compliance cost for each operating unit. Banking institutions are in a problematic situation as the GST is setting the inter branch operations into the GST ambit. As the GST is applicable on point of origin of service, in banking sector it is very complicated to know the origin because bank is located at one place and customer making the transactions is at other place. Where the locations discharging GST liability are different from the input received, the accumulated input credit can be utilized through ISD (Input Service Distribution). To provide services to customers, banks deal with various vendors; the reversal of ITC for services availed from dealer who does not discharge his liability increases the cost and requires additional efforts in tracking status of dealer. Banks and financial services companies will face challenges under the GST because of changes to the place of supply rules under the GST. Some services are given to customers centrally while some others are provided locally. This complexity increases the compliance cost due to multiple assessment and audits. Section 10 of the Model GST Law creates distinct taxable persons for each registration in each state; these institutions will file more tax returns under this rule because branches in each state will need to file GST returns as opposed to a consolidation at the national level. After GST, Branches in each state has to file GST Returns rather than a combination at the national level. This newly incorporated scheme has increased the process compliance anyhow. The GST has made a higher turn towards the financial services of India as the previously followed 15 percent service tax is now converted into 18 percent GST. All the services like ATM withdrawing (beyond the free withdrawal limit); Bank account maintenance charges, loan processing charges everything has been hiked up to 3 percent from earlier rates. This would have a slight inflationary impact. Also, interest on loans, trading in securities, foreign

currency and retail services are also under the ambit of GST. Implementation of GST has made banking and financial services costly

Charges on Personal Loan	GST Rate	Pre GST Rate
Processing Fee	0.50%-1.00% of the loan amount+18% GST	0.50%-1.00% of the loan amount + 15% Service Tax and surcharge
Prepayment Charges	2%-5% p.a. principal outstanding amount + 18% GST	2%-5% per annum of Principal outstanding + 15% Service tax

Source: www.icicibank.com, Personal FN Research

This table clearly shows that earlier with basic processing fee 15 percent service tax was applicable but after GST this tax was increased by 3 percent resulting to 18percent GST. So for example, if a loan amount of Rs. 10,00,000 attracts a processing fee of in the range of 10000-20000 , the service tax equates to Rs. 1500-3000. But under GST, your cost will go upto Rs. 1800-3600; a sum total of around Rs.11800-23600 (processing fee+18% GST).As the IGST is distributed between Central as CGST and state as SGST, although the classification of transactions is done and rates have been decided, there is still the matter of quickly and correctly completing several GST returns for a single institution. By the introduction of GST banks are now able to set-off GST liabilities against credit received on purchase of goods.

Difficulties faced by Banking Industry

- Registration for all office locations i.e. all the branches.
- Maintenance of separate books of accounts to have control on ITC.
- Increased compliance cost with requirements of reverse charge.
- Multiplicity of registrations for different branches creates trouble in paying the taxes.
- Determination of place of supply has become critical.
- Under current tax regime (servive tax) "interest" was not covered under service tax legislations but under GST

Benefits to Banking Industry

- Easy set off of GST liability against credit received on purchases
- Earlier banks were not able to get ITC of goods purchased from state but as now all the taxes has been subsumed under GST Banks are now able to get GST credit on procurement.
- GST has helped in reducing tax evasion.
- GST has simplified doing business thus creating additional demand for funds which will ultimately lead to increasing bank transactions and digital transactions.
- Under CENVAT rules ITC was not allowed for making any outward supply in the course of business but under GST regime input tax credit is allowed for the same.

Impact on Others

The GST is affecting each and every sector including real estate, e-commerce, hospitality, smart phones, banking, automobiles, transportation, FMCG, etc. Under the new tax structure because of input tax credit benefit, builders are able to get ITC on the key raw materials they buy. As against the earlier tax rate of 5.5% a net effective tax rate of 12% is attracted by the under-construction properties. Before implementation of GST mobile phones were taxed at the rate of 8-18% in different states and are now taxed at 12%. An additional 10% basic custom duty has been levied on imports of mobile phones to give protection to local producers. With the passage of time GST rates are continuously changing. Recently, rates for many items were reduced or changed. List of those items are:

- Goods on which GST has been reduced from 28 to 18 percent:
  - Buses (for use in public transport) which exclusively run on bio-fuels.
  - Old and used motor vehicles (medium and large cars and SUVs)
- Goods on which GST has been reduced from 28 to 12 percent -
  - All types of old and used motors vehicles (other than medium and large cars and SUVs)
- List of goods on which GST reduced from 18 to 12 percent:
  - Sugar boiled confectionary
  - Fertilizer grade phosphoric acid

- Bio-diesel
- 12 types of Bio-pesticides
- Bamboo wood building joinery
- Mechanical sprayer
- Drip irrigation system including laterals, sprinklers

- List of goods on which GST reduced from 18 to 5 percent -

  - Tamarind Kernel Powder
  - Mehendi paste cones
  - LPG supplied for supply to household domestic consumers by private LPG distributors
  - Scientific and technical instruments, apparatus, equipment, accessories, parts, components, spares, tools, mock ups and modules, raw material and consumables

- Goods on which GST has been reduced from 12 to 5 percent:-

  - Articles of straw, of esparto or of other plaiting materials;
  - Basket ware and wickerwork velvet fabric (with no refund of un-utilized input tax credit)

- Goods in which GST has been reduced from 3 per cent to 0.25 per cent:

  - Diamond and precious stones

- Goods that got expensive (items changes into higher rates)

- Goods in which GST has increased from 12 per cent to 18 per cent

  - Cigarette filter rods

- Goods in which GST has increased from nil to 5 per cent

  - Rice Bran (other than de-oiled rice bran)

Conclusion

With the introduction of GST there has been an increase in the cost of compliance for all the banks to register all their branches under each state. Now each of these branches will now have to file and pay their taxes independently, unlike earlier where it was all accumulated at and submitted by the Head Branch Office. Almost all the transactions charges have gone up because earlier it was 15% service tax but now it is 18% after GST. At the time of implementation of GST the biggest doubt was its success or failure. But with some negative and some positive effects GST has proved to be a long- run beneficial programme in India , which can be seen by amount of tax collection increasing day by day and at the same time number of registered tax payers is also increasing.

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SHIFTING PARADIGMS OF BIOETHICS AND HUMAN RIGHTS

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It's a matter of great concern that despite increasing recognition of the importance of human rights in the protection and promotion of health, formal human rights education has been lacking in schools of medicine and public health. The conceptualization of human rights as essential conditions for health was first articulated in the mid-1990's1[1]; since then, health professionals have increasingly recognized the importance of human rights in the protection and promotion of individual and global health.[2] Today, almost every country is a party to at least one human rights treaty that talks about health-related rights. The importance of human rights in medical and health practices has been recognized in a number of statements and publications by professional health organizations.[3] This aspect of scientific advancement has not only raised a number of questions regarding bioethics but is also threat to compromise with the destiny of the human species.

Bioethics includes not only philosophical study of the ethics of medicine, but also such areas as medical law, medical anthropology, medical sociology, health politics, health economics and even some areas of medicine itself. More specifically, bioethics is one branch of practical (or applied) ethics, which is one branch of ethics, which in turn is one branch of philosophy. According to World Health Organization, "Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease."[4] The individual's intrinsic value as a person and the implicit risk associated with the advance of science in challenging bioethical conduct has created a challenge. Advancement of technology in the field of science and research has raised certain questions which may lead to discrimination. State is under the obligation to ensure that medical

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[1] Mann JM, Gostin L, Gruskin S, Brennan T, Lazzarini Z, et al. (1994) Health and human rights. Health Hum Rights 1: 6–23.

[2] Iacopino V (1995) Human rights: health concerns for the twenty-first century. In: Majumdar SK, Rosenfeld LM, Nash DB, Audet AM, editors. Medicine and Health Care Into the Twenty-First Century. Philadelphia: Pennsylvania Academy of Science. pp. 376–392.

[3] Gruskin S, Grodin MA, Annas GJ, Marks SP, editors. (2005) American Public Health Association Principles on Public Health and Human Rights. Perspectives on Health and Human Rights: A Reader. Routledge. In,

[4] World Health Organization. (2006) Constitution of the World Health Organization - Basic Documents, Forty-fifth edition, Supplement, October 2006.

practitioners and professionals maintain the standards and ethical codes of conduct. Emphasis should be given to the right to enjoy the benefits of advanced technology and liberalization of trade along with intellectual and paternity rights.

The first legally binding international instrument in this field was the *Convention for the Protection of Human Rights and Dignity of the Human Being with Regard to the Application of Biology and Medicine*. This regional instrument was adopted by the Council of Europe in 1997. However, in 2005, the UN Educational, Scientific and Cultural Organization (UNESCO) developed a Universal Declaration on Bioethics and Human Rights, which, among other goals, aims to promote respect for human dignity and protect human rights by ensuring "respect for the life of human beings, and fundamental freedoms, consistent with international human rights law"[5]. In *CESC Ltd. v. Subash Chandra Bose*[6], the Supreme Court relied on international instruments and concluded that right to health is a fundamental right. It went further and observed that health is not merely absence of sickness

The Constitution of India guarantees under 'Right to Equality' under Articles 14 to 18. It has been said in the case of *Indira Sawhney v. UOI*[7], "Equality is one of the magnificent corner-stones of Indian democracy." At the same time the Supreme Court has declared right to equality as the basic feature of the Constitution. The concept of equality is also embedded in the Preamble of the Indian Constitution. Hence, any law or even a Constitution amendment would be declared as invalid if it is offending the right to equality. The Supreme Court in *M.G. Badappanavar v. State of Karnataka*[8], has said any treatment of equals unequally or unequal as equals will be violation of basic structure of the Constitution of India. Our Judiciary has widely interpreted the scope of 'Right to Health' under Article 21 (right to life) and has thus, established right to health as an implied fundamental right. Along with Article 21, other Articles under Part-III have also been linked to Right to Health. Article 23(1) prohibits traffic in human beings. Since, trafficking of women leads to prostitution, which in turn, is a major factor in spread of AIDS, which is in violation to Right to Health. Human beings involved in trafficking have a very high risk of communicating sexually transmitted diseases. Similarly, most provisions related to health in Part-IV (Directive Principles) are:

- Article 38 says that the state will secure a social order for the promotion of welfare of the people. Providing affordable healthcare is one of the ways to promote welfare.
- Article 39(e) calls the state to make sure that health and strength of workers, men and women, and the tender age of children are not abused.
- Article 41 imposes duty on state to provide public assistance in cases of unemployment, old age, sickness and disablement etc.
- Article 42 makes provision to protect the health of infant and mother by maternity benefit.

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5   UNESCO (2005) Universal Declaration on Bioethics and Human Rights. Available: http://portal.unesco.org/en/ev.phpURL_ID=31058&URL_DO=DO_TOPIC&URL_SECTION=201.htmlvia the Internet. Accessed 25 Feb 2008.
6   AIR 1992 SC 573
7   AIR 1993 SC 477
8   2001 (2) SCC 666

Article 47 make it duty of the state to improve public health, securing of justice, human condition of works, extension of sickness, old age, disablement and maternity benefits and also contemplated. Further, State's duty includes prohibition of consumption of intoxicating drinking and drugs are injurious to health.

Article 48A ensures that State shall Endeavour to protect and impose the pollution free environment for good health.

Article 39(e) directs its policy towards securing the health and strength of workers, even men and women. The children of tender age are not to be abused and that citizens should not be forced by economic necessity to enter avocations unsuited to their age or strength. Article 39(f) lays down that the children should be given opportunity and facilities to develop in a healthy manner and with dignity, youth should be protected against exploitation and against moral and material abandonment. Basic aim is to protect and safeguard the interest and welfare of the children and young persons.

Article 42 requires the State to make provisions for securing just and humane conditions of work and for maternity relief. The Maternity Benefit Act, 1961 gives the women workers a relief during and after pregnancy. Article 43 requires the State to endeavor to secure by suitable legislation, or economic organization or in any other way, to all workers, agricultural, industrial or otherwise, work, a living wage, conditions of work ensuring a decent standard of life and full employment of leisure and social and cultural opportunities. This includes protection against ill-health and a measure of insurance against misfortunes including old age. The Minimum Wages Act, works in accordance with Article 43. Article 47 obligates the State to regard, as among its primary duties, the raising of the level of nutrition and the standard of living of its people and the improvement of public health. In particular, the State is to endeavor to bring about prohibition of the consumption, except for medicinal purposes, of intoxicating drinks and drugs which are injurious to health. The Supreme Court reading Articles 21 and 47 together has observed in the case of *Vincent Panikurlangara v. Union of India,*[9] " ..... maintenance and improvement of public health have to rank high as these are indispensable to the very physical existence of the community and on the betterment of these depends the building of the society of which the Constitution makers envisaged. Attending to public health, in our opinion, therefore, is of high priority-perhaps the one of the top."

Euthanasia - or physician-assisted suicide and end of life care are important aspects relating to bioethics and human health.[10] The government has begun to act on the issue of long-term palliative care though its draft bill.[11] It provides for declining (by patients or families) or withholding (by doctors) treatment for terminally ill patients. So far, Indian courts have consistently opposed assisted deaths, even in long-term bedridden cases such as the Aruna

AIR 1987 SC 990
Sinha VK, Basu S, Sarkhel S. Euthanasia: An Indian perspective. Indian J Psychiatry 2012;54:177-83. Back to cited text no. 16Medknow Journal
Sharma H, Jagdish V, Anusha P, Bharti S. End-of-life care: Indian perspective. ...l 2:S293-8.

Shanbag case.[12] So, whenever the citizens feel that the statutory obligations are not fulfilled, they can always approach the High Court under Article 226 of the Constitution for seeking a mandamus to get the duties enforced. The Supreme Court in *Paramanand Katara v Union of India*[13] case gave a landmark judgment that a every doctor at government hospital or otherwise has the professional obligation to extend his services with due expertise for protecting life of a patient and has also provided certain directions such as:

- Provision of adequate health facilities at public health centers.
- Upgradation of sub-divisional level hospitals to make them capable of treating serious patients.
- To ensure availability of bed in any emergency at State level hospitals there should be a centralized communication system so that the patient can be sent immediately to the hospital where bed is available in respect of the treatment, which is required.
- Proper arrangement of ambulances adequately provided with necessary equipments and personnel.

There are many technological discoveries emerging in the fields of medicine and genetic manipulation that are not covered by law in many countries. There is a need for country-specific interpretation and operationalisation of ethical principles and norms to ensure compliance with and acceptability to specific social, cultural, religious beliefs, norms and customs. Bioethics works as a normative instruments that have been developed so far in response to the scientific revolution with a focus on the protection of human rights. In the case of a potential conflict between the preservation of the human being from harm and other intervening interests, preference should be given to the preservation and protection of the human person.[14] Prohibiting research and application in this sphere may not probably be a desirable solution instead, regulating any damage to individuals and/or humanity as a whole is required.

In *Indian Medical Association v. V.P. Shantha*[15], the Supreme Court while holding that remedy against medical malpratice or neligence of medical practitioners, hospitals and nursing homes is available under the Consumer Protection Act of 1986, also observed that medical professionals are liable for damages on ground of negligence or malpractice, in tort and can also be sued in contract.

In *Paschmim Bangal Khet Mazdoor Samity v. State of W. B.*[16] case, the code of medical professional ethics and the denial of emergency medical aid by government hospital which is unacceptable. Providing adequate medical facilities for the people is an obligation undertaken by the government in a welfare state. The Supreme Court of India in *ABSK (Sangh) v. Union of India*[17], has rightly observed, 'Maintenance and improvement of public health have to rank high as

12 Aruna Ramchandra Shanbaug Versus Union of India & Others. Chawla PK and Satija I: Supreme Court of India; 2011. Available from: http://www. supremec - ourtofindia. nic.in/outtoday/wr1152009.pdf. [Last accessed on 2016 Dec 01].
13 (1989) 4 SCC 286
14 Mathiharan K: The Fundamental Right to Health Care, Issues in Medical Ethics. 2003
15 (1995) 6 SCC 651
16 1996(4) SCC 37
17 (1981) SCC 246

these are indispensable to the very physical existence of the community and on the betterment of these depends the building of the society which the Constitution makers envisaged. Attending to public health, in our opinion, therefore, is of high priority-perhaps the one at the top.' So to ensure, the effective exercise of the right to protection of health, appropriate measures designed *inter alia* has to be taken

A.   Appropriate steps to be taken to remove possible causes of ill-health;

B.   Advisory and educational facilities for the promotion of health and the encouragement of individual responsibility in matters of health should be provided;

C.   To prevent as far as possible epidemic, endemic and other diseases as well as accidents.

Thus, there is utmost requirement of formal network for Bioethics. Clinicians in practice need to be trained. Following the UNESCO mandate, curricula for various medical specialties need to be developed for bioethics teaching. Research, innovation, and publications need to improve.* So, all governments are legally obliged to protect, respect and fulfill the constitutional fundamental right. The challenge for the nation is to translate into reality an accessible, affordable and equitable health care for all. Non-functioning health facilities, sub-standard treatment, denial of care and medical negligence are not uncommon but, effective law has to be employed to deliver health justice to the citizens of India, especially its most vulnerable population. Most importantly, we need to recognize the autonomy and wisdom of our patients and partner with them rather than dictate to them. The belief of co-operation and collaboration needs to be built into the innermost core of our clinical and legal work.

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मधुमती
जनवरी, 2018

तारतम्य

ब्रह्माण्ड में आदित्य-तेज तम को नष्ट करता है किन्तु महान विभूतियाँ धरा पर देह धारण कर दिव्य गुण तेज से हृदय अंधकार को विदीर्ण करती है। धरा पर वही देश धन्य है, जहाँ महान विभूतियाँ पैदा होती है। सम्पूर्ण सृष्टि में भटकते लोगों को रास्ता दिखाने का महान कार्य, व्यथित मनों पर मरहम का कार्य महान विभूतियों ने किया है। जिन्होंने निःसकोच व निःस्वार्थ रूप से अपने समग्र जीवन दर्शन, अपनी समस्त क्षमताओं को मानव कल्याण हेतु समर्पित कर दिया। इसी परम्परा में उदार विभूति कवि कमलाकर 'कमल' है-

हम उसे ही कवि कहें जो आग लिखना जानता हो।

काल सी अपनी अखण्डित शक्ति को पहचाना हो। के उद्घोषक कलाकार का जन्म 28 जनवरी 1915 को रेवई ग्राम (म.प्र.) में हुआ। जब आप ढाई माह के थे तो मातृ सुख छिन गया और 14 वर्षीय किशोरावस्था में पितृ-छाया भी न रहा। अपने काका सुधाकर से आपने काव्य शिक्षा ग्रहण की और अपने कुल के ध्येय वाक्य ''कर कलम रुके तो कर कलम कराईये'' के अनुरूप आप जीवन पर्यन्त साहित्य साधना में रत रहे।

आप पुष्टिमार्ग में दीक्षित ब्राह्मण, मन से संत, मस्तिष्क से दार्शनिक थे। आप आस्तिक रहे पर अंधविश्वासों से परे। बाह्याडम्बरों व रूढ़ियों का विरोध आप जीवन भर करते रहे। आपकी निम्न पंक्तियों में यही भाव व्यक्त हुआ है-

अए मुसलमां तू किसी भी मौलवी पर मत फिदा हो।
हिन्दू भी बोले पंडित से अरे, पंडित विदा हो।।
पादरी का काम दुनिया का निरा नुकसान करना।
पंडितों का काम हरदम दूसरों का माल हरना।।

प्रातः चार बजे से रात्रि ग्यारह बजे तक पाँच सौ के लगभग विद्यार्थियों को निःशुल्क हिन्दी काव्य शास्त्र, हिन्दी साहित्य, इतिहास पढ़ाते रहना तथा उनके अन्दर के साहित्यकार की खोज कर उसका परिष्कार करना आपकी दिनचर्या थी। हिन्दी उत्थान हेतु आपने साहित्य सदावर्त नामक संस्था की स्थापना की और हिन्दी की सेवा में रत रहे। आपने 'प्रकाश' मासिक हिन्दी

लेख
○
कवियों
के
गुरु
कमलाकर
'कमल'

डॉ. शीतांभ शर्मा

हिन्दी विभाग, कानोडिया पी. जी. महिला महाविद्यालय, जयपुर (राज.)
मो. 9413836340

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जन्म : 30 जनवरी, 1890
निधन : 15 नवम्बर, 1937

रांगेय राघव

जन्म : 17 जनवरी, 1923
निधन : 12 सितम्बर, 1962

Study of Hopping Conduction in Mn Doped CdS Nanoparticles

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ABSTRACT

The present paper reports the electrical properties of pure CdS and Mn doped CdS nanoparticle samples. The samples were prepared using chemical precipitation method and were characterized using XRD, TEM and EDXA. Structural characterization indicates nanoparticle formation in samples. DC conductivity measurements were carried out at room as well as elevated temperatures. Results show that conduction in samples takes place via variable range hopping and thus samples follow Mott's three dimensional variable range hopping (3D VRH) model. Further, it was found that conductivity increases on increase of Mn concentration in CdS matrix.

KEYWORDS: CdS:Mn, Nanoparticles, Electrical Conductivity, Hopping Conduction.

1. INTRODUCTION

Cadmium sulfide (CdS) nanoparticles have been studied extensively in past two decades due its tunable direct band gap which makes it potential candidate for various applications such as high-frequency lasers, opto-electronic devices and many other photovoltaic devices.[1-8] However, CdS nanoparticles are found to be highly unstable and have tendency to agglomerate quickly in the absence of a trapping media or some of other form of encapsulation.[9] Therefore, capping agents are used to provide bonding to nanoparticles for chemical passivation which has significant effect on the optical and electronic properties of nanoparticles.[10-13] The properties of these nanoparticles can further be modified by doping it with transition metal ions such as Mn, Cu, Co etc.[14] The transition metal doped nanoparticles shows different optical and electrical properties compared to their host counterparts. These doped CdS nanoparticles have found applications in light emitting displays, electroluminescence devices and optical sensors.[15-18]

Much work has been reported on metal ion doped CdS nanoparticles mainly citing the optical and luminescence properties of these systems. Lozada-Morales et al.[19] studied the influence of internal stress on the optical properties of CdS:Cu nanoparticles and found that two effects i.e., the quantum confinement and the internal stress are responsible for change in E_g values. Giribabu et al.[20] studied the structural, optical and magnetic properties of Co doped CdS nanoparticles and found redshift of absorption edge and bandgap narrowing can be attributed to increase in the carrier concentration by the inclusion of cobalt ions and creation of defect levels in the bandgap. Hasanzadeh and Farjami Shayesteh[21] investigated optical properties of Cu doped CdS (CdS:Cu) nanoparticles. They reported that variation of the thioglycerol (TG) concentration does not shift the position of the excitonic peak in the absorption spectrum but the PL intensity increases as the TG concentration is increased. Devi et al.[22] studied influence of Mn doping on structural and optical properties of CdS nanoparticles and found that absorption spectra and fluorescent emission spectra show significant blue shift compared to that of bulk CdS.

In most of the work cited above, emphasis was laid on the optical and luminescence properties of doped CdS nanoparticles. Few efforts were made to study electrical properties of transition metal doped CdS nanoparticles. Firdous et al.[23] studied the electrical and optical properties of pure and Ni-doped CdS quantum dots and reported the semiconducting nature of these samples. Thambidurai et al.[24] studied the electrical properties of cobalt doped CdS quantum dots. They reported increase in electrical conductivity with increase in cobalt concentration and temperature. The electrical properties of these nanoparticles have not been studied comprehensively. Therefore, the present paper aims on the study of temperature dependent electrical properties of Mn doped CdS nanoparticles. DC electrical conductivity and activation

energy of conduction has been evaluated. Mott's three dimensional variable range hopping (3D VRH) model has been applied to obtain hopping range and hopping energy.

2. EXPERIMENTAL DETAILS

Wet chemical precipitation method has been used to prepare pure CdS and Mn doped CdS nanoparticles. All the chemicals ($CdSO_4$, Na_2S, EDTA) were of analytical grade and purchased from Sigma Aldrich. Pure CdS nanoparticles were prepared by dropping simultaneously 50 ml of 1 M solution of $CdSO_4$ and Na_2S each into 200 ml of distilled water containing 50 ml of 0.1 M solution of EDTA. This mixture was continuously stirred using a magnetic stirrer for homogenation. After this, the precipitate was separated and dried at room temperature. After sufficient drying, the precipitate was crushed to fine powder with the help of mortar and pestle. This as-prepared sample has been named as pure CdS. Similar procedure was adopted to prepare Mn doped CdS nanoparticles. For this, 50 ml of 0.9 M solution of $CdSO_4$, 50 ml of 1 M solution of Na_2S and 50 ml of 0.1 M solution of $MnSO_4$ was dropped simultaneously into 200 ml of distilled water containing 50 ml of 0.1 M solution of EDTA. This mixture was also stirred using a magnetic stirrer. This leads to dissolution of Cd^{2+}, Mn^{2+} and S^{2-} ions which eventually results into Mn^{2+} doped CdS nanoparticles designated as CdS:Mn nanoparticles. The percentage of Mn was varied from 2–8 wt% by adding 2–8 wt% of metal sulphate ($MnSO_4$) to $CdSO_4$ for preparation of different compositions of CdS:Mn nanoparticles. The precipitate was then separated, dried and crushed to fine powder with the help of mortar and pestle. The doped samples of CdS:Mn have been named as CdS:M1, CdS:M2, CdS:M3 and CdS:M4 for 2, 4, 6 and 8 wt% of Mn respectively.

In both above mentioned processes, EDTA was used to stabilize the particle against aggregation which may lead to an increase in the particle size. X-ray diffraction pattern (XRD) of the samples were recorded on Bragg-Brentanno geometry on panalytical X'pert pro diffractometer in 2θ range of 15–80° with Cu Kα radiation source ($\lambda = 1.5406$ Å). Transmission electron microscopy (TEM) measurements were carried out on Hitachi transmission electron microscope. The energy dispersive X-ray analysis (EDXA) measurements were performed on FEI Quanta 200F SEM fitted with an EDXA. For electrical measurements, 50 mg fine powder of CdS:Mn nanoparticles was pressed into a circular pellet diameter 1.2 cm and thickness 0.155 cm using hydraulic press by applying pressure of 5 tons. The pellet was placed in a specially designed two-probe set up. I–V measurements were recorded using two-probe technique on Keithley electrometer 6517 A model in temperature range 303–373 K.

3. RESULTS AND DISCUSSION

3.1. Structural Characterization

Figure 1 shows the XRD patterns of pure CdS and Mn doped CdS nanoparticles. The XRD peaks were found to be broadened due to finite size of these particles. The diffraction peaks appearing for all the samples at 2θ values of about 26.55, 44.03 and 52.08 correspond to the (111), (220) and (311) planes of cubic phase of CdS. The peaks were identified using JCPDS reference code 01-080-0019.[25] Further, it was noticed that the addition of Mn to CdS nanoparticle shows slight broadening in peak width but it does not create any additional change in the CdS matrix. Similar results were obtained by Nag et al.[26] They reported that synthesis approach allows to dope Mn^{2+} into CdS nanocrystals without causing any perceptible variation in the nanocrystal size. The XRD data was also used to determine the particle size of these nanoparticle using Debye Scherrer formula. The Scherrer formula[27] is given by:

$$D = 0.9\lambda/\beta \cos\theta \qquad (1)$$

where D is the average particle size perpendicular to the reflecting planes, λ is the X-ray wavelength, β is the full width at half maximum (FWHM), and θ is the diffraction angle. The average particle size of Mn doped CDS nanoparticles are listed in Table I.

Figure 2 shows the TEM images of Mn doped CdS samples. From Figure 2, it is observed that the so-prepared CdS:Mn nanoparticles have their sizes in the nano regime. The particle size of pure CdS and different samples of CdS:Mn nanoparticles as obtained from TEM measurements are given in Table I. From Table I, it is observed that the particle size of these nanoparticles decreases with the increase in doping concentration of transition metal ion. On doping CdS with Mn^{2+} ions, the MnS is formed and this sulphide (MnS) does not show good solubility in the solution and therefore, the number and rate of nucleation increases which produces relatively small particle leading to quantum confinement effect. As per Nag et al.,[26] extent of doping of Mn^{2+} is much less in CdS nanocrystals inspite of repeated efforts to dope higher concentrations of Mn^{2+} in CdS lattice. Further, it is suggested that
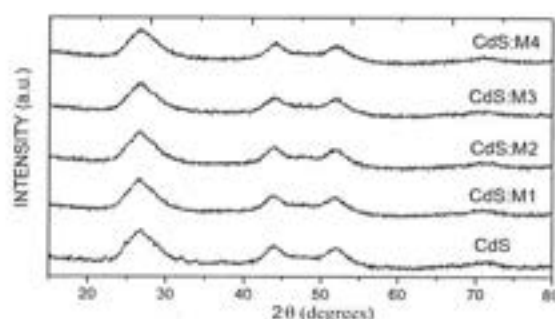
Fig. 1. XRD patterns of pure CdS and Mn doped CdS nanoparticles.

Table I. Values of particle size obtained through XRD and TEM and dc electrical conductivity (σ_a) obtained at room temperature for pure CdS and CdS:Mn samples.

Sample	Particle size through XRD (nm)	Particle size through TEM (nm)	σ_a (Ω^{-1} cm^{-1})
Pure CdS	5	8	0.151×10^{-4}
CdS:M1	4	6	0.454×10^{-4}
CdS:M2	4	5	0.137×10^{-3}
CdS:M3	3	4	0.595×10^{-3}
CdS:M4	2	4	0.757×10^{-3}

Mn^{2+} is not homogeneously or statistically doped across the entire size distribution, but is preferentially doped into the larger sized nanocrystals, making the smaller sized one less doped. The present samples also show less solubility of Mn^{2+} as also reported by Nag et al.[26] However, little solubility of Mn^{2+} is visible as a peak of very low intensity in EDXA pattern (Figs. 3–4) of the CdS:Mn sample. The EDXA of CdS:M1 has been shown as a representative case.

From Table I, it is also observed that the particle size obtained from TEM is slightly larger than that estimated through XRD results. The slight discrepancy is due to the intrinsic defects like twining and dislocations present in the lattice of these samples.[28] It is reported[23, 29] that the particle sizes obtained from XRD are always found to be smaller than that measured by TEM, since from XRD, the lengths of coherence in grains which do not include grain boundaries are obtained. Moreover, in XRD patterns, broadening of peaks also arise due to microstraining of the crystal structure arising from defects like dislocations and twinning etc. These defects are believed to be associated with the chemically synthesized nanocrystals as they grow spontaneously during chemical reaction. As a result, the chemical legands get negligible time to diffuse to an energetically favourable site. These factors affect the particle size determination obtained using XRD. Therefore, discrepancy is observed in the particle size values obtained from XRD and TEM.
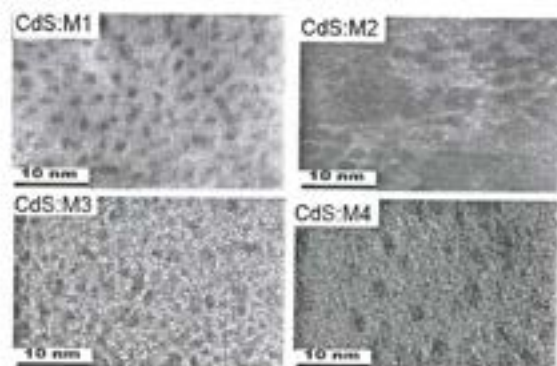
Fig. 2. TEM images of Mn doped CdS samples.
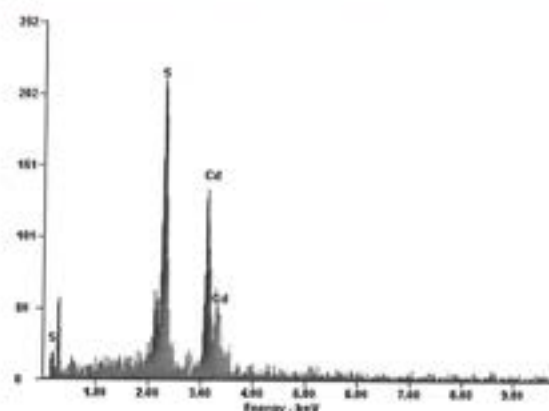
Fig. 3. EDXA pattern of pure CdS sample.

3.2. Electrical Properties

The electrical studies of the samples include the dc electrical conductivity at room temperature as well as elevated temperatures. The conductivity measurements are important to see the effect of transition metal ion doping in CdS matrix. Figure 5 shows the I–V characteristics of pure CdS and Cds:Mn nanoparticle samples at room temperature. According to Abdulkhadar et al.,[30] in the case of pellets of small particles, the boundary between the particles must play an important role in determining conductivity as in the case of polycrystalline semiconductor films.[31-34] According to grain-boundary trapping theory, free carriers are trapped by trapping states at the boundary causing a depletion of charges in the grain region nearest to the boundary.[33] Therefore, the region near the surface of the particle becomes depleted of charges causing a space charge which should establish an energy barrier between adjacent particles. In this case, assuming the voltage drop in the particles to be negligible compared with the voltage drop in the barrier, the electrical conductivity may be assumed to be completely dependent on the voltage drop in the barrier. For pure CdS and low doped samples (CdS:M1 and CdS:M2), I–V characteristics show ohmic behaviour. In high doping samples i.e., CdS:M3 and CdS:M4, it was observed that current increases slowly upto 4 V and increases slightly thereafter. It may be suggested
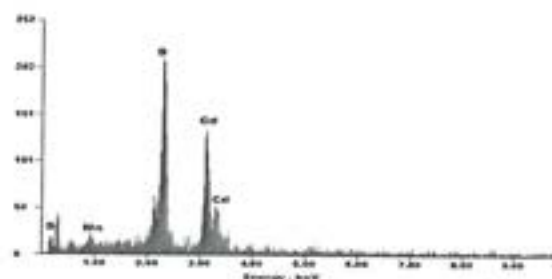
Fig. 4. EDXA pattern of CdS:M1 sample.

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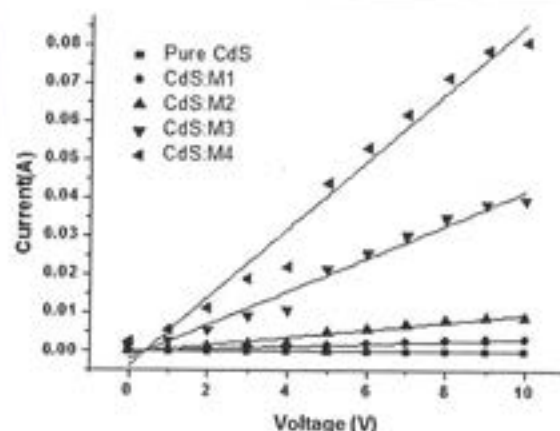
Fig. 5. I–V characteristics of pure CdS and Cds:Mn samples fitted to straight line at room temperature.

Fig. 7. I–V characteristics of CdS:M1 nanoparticles at different temperatures.

that at low voltages, charge carriers have low energy and move slowly therefore, small current values are obtained. But, when voltage is increased beyond 4 V, these charge carriers gains mobility and rise in current is observed, which can be seen as change in slope in I–V curve beyond 4 V.

The dc electrical conductivity has been calculated from the following relation.

$$\sigma_{dc} == L/RA \qquad (2)$$

where R is the resistance of the sample, L is the thickness of the pellet and A is the cross sectional area of the pellet. The values of dc electrical conductivity of the pure CdS and CdS:Mn samples obtained at room temperature are listed in Table I. It is found that dc conductivity increases on Mn doping in CdS matrix. This can be explained on basis of Mott and Davis model. According to Mott and Davis,[35–36] doping of sample causes structural defects in the system which creates additional energy states near band edges. This decreases the energy band gap, consequently increases the electrical conductivity on Mn doping in CdS samples. Moreover, doping of impurity atoms by chemical substitution generally brings disorder in the system, which may tend to delocalize the carriers at doping site.[23] On Mn doping, additional energy states are created within the bandgap, which narrows the band gap and increases the electrical conductivity of the samples. As Mn doping is increased, density of states increases near the band edges leading to further increase in electrical conductivity.

The temperature dependence of dc electrical conductivity has been studied for pure CdS sample and among Mn doped CdS samples, samples with lowest and highest concentration of Mn i.e., CdS:M1 and CdS:M4 were subjected to higher temperatures to study the temperature dependence of dc electrical conductivity. Figures 6–8 shows the I–V characteristics of pure CdS, CdS:M1 and CdS:M4
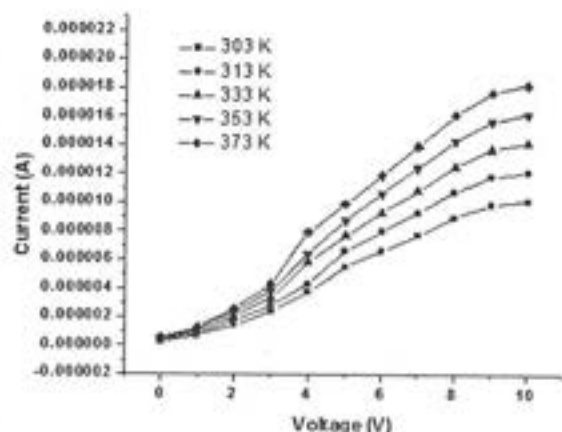
Fig. 6. I–V characteristics of pure CdS nanoparticles at different temperatures.
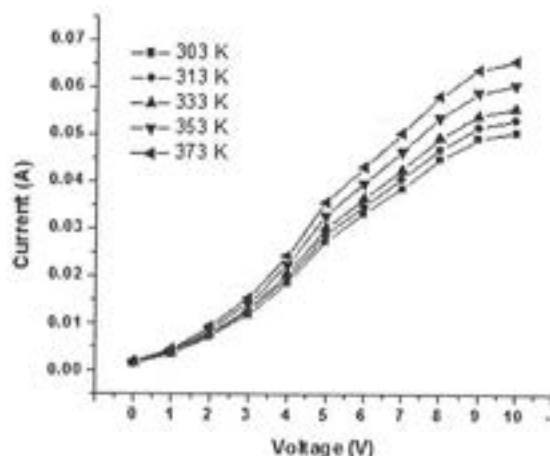
Fig. 8. I–V characteristics of CdS:M4 nanoparticles at different temperatures.

4
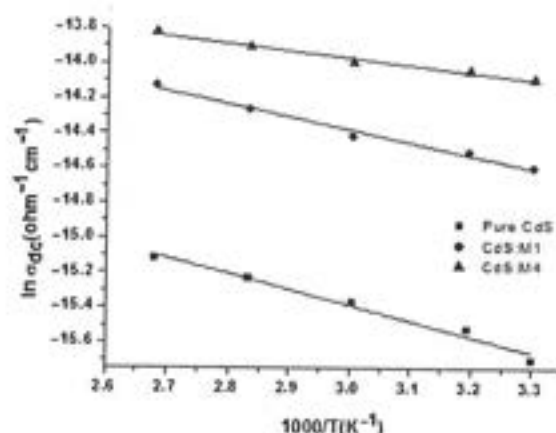
Fig. 9. Variation of dc electrical conductivity with temperature for pure CdS and CdS:Mn samples.
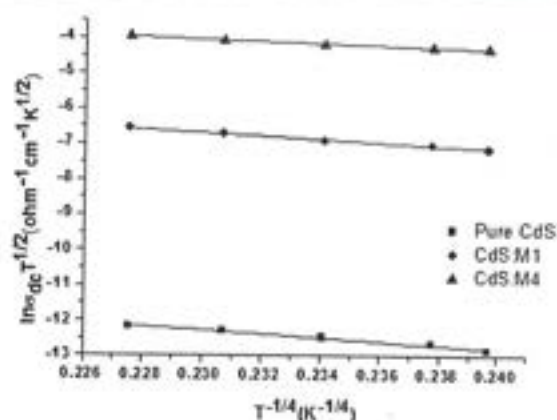
Fig. 10. Temperature dependence of dc electrical conductivity $(\ln \sigma_{dc}\sqrt{T})$ with $T^{-1/4}$ for pure CdS and CdS:Mn samples.

nanoparticles at different temperatures respectively. From Figures 6–8, it is observed that current increases with increase in voltage as well as temperature. This indicates that samples are semiconducting in nature. It is also observed that order of current increases from 10^{-6} to 10^{-2} on doping of Mn into CdS matrix. The current is found to be highest for CdS:M4 sample. From Table I and Figures 6–8, it is again observed that dc electrical conductivity increases with the increase in doping concentration of Mn^{2+} into CdS matrix. The reason for this increase has already been discussed above.

The dependence of dc electrical conductivity on temperature has further been used to determine the activation energy of conduction using the following relation:[33]

$$\sigma_{dc} = \sigma_o \exp\left[\frac{-\Delta E}{kT}\right] \qquad (3)$$

where, σ_o and ΔE represents the pre-exponential factor and activation energy respectively, and k is Boltzman constant. Figure 9 shows the variation of dc electrical conductivity with temperature for pure CdS and CdS:Mn samples. The slope and intercept of the plot gives value of activation energy of conduction (ΔE) and pre-exponential factor (σ_o) respectively. These values are mentioned in Table II for for pure CdS and CdS:Mn samples.

The activation energy of conduction alone does not provide information regarding the conduction process. The electrical conduction in samples may take place by two parallel processes i.e., band conduction and hopping conduction. According to Mott,[38] the two conduction mechanism can be distinguished on the basis of the value of pre-exponential factor. He suggested that pre-exponential factor should be two to three orders smaller in magnitude for conduction in localized states than that of the conduction in extended states. In the present study, the values if σ_o were found to be of the order of $10^1\ \Omega^{-1}\ cm^{-1}$, therefore, the possibility of extended state conduction has been ruled out and localized state conduction in the tail states is likely to take place. Therefore, Mott's three dimensional variable range hopping (3D VRH) model is applied to experimental data to get temperature dependence of dc electrical conductivity. Mott's formula[38] for temperature dependence of dc electrical conductivity is given by:

$$\sigma\sqrt{T} = \sigma_o' \exp\left[\frac{-B}{T^{1/4}}\right] \qquad (4)$$

where, σ_o' is pre-exponential factor and B is given by:[39]

$$B^4 = T_o = \frac{\lambda \alpha^3}{kN(E_f)} \qquad (5)$$

Here, α^{-1} describes the spatial extent of the wave function $\exp(-\alpha R)$ associated with the localized states, $N(E_f)$ is the density of localized states at the fermi level, λ is a dimensionless constant (about 18), T_o is degree of disorder and k is Boltzmann constant.

Table II. Value of dc electrical conductivity (σ_{dc}) at 298 K, activation energy of conduction (ΔE), pre-exponential factor (σ_o), density of states near fermi level ($N(E_f)$), spatial extent of wave function (α) and degree of disorder (T_o) for pure CdS and CdS:Mn samples.

Sample	σ_{dc} ($\Omega^{-1}\ cm^{-1}$)	ΔE (eV)	σ_o ($\Omega^{-1}\ cm^{-1}$)	$N(E_f)$	α (cm^{-1})	T_o (K)
Pure CdS	0.151×10^{-6}	0.778	12.67	1.40×10^{11}	1.88×10^4	8.86×10^6
CdS:M1	0.454×10^{-4}	0.633	12.17	2.71×10^{14}	1.87×10^5	4.53×10^6
CdS:M4	0.757×10^{-3}	0.353	12.73	3.91×10^{15}	5.44×10^4	7.67×10^5

Table III. Values of hopping distance (R), hopping energy (W) and αR for pure CdS and CdS:Mn samples at different temperatures.

	Pure CdS			CdS:M1			CdS:M4		
T (K)	R (cm)	W (meV)	αR	R (cm)	W (meV)	αR	R (cm)	W (meV)	αR
303	2.68×10^{-4}	88.6	5.03	2.27×10^{-5}	75.3	4.24	0.50×10^{-4}	48.8	2.72
313	2.66×10^{-4}	90.6	5.00	2.26×10^{-5}	76.3	4.22	0.49×10^{-4}	51.9	2.66
333	2.62×10^{-4}	94.8	4.92	2.22×10^{-5}	80.5	4.15	0.48×10^{-4}	55.2	2.61
353	2.58×10^{-4}	99.3	4.85	2.19×10^{-5}	83.9	4.09	0.48×10^{-4}	55.2	2.61
373	2.54×10^{-4}	104.1	4.77	2.16×10^{-5}	87.4	4.03	0.47×10^{-4}	58.8	2.55

The value of pre-exponential factor is reported as

$$\sigma_o' = 3e^2\gamma \left[\frac{N(E_f)}{8\pi\alpha kT} \right]^{1/2} \tag{6}$$

where e is electron charge and γ is Debye frequency (about 10^{13} Hz).

Solving simultaneously Eqs. (4) and (6) gives

$$\alpha = 22.52\sigma_o'B^2 \text{ cm}^{-1} \tag{7}$$

and

$$N(E_f) = 2.12 \times 10^9 \times (\sigma_o')B^2 \text{ cm}^{-3}\text{eV}^{-1} \tag{8}$$

Figure 10 shows temperature dependence of dc electrical conductivity ($\ln\sigma\sqrt{T}$) with $T^{-1/4}$ for pure CdS and CdS:Mn samples. From Figure 10, it is observed that conductivity increases slowly with increasing temperature. This indicates that electrical conduction in the samples is due to variable range hopping (VRH). The value of other parameters i.e., T_o, α and $N(E_f)$ for pure CdS and CdS:Mn samples are mentioned in Table II. The values of $N(E_f)$ indicate that density of states near fermi level increases on doping of Mn into CdS matrix. Researchers[40-42] have reported that value of T_o depends on the nature of hopping and the degree of disorder of the sample. It is reported that value of T_o between 10^7–10^5 K indicate amorphous nature of samples. In the present case, the values of T_o lies between above mentioned range which suggest that samples are structurally amorphous in nature.

Mott formula for hopping distance (R) is given by

$$R = \left[\frac{9}{8\pi\alpha N(E_f)kT} \right]^{1/4} \tag{9}$$

and hopping energy is

$$W = \frac{3}{4\pi R^3 N(E_f)} \tag{10}$$

The values of W and αR can also be used to determine the type of conduction taking place in samples. Mott and Davis[35-36] suggested that if the values of W and αR are greater than kT (25.7 meV at 298 K) and unity respectively then conduction takes place via variable range hopping. The values of W, R and αR obtained for pure CdS and CdS:Mn samples at different temperatures are listed

in Table III. It can be noticed that the values of W and αR are greater than kT and unity which suggest that samples follow the Mott's 3D VRH model. Moreover, the decrease in value of R and increase in value of W with increase in temperature also supports the concept of Mott's VRH model.

4. CONCLUSIONS

The present study reports dc electrical conductivity measurements of pure CdS and Mn doped CdS samples. The structural study suggests nanoparticle formation in the samples. DC conductivity measurements reveal that samples are semiconducting in nature. Further, it was found that conductivity increases on increase on Mn concentration in CdS matrix. This is due to availability of additional energy states created due to doping of Mn in CdS. The study of temperature dependence of conductivity suggests that conduction in samples take place via variable range hopping. The values of hopping range and hopping energy were also found to follow Mott's 3D VRH model.

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संगीत व साहित्य का ब्रज संस्कृति में महत्त्व

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भारतीय कला एवं संस्कृति की चिंतनधारा सदैव से ही आध्यात्मवादी रही है। आध्यात्मबाद में "आनन्दमय" की प्रतिष्ठा होती है और आनन्दमयी की उपलब्धि का मूल संगीत है। इसी कारण ब्रज भूमि का कण—कण संगीतमय रहा है। संस्कृति एवं साहित्य के साथ—साथ कला का भी केन्द्र अत्यन्त पुरातन काल से ब्रज वसुन्धरा ही है। "नाट्य शास्त्र एवं संगीत रत्नाकर" जैसे प्रामाणिक ग्रन्थों के युग के संगीत का यथार्थ स्वरूप जानने का साधन यदि हमें प्राप्त हो सकता है तो वह है— ब्रज का साहित्य एवं संगीत। ब्रज के भक्त संगीतज्ञ, कवि सन्तों, आदि ने युग—युग में संगीत का सांगोपांग विकास एवं प्रसार किया इसी कारण भारतीय संगीत पर ब्रज वसुधा की अमिट छाप परिलक्षित होती है।

भारत में ऐसा कोई क्षेत्र नहीं जो ब्रज वैभव से समन्वृत न हो।

ब्रज के रूप रस की दर्शन और शास्त्र की साहित्य और कला वैभव की संस्कृति और सभ्यता की लोकमयी और लोकोत्तर जीवन पद्धति की अमिट कहानी इतिहास में सर्वत्र स्वर्णाक्षरों में लिखी हुई है। कहीं पत्थरों पर उकेरी और तराशी हुई है तो कहीं विविध रंगों के संयोजन से युक्त चित्रांकना में जैसे बोल रही है। कहीं वह संगीत की स्वर लहरियों में झंकृत है, तो कहीं ढोल—ढोलक और नक्कारों या डफ, मृदंग, बेणुरी और सारंगी के स्वरों में नुपुरों की लयकारी के साथ दिये नृत्य मुद्रा में देखा जा सकता है। ब्रज का अधिकांश संगीत साहित्य मन्दिरों की देन है।

इन मन्दिरों में साहित्य, संगीत और कला का जो संगम हुआ है उसमें अवगाहन या तो रसिक जन करते हैं, अथवा साहित्य और कला के पारखी, इन मन्दिरों में जिन भक्त कवियों ने गाया वे गीत अमर हो गये और गायक भी संगीत साहित्य की दुनियाँ में चिर अमरता प्राप्त कर गये। स्वामी हरिदास जी, तानसेन जी, सूर, गोविन्द स्वामी आदि संगीत के आचार्य थे गायक थे, और स्वयं सरस पद रचना के रचियता कवि थे।

ब्रज में शास्त्रीय संगीत, लोक संगीत, अथवा सरल संगीत आदि जो कुछ हमें आज सुनने को मिल रहा है। उसका सम्बन्ध रूपान्तर से या प्रत्यक्ष रूप में परम्परागत शास्त्रों के विचारों के साथ—साथ १५वीं, १६वीं, एवं १७वीं शताब्दी के भक्ति संगीत से अवश्य रहा है। चाहे वह राग योजना में हो ताल योजना में पदगत साहित्य के रूप में अथवा गायन पद्धति के रूप में हो। इस युग में समस्त विद्या और कला साधनाओं के साथ कीर्तन प्रणाली का सरस समन्वय हुआ। मानव जीवन की समस्त सौन्दर्य भावना अष्ट छाप के कवियों के संगीत में साकार हो गई। क्योंकि ये कीर्तनकार महान कवि होने के साथ—साथ उच्च कोटि के गायक भी थे। इस प्रसंग में गोविन्द स्वामी, स्वामी हरिदास, तानसेन चेतन्य महाप्रभु एवं उनके शिष्य रूप और सनातन के अतिरिक्त राधा वल्लभ सम्प्रदाय प्रर्वतक हित हरिवंश का नाम भी नमनीय है, जिन्होंने ने बृन्दावन को केन्द्र बनाकर कीर्तन भक्ति का प्रसार किया।

इस प्रकार ब्रजभूमि भक्ति एवं संगीत की ऐसी अगम, अगाध स्रोत वाहिनी है जिसका अवगाहन कर पाना कठिन है। ब्रजभूमि में भक्ति की अनेक सरितायें प्रवाहित होकर उस संगम की ओर जाती है जहाँ श्रीराधा कृष्ण भक्ति का अपार पारावार लहराता नजर आता है। इस पारावार में भक्ति की पाँच प्रमुख सरिताओं का कल—कल नाद स्पष्ट कानों से सुना और भक्ति—लहरियों का तरंगित दृश्य आंखों से देखा जा सकता है। ये पंच प्रमुख भक्ति सरिता है, निम्बार्क सम्प्रदाय, चैतन्य (गौड़ीय) सम्प्रदाय, वल्लभ सम्प्रदाय, राधा वल्लभ सम्प्रदाय और स्वामी हरिदास का सखी सम्प्रदाय।

इन सभी सम्प्रदायों से सम्बन्धित विभिन मन्दिरों, मठों, देवालयों, देवस्थान सभी में राधा कृष्ण की

मनोहारी छबि के दर्शन पाकर भक्तगण आह्लादित होते है। इन ब्रज भक्त कवियों के पद अन्तर्संगीत के शब्द, वर्ण—माधुर्य और भावानुकूल योजना के साथ संगीत ताल मात्राओं के इतने समीप हैं कि उन्हें संगीत में निबद्ध कर सहज ही गाया जा सकता है। इन सम्प्रदायों के भक्त गीतों में संगीत की ध्रुवपद गायन व धमार शैली खूब फूली—फली है, क्योंकि कृष्ण भक्त कवि ध्रुवपद गायन में पारंगत थे तथा ध्रुवपद शैली ही शुद्ध भारतीय गायन प्रणाली समझी जाती थी। ध्रुवपद के समान ही धमार गीत भी इन ब्रज के मन्दिरों में गाये जाते हैं, जिनमें प्रयुक्त लय योजना उत्सवों के उल्लास को मुखर करती हैं।

यह ऐतिहासिक सत्य है कि ख्याल गोई का विकास, ९वीं, १०वीं शताब्दी में ब्रज भूमि में सिद्ध योगियों के चर्यापदों की लोक गायकी से हुआ। ख्यालगोई के जितने सम्प्रदाय है जैसे — कलगी वाले तुर्रे वाले, सेहरा वाले, छतर वाले, मुकुट वाले आदि उन गुरू परम्परा का यदि अन्वेषण किया जाए तो इन सबका निकास "ब्रज जनपद" से ही सिद्ध होता है। ब्रज का साहित्य तो वह मानसी गंगा है, जिसके अवगाहन से मन पवित्र होता है। तन में स्फूर्ति आती है और ध्यान मानव के जीवन रस पर केन्द्रित हो जाता है। ब्रज के साहित्य ने अपने समसायिक दायित्व को पूरी तरह निबाहा है। भक्तियुग में उसने तानपूरा उठा लिया तो ज्ञान—विज्ञान के युग में वह आत्मा—परमात्मा की खोज में संलग्न होकर मन और इन्द्रियों के विषय—नियंत्रण के कठिन कार्य में प्रवृत्त हो गया। मुगलों के राज—दरबारों में जाकर भी उसने अपनापन नहीं खोया। ब्रज की कविता ने तत्कालीन आश्रयदाताओं की कामुकता और विलासता को ही व्यंग रूप में उभार कर अपनी सम—सामयिकता को प्रतिबिम्बित किया है। आधुनिक कला के नव जागरण में स्वतंत्रा संग्राम में भी ब्रज के उपेक्षित कवियों ने अपने दायित्व को भली प्रकार निवाहा है और इस समय भी ब्रज में साहित्य सृजन लगातार हो ही रहा है।

संदर्भ:

१ शर्मा अंजु — ब्रज संस्कृति में संगीत — पृ. सं. ४८, ४९.

२ सिंह डॉ. वंदना — ब्रज की संगीत परम्परा — पृ.सं. ११२

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वर्तमान परिप्रेक्ष्य में संगीत के क्षेत्र में बढ़ती हुई महिलाओं की भूमिका

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भारतीय संगीत का इतिहास वैदिक काल से ही माना जाता है, मानव और संगीत का इतना गहरा सम्बन्ध है, जो उसके जन्म के साथ ही चला आ रहा है, प्राचीन साहित्य के उल्लेखों को देखते हुए यह अनुमान लगाया जा सकता है कि जहाँ तक धार्मिक अवसर का सम्बन्ध था। ब्राह्मण एवं क्षत्रिय दोनों वर्ग अपने जातिगत धर्म के अनुसार यज्ञादि में भाग लेते थे, यज्ञ में धार्मिक संस्कारों पर कन्याओं एवं यजमानों की पत्नियों का संगीत से सम्बन्ध प्राप्त होता है। सामगायन जैसे धार्मिक अवसर तथा अन्य यज्ञ एवं धार्मिक संस्कारों के अवसरों से लेकर सामाजिक अवसरों तक में स्त्रियों का महत्त्वपूर्ण योगदान रहा है। महाव्रत यज्ञ इत्यादि के अवसर पर सामगायक पुरूषों के साथ—साथ उनकी स्त्रियाँ गायन वादन करती थीं, दास कुमारियों द्वारा नृत्य तथा गाथाओं का गायन किया जाता था। संगीत सम्बन्धी सभी अवसरों पर महिलाओं का विशेष सहयोग रहता था, ऋग्वेद में स्त्रियों के गायन और नृत्य की चर्चा की गई है।

'शतपथ ब्राह्मण' 'तैत्तिरीय संहिता' आदि में भी साम—गान स्त्रियों का विशेष कार्य माना गया, तथा उस समय भी संगीत स्त्रियों का विशेष गुण माना जाता था। महाभारत काल में भी स्त्रियों की संगीत में विशेष भूमिका रही है। जिसमें क्षत्रिय वर्ग की स्त्रियों द्वारा विराट पर्व में नृत्य कला की प्रस्तुतियाँ एवं ब्राह्मण कुल की स्त्रियों के साम गायन के उल्लेख मिलते हैं। देवगंधर्व के साथ—साथ, मेनका, रंभा आदि अप्सराओं का रामायण काल में भी उल्लेख मिलता है।

ततः स्वस्त्ययनं कृत्वा मन्त्रविद् विजयैशिणी ॠ

ये श्लोक इस बात का प्रबल प्रमाण है कि स्त्रियों के सम्बन्ध में वैदिक युग से अविच्छिन्न रूप से चली आ रही भावनाओं एवं मान्यताओं के आधार पर ही रामायण काल में भी तदनुसार प्रक्रिया प्रचलित रही। जीवन के समस्त क्षेत्रों में स्त्रियाँ सक्रिय थीं। तथा उनकी उच्च छवि प्रेरणादायक रही। अनेक प्रकार के उत्सवों मे स्त्रियों द्वारा गायन—वादन तथा नृत्य के कायक्रम प्रस्तुत किये जाते थे, महाभारत युग में भी संगीत स्त्रियों के लिए निशिद्ध नहीं था।

ललित कलाओं में संगीत को सर्वश्रेष्ठ स्थान प्राप्त है। संगीत एक ऐसी कला है कि जिसके द्वारा मनुष्य लौकिक तथा पारलौकिक सुख का अनुभव कर सकता है। भारत एक ऐसा देश है। जहाँ पुरूषों ने संगीत में नाम कमाया है, वहीं नारी भी किसी विद्या में कम नहीं है। आधुनिक युग में जब महिलाएँ हर क्षेत्र में पुरूषों की बराबरी कर रही हैं तो संगीत तो उसका अपना स्थान है।

मैं भीलवाड़ा में पैदा हुई, बाल्यकाल से ही मुझे संगीत में बहुत रूचि रही। संगीत तो जो प्रत्येक के दिल को छू लेता है, इससे मैं भी अछूती नहीं रही और बचपन से ही संगीत की ओर रूचि बढ़ती गई। इस रूचि ने मेरे हृदय में ऐसा बीज बोया जो समय के साथ फला—फूला और मुझे प्रेरणा मिली कि मैं उन महिला कलाकारों को एक लड़ी में पिरोऊँ जिन महिला कलाकारों ने अपना जीवन संगीत को समर्पित कर दिया। इसीलिये ये आवश्यक प्रतीत होता है कि उन महिला कलाकारों का संगीत के क्षेत्र में उपलब्धियों तथा उनका योगदान प्रस्तुत किया जाये।

प्राचीन भारत में मनोरंजन के साधनों में नश्त्य, गायन, वादन व अभिनय का प्रमुख साधन रहा है। पहले अभिनय का प्रमुख स्थान रंगमंच हुआ करता था, फिल्म उद्योग के विकास से पूर्व नर नारी, रंगमंच पर अभिनय करके अपनी कला को प्रदर्शित करते थे। फिल्मी दुनिया में लीला चिटनिस का नाम विशेष रूप से उल्लेखनीय है। इस क्षेत्र में उनके योगदान को दृष्टि में रखकर फिल्म उद्योग में भाग लेने वाली अभिनेत्रियों

में नर्गिस, वजीनी कौशल, मीना कुमारी, मधुबाला आदि के नाम भी अत्यन्त महत्वपूर्ण हैं। जिन्होंने अपने श्रेष्ठ अभिनय के द्वारा लोगों को सिनेमा की ओर आकर्षित किया। १९१३–१४ तक महिलाओं की भूमिका भी अक्सर कम उम्र के बालक ही निभाया करते थे क्योंकि इस क्षेत्र में नारी की भागीदारी उचित नहीं समझी जाती थी।२ समय के साथ–साथ महिलाओं की स्थिति में परिवर्तन आता गया और वह अभिनय के साथ–साथ फिल्म निर्देशन, संगीत निर्देशिका, नश्त्य निर्देशिका के कार्य को सम्पन्न होने लगी। वर्तमान में सिनेमा जगत में जिन महिला निर्देशिकाओं का संदर्भ मिलता है उनमें से कुछ प्रमुख नाम सईपरांजपे, दीपा मेहता, अर्पणा सेन, फराह खान आदि हैं। कुछ अन्य प्रमुख महिलाएं उषा खन्ना, सरोज खान आदि हैं।

हिन्दुस्तानी संगीत के इतिहास के बारे में चर्चा की जाये तो इस क्षेत्र में अनेक महान विदुषी गायिकाएं हुई हैं। जिन्होंने संगीत को विकसित किया। इतिहास का कोई कालखंड ऐसा नहीं है, जब महिलाओं ने अपनी लोकप्रियता एवं सशृजन कौशल का परिचय न दिया हो। स्त्री और कला एक दूसरे के पर्यायवाची हैं। स्त्री सशृष्टि की वह सुंदर रचना है जिसका सम्बन्ध ललित कलाओं से होना स्वाभाविक है। अर्थात् गायन–वादन और नश्त्य के गुण उसमें स्वभावत: पाये जाते हैं, गायन के क्षेत्र में महिला कलाकारों के क्रियात्मक संगीत के साथ–साथ नित्य नवीन रागों का निर्माण एवं गायन शैलियों में नये जोड़ का समावेश कर अपनी सृजनात्मक प्रतिभा को अनन्त विस्तार दिया है। इन महान् गायिकाओं की निरंतर कठोर साधना, रियाज, शिक्षा तथा जिस लगन के साथ इस कला को इन्होंने अपनाया है उसे देखकर हम उनके सामने नतमस्तक हो जाते हैं। हिन्दुस्तानी शास्त्रीय संगीत की अनमोल गायन परम्परा को आधुनिक काल में भी अनेक संगीत साधिकाओं ने अपनी योग्यता और सृजन क्षमता से भारतीय संगीत को अति उच्च स्थान पर पहुंचाया है, इनमें प्रमुख । नाम है सुश्री, केसर बाई केरकर, हीरा बाई बड़ोदकर, जयपुर घराने की गायिका मोगुबाई कर्डीकर, मल्लिका ए गजल बेगम अख्तर, गंगुबाई हंगल, डॉ. प्रभा अत्रे, गान सरस्वती किशोरी अमोनकर, शोभा गुर्टु, मालिनी राजुरकर, परखीन सुल्ताना, और सुगम संगीत की अलौकिक आवाज की गायिका लता मंगेशकर आदि हिन्दुस्तानी संगीत के जगमगाते सितारे हैं। वर्तमान में यदि लोकगायिकाओं की बात करें तो गुलाबां, रेशमा आदि के नामों को भुलाया नहीं जा सकता। ये आसमां के हमेशा टिमटिमाने वाले वे सितारे हैं जिन्हें आने वाली सदियों तक याद किया जायेगा। इन सब गायिकाओं ने अपने जीवन में अनेक कठिनाईयों का सामना करते हुए अपनी लगन और मेहनत से गायिकी में अपने आपको निपुण बनाने के लिए कठोर साधना की और शास्त्रीय एवं लोक गायन की समृद्ध परम्परा को आगे बढ़ाने में विशिष्ट भूमिका निभायी है।

१ वाल्मिकी रामायण, सुन्दर काण्ड ४, १६१३
२ ranchiexpress.com / फिल्मों एवं टी.वी. में महिलाओं का योगदान

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'ओमृकार नाद' अद्भुत शक्तियों का दाता

डॉ. प्रभा बजाज

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'नाद, अव्यक्ने शब्दे' अर्थात् अव्यक्त (अस्पष्ट) शब्द के अर्थ में 'नाद' धातु से नाद शब्द रूप निष्पन्न होता है। अतः नाद का अर्थ अव्यक्त ध्वनि है। वर्ण, पद, वाक्य, स्वर, ये सब उस 'अव्यक्त ध्वनि' के ही व्यक्त रूप हैं। प्रसंगानुसार नाद शब्द के अनेक अर्थ स्वीकृत किये जाते हैं। लोक—व्यवहार में शब्द अर्थात् आवाज, योग और तन्त्र के अनुस्वार के समान उच्चारण किये जाने वाले 'वर्ण'। ''शारदा तिलक में स्पष्ट कहा है कि परमेश्वर के सच्चिदानन्द रूप विभव से 'शक्ति' उसमें 'नाद' उसमें बिन्दु उत्पन्न हुआ है। बिन्दु ही प्रणव है, उसी को बीज कहते हैं। नाभि देश के ऊर्ध्व भाग में स्थित हृदयस्थान से ब्राह्यग्रान्त में प्राणसंज्ञक वायु, शब्द को उत्पन्न करता है, उसी को नाद कहते है।''

शास्त्रों में ओंमकार नाद/ध्यान के महत्व को प्रतिपादित करते हुए वर्णित है —

''ओंमकार बिन्दु संयुक्त नित्यम् ध्यायन्ति योगिनः कामद मोक्षदम् चैव, ओंमकाराय नमो नमः।।''

ॐ आध्यात्मिक लक्ष्य और बाह्य साधना का बीज मंत्र है। यह वैज्ञानिक एवं आध्यात्मिक पद है। जिसके उच्चारण से पैदा होने वाली तरंगे हमें अनेक प्रकार के शारीरिक, मानसिक एवं आध्यात्मिक लाभ प्रदान करती है तथा आत्मा से परमात्मा बनने का उपाय है।

ॐ शब्द का अर्थ है जिमका कभी क्षरण न हो अ, उ, म से मिलकर बना है 'ॐ'। माना जाता है कि सम्पूर्ण ब्रह्माण्ड से सदा 'ॐ' की ध्वनि निःसृत होती रहती है। समस्त प्राणियों के श्वास में 'ॐ' की ध्वनि निकलती है। यही समस्त प्राणियों के श्वास की गति को नियन्त्रित करता है। भारतीय संस्कृति में 'ॐ' नाद का महत्वपूर्ण स्थान है। किसी भी मंत्र से पहले यदि 'ॐ' जोड़ दिया जाये तो वह पूर्णतया शुद्ध एवं शक्ति सम्पन्न हो जाता है। किसी देवी—देवता, ग्रह या ईश्वर के मंत्रों के पहले 'ॐ' लगाना आवश्यक होता है, जैसे— 'ॐ महावीराय नमः, श्री राम का मंत्र — 'ॐ रामाय नमः', विष्णु का मंत्र — 'ॐ विष्णवं नमः' प्रसिद्ध है। कहा जाता है कि ॐ से रहित कोई मंत्र फलदायी नहीं होता है। चाहे उसका कितना भी जाप हो। मंत्र के रूप में मात्र ॐ भी पर्याप्त है। माना जाता है कि एक बार 'ॐ' का जाप हजार बार किसी मंत्र के जाप से महत्वपूर्ण है। 'ॐ' का दूसरा नाम प्रणव (परमेश्वर) है।''

''तस्य वाचकः प्रणवः''

अर्थात् उस परमेश्वर का वाचक प्रणव है। इस तरह प्रणव अथवा ॐ एवं ब्रह्म में कोई भेद नहीं होता। ॐ अक्षर है इसका क्षरण अथवा विनाश नहीं होता।

ॐ धर्म, अर्थ, काम, मोक्ष इन चारों पुरुषार्थों का प्रदायक है। मात्र ॐ का जाप कर कई साधकों ने अपने उद्देश्य की प्राप्ति कर ली।

''श्री मद्भागवत में ॐ के महत्व को कई बार रेखांकित किया गया है। श्री गीता जी के आठवें अध्याय में उल्लेख मिलता है कि जो 'ॐ' अक्षर रूपी ब्रह्म का उच्चारण करता हुआ शरीर त्याग करता है, वह परम गति प्राप्त करता है।''

सनातन धर्म ही नहीं भारत के अन्य धर्म दर्शनों में भी ''ॐ'' को महत्व प्राप्त है। बौद्ध दर्शन में 'मणिपद्महुय का प्रयोग जप एवं उपासना के लिए प्रचुरता से होता है। महात्मा कबीर जो कि निर्गुण संत एवं कवि थे। उन्होंने भी ॐ के महत्व को स्वीकारा और इस पर ''साखियां'' भी लिखीं —

ओ ओंकार आदि मे जाना। लिखि ओ गंे नांद

ओ ओंकार लिखे जो कोई।

सोई लिखि मेहणा न होई।।

गुरूनानक ने 'ॐ' के महत्व को प्रतिपादित करते हुए लिखा है –

"ओम सतनाम कर्ता पुरूष निर्भो निर्वेर अकालभूत"

यानि ॐ सत्यनाम जपने वाला पुरूष निर्भय वैर रहित एवं अकाल–पुरूष सदृश हो जाता है।

जैन धर्म के अनुसार आदिकाल–यानि भगवान आदिनाथ के काल से ही भारतीय संस्कृति में ओमकार को सबसे पुनीत स्वर माना गया है। भारत के सभी धर्मावलम्बी अपने धार्मिक क्रियाकलापों एवं लोक व्यवहार कार्यों के प्रारम्भ में 'ॐ' अंकित कर कार्यारम्भ करना मांगलिक मानते है। जैन दर्शन में पूजा, पाठ आराधना कार्यों में ओमकार को सर्वोच्च स्थान दिया गया है। कारण "ओम" शब्द की रचना पंच परमेष्णी के नामों के आद्य अक्षरों को लेकर हुई है। अ (अरिहन्त) अ(अशरीरी सिद्ध) आ (आचार्य) उ (उपाध्याय) म (मुनि) ये पाँचों प्रतिनिधि स्वर अ+अ+आ+उ+म मिलाकर ओम का निर्माण करते है इस प्रकार ओम उच्चारण से पंच परमेष्ठियों का ध्यान व स्मरण किया जाता है। अत: एकाग्र होकर सभी अति ध्यान व विकल्पों से दूर होकर ओम मंत्र साधना काल में सहज ही शुभोपयोग होने से सातिशय पुण्य का उदय होता है।

'विश्व स्तर के वैज्ञानिक स्वीकार कर चुके है कि ६ मिनट गेज ओमकार उच्चारण ध्यान करने से सैकड़ो रोग ठीक हो जाते हैं जो दवा से भी इतनी जल्दी ठीक नहीं होते। 'ॐ' का उच्चारण करने से मस्तिष्क में विशेष वाइब्रेशन (कम्पन) होता है और ऑक्सीजन प्रवाह होने लगता है। स्ट्रेस और टेन्शन दूर होती है। मैमोरी पॉवर बढ़ती है। रक्त संचार संतुलित होता है। रक्त चाप, हृदय रोग, कोलेस्ट्रॉल जैसे रोग ठीक हो जाते हैं। ये सारे शोध विश्व स्तर के वैज्ञानिक स्वीकार कर चुके हैं। जरूरत है प्रतिदिन ध्यान करने की।''[3]

ओमकार ध्यान हेतु पद्मासन या पालती बनाकर दोनों हाथों के अंगूठे व तर्जनी अंगुली को मिलाकर या बायीं अंगुली पर दायीं रखकर (ध्यान मुद्रा में बैठ) ॐ पर ध्यान केन्द्रित कर लम्बा श्वास खींन कर ॐ मंत्र का उच्चारण प्रारम्भ करें एवं एक श्वास में हम अपनी दृष्टि ॐ पर घुमाते जाएँ व ॐ नम. उच्चारण के साथ इसे समाप्त करें पुन: लम्बा श्वास खींच कर यह क्रम दोहराते जाएँ। ॐ उच्चारण में होंठ हल्के से खुले रहें व दृष्टि नासिका पर रहें। छ: मिनट में आप महसूस करेंगे के सम्पूर्ण मस्तिष्क में ॐ गूंज भर गयी है व सभी नाड़ी तंत्र गुंजायमान होकर सक्रिय हो गये हैं। यह गूंज बढ़ती रहेगी तो मान लीजिए कि मस्तिष्क में ऑक्सीजन का प्रभाव हो रहा है एवं विशेष ऊर्जा का संचार होने से अनेक रोग मिटने प्रारम्भ हो गये हैं, व शारीरिक मानसिक व आध्यात्मिक दृष्टि से हम सम्पन्नता की ओर बढ़ रहे हैं।

(Footnotes)

[1] स्वर और राग – डॉ. रेणु जैन – पृष्ठ संख्या – ३

[2] https://hi.wikipedia.org/wiki/ओइम्

[3] जीवन के सीक्रेट व पेशनर्स टाइम्स से उद्धृत

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उच्च शिक्षा में संगीत की स्थिति

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आधुनिक काल मे संगीत शिक्षा का एक अभिन्न विषय बन चुका है। शिक्षा मानव के सर्वांगीण विकास के लिए एक अविच्छिन्न भावात्मक गत्रा है, जिसके प्रभाव मे मनुष्य के मन की कल्पनाएं अथवा उदारतम भावनाएँ न तो प्रस्फुटित होती है और न ही मनुष्य की कलात्मक आकांक्षाओं की तर्पित हो सकती है। संगीत अन्य ललित–कलाओं की अपेक्षा मानव समाज की कलात्मक उपलब्धियों व सांस्कृतिक परम्पराओं का मूर्तिमान प्रतीक है। यह मानव के आरम्भिक काल मे ही जन–जीवन के आत्मिक उल्लास और सुखानुभूतियों की ललित अभिव्यक्ति का मधुरतम माध्यम रहा है। इतना ही नहीं, दुःख के समय भी संगीत मनुष्य का साथ नहीं छोड़ता। अतः संगीत जैसी सर्वोत्कृष्ट कला जो मानव–जीवन के इतना समीप है और जीवन मे महत्वपूर्ण स्थान रखती है। उसकी शिक्षा प्राप्त करना अति आवश्यक हो जाता है।

इस महत्व को स्वीकार करते हुए ही शिक्षाविदो ने इसे शिक्षण–विषयों मे एक विषय के रूप मे स्वीकार किया है।

१९वीं शताब्दी के अन्तिम चरणों मे श्रद्धेय विष्णुदुय के अथक प्रयलों द्वारा संगीत का संस्थागत शिक्षण प्रारम्भ हुआ। विष्णु नारायण भातखण्डे एवं विष्णु दिगंबर पलुस्कर इन दोनों संगीत उद्धारकों ने संगीत को शिक्षा के क्षेत्र मे पदार्पण करवाया और अनेक संगीत सम्मेलनों, संगीत सभाओं का आयोजन करवाया जिससे संगीत साधारण जन–समुदाय तक

पहुँच सके। इसके लिए इन्होंने असंख्य संगीत सम्बन्धी पुस्तकों की रचना की और स्वयं संगीत के प्रशिक्षण स्थानों की स्थापना भी की। सर्वप्रथम स्वरलिपि पद्धति का निर्माण भी किया जिससे संगीत की उच्च शिक्षा वैज्ञानिक ढंग से दी जा सके। इन दोनों महान विभूतियों के कार्यों से हमारा भारतीय संगीत पूर्णतया प्रभावित है, क्योंकि इन्ही के अधिक प्रयासों और परिश्रम द्वारा ही हमारे संगीत को एक व्यवस्थित व सुनियोजित दिशा प्राप्त हुई है। इस प्रकार शनै–शनै संगीत आज प्रत्येक नगर मे प्रायः सभी सरकारी विद्यालयों, महाविद्यालयों और विश्वविद्यालयों मे पाठ्यक्रम का एक अभिन्न अंग बन गया है अथवा ऐच्छिक विषय के रूप मे पढ़ाया जाता है। यह विद्यार्थियों की रुचि अनुसार संगीत की उच्च स्तरीय शिक्षा के प्रायः समस्त साधन उपलब्ध है। संस्थागत अथवा विद्यालयीन शिक्षा के कारण आज हमारे समाज मे संगीत का प्रचार तीव्र गति से हो रहा है।

'सन् १९४९ मे अर्थात् स्वतन्त्रता प्राप्ति के दो वर्ष उपगन्त भारतीय सरकार ने सामान्य शिक्षण मे ललित–कलाओं के महत्व को पूर्णतः स्वीकार किया और सामान्य पाठ्यक्रम मे ललित कलाओं को भी सम्मिलित करने के लिये गम्भीरता पूर्वक विचार करने लगी। अततः सन् १९५२–५३ मे भारत के नियुक्त माध्यमिक शिक्षा आयोग (मुदालियर कमीशन) की सर्वेक्षण रिपोर्ट के अनुसार माध्यमिक विद्यालयों मे अन्य विषयों के साथ संगीत विषय को भी सम्मिलित करने का सुझाव दिया गया।''

सरकार एवं शिक्षाविदों के प्रयासों से संगीत विषय को माध्यमिक स्तर के पाठ्यक्रम मे महत्व प्राप्त होने के उपरान्त संगीत को धीरे–धीरे स्नातकोत्तरीय कक्षाओं मे भी विषय के रूप मे पढ़ाया जाने लगा। पुनः त्रिवर्षीय स्नातक डिग्री के लिए संगीत का पाठ्यक्रम बना जो समय की निर्धारित सीमाओं मे अधिक विस्तृत था और सैद्धान्तिक पथ की प्रबलता के कारण क्रियात्मक पथ गौण हो गया। स्नातकोत्तर कक्षाओं का पाठ्यक्रम भी बहुत विस्तरत बनाया गया पुनः समय की निर्धारित सीमाओं मे विषय पर प्रभुत्व प्राप्त करना तो दूर उसे पूर्ण करना भी विद्यार्थियों के लिये कठिन हो

गया।

बीसवी शताब्दी में भारतीय सरकार ने ललित कलाओं के विकास हेतु सराहनीय प्रयास किये। आकाशवाणी, दूरदर्शन, संगीत नाटक अकादमी की स्थापना एवं अपने देश के विभिन्न राज्यों में व विदेशों के सांस्कृतिक आदान–प्रदान सम्बन्धी कार्यक्रमों का आयोजन कर तथा लोक–संगीत व लोक–कलाओं को विभिन्न प्रकार से प्रोत्साहन देकर हमारी सरकार ने संगीत शिक्षा का विस्तार कर दिया है। विभिन्न विश्वविद्यालयों और विश्वविद्यालय अनुदान आयोग की सहायता से संगीत सम्मेलनों, सेमिनार, संगोष्ठियों आदि का आयोजन करते रहते है। अनेक विश्वविद्यालयों में संगीत पर शोध कार्य भी हो रहा है।

वर्तमान संगीत शिक्षण की कुछ उपलब्धियाँ है। संगीत सर्वजन सुलभ हो गया है पहले गुरू शिष्य परम्पर में संगीत शिक्षा देने के लिए गुरूगण सरलता से तैयार नही होते थे। परन्तु आज जब संगीत शिक्षण विद्यालयों में विषय के रूप में पढ़ाया जा रहा है। तब प्रत्येक संगीत सीखने का इच्छुक व्यक्ति संगीत सीख सकता है।

आधुनिक काल में नारी ने संगीत के संस्थागत शिक्षण का पूर्ण लाभ उठाते हुए आश्चर्यजनक उन्नति की है। वैसे तो आज नारी प्रत्येक क्षेत्र में प्रगति कर रही है किन्तु संगीत जब तक संस्थागत शिक्षण के अन्तर्गत नहीं आया था, तब तक संगीत सीखने के लिए उसे बहुत कठिनाइयों का सामना करना पड़ता था। नारी कलाकार आज तीनों क्षेत्रों में (गायन, वादन एवं नृत्य) प्रशंसा का पात्र बन रही है।

संगीत में स्वरलिपि पद्धति के कारण ही हमारा संगीत समाज के निकट आ सका है। इस पद्धति से संगीत सीखने वालों को बहुत सुविधा हो गई है। इसी के द्वारा शिक्षक कम से कम समय में अधिकारिक शिष्यों को वैज्ञानिक ढंग से सामूहिक शिक्षा दे सकता है। आधुनिक समय में प्रकाशन सम्बन्धी सुविधाओं के कारण ही अनेक संगीत सम्बन्धी पुस्तकें उपलब्ध हो सकी है। जो विद्यार्थियों के ज्ञानवर्धन में सहायक है। आज होनहार विद्यार्थियों को सरकार की ओर से छात्रवृत्तियाँ प्रदान करने की सुविधा उपलब्ध है। विद्यालयों

एवं महाविद्यालयों में छात्र–छात्राओं के मानसिक विकास हेतु अनेकों सांगीतिक प्रतियोगिताएं आयोजित की जाती है। जिससे उनके मन में आत्मविश्वास की भावना उत्पन्न होती है। इसके अतिरिक्त आकाशवाणी, दूरदर्शन, आदि का सहयोग भी संगीत शिक्षा को प्रसारित करने में बहुत उपयोगी सिद्ध हो रहा है।

इस प्रकार संगीत ने शिक्षा पाठ्यक्रम में प्रवेश प्राप्त कर अनेक उपलब्धियाँ प्राप्त की है। इसमें कोई सन्देह नहीं, किन्तु विद्याध्ययन का अंग बन जाने के बाद भी विद्यार्थियों के लिए अनेक प्रकार की समस्याएं सामने आती हैं जिन्हें हमारे शिक्षाविदों ने उपेक्षित कर दिया है जिसके कारण हमारा संस्थागत संगीत शिक्षण त्रुटिपूर्ण अथवा दोषपूर्ण हो गया है। माध्यमिक स्तर पर तो विद्यार्थी को संगीत विषय के साथ अन्य पाँच या छः विषय भी पढ़ने होते हैं और यह आवश्यक भी है। प्रत्येक विषय की प्रारम्भिक जानकारी होना आवश्यक है। अतः संगीत के पाठ्यक्रम में भी संगीत का उतना ही ज्ञान दिया जाना चाहिए जितना उस आयु वर्ग के लिए आवश्यक है। किन्तु हमारा पाठ्यक्रम उस आयु के लिए अधिक होता है जो समयावधि में पूर्ण भी नहीं हो पाता कि परीक्षाएं प्रारम्भ हो जाती है। ऐसे में विद्यार्थी के कलाकार बनने की सम्भावनाएं तो बहुत कम हो ही जाती है, उसे संगीत का मौलिक ज्ञान भी भली–प्रकार मिलना कठिन हो जाता है। माध्यमिक स्तर तक उन विषयों की जानकारी मिलना भी विद्यार्थी के लिए अति आवश्यक है। इसके लिए पूर्णतया हमारा पाठ्यक्रम दोषी है जो माध्यमिक स्तर के लिए अधिक है। माध्यमिक स्तर से ऊपर महाविद्यालय स्तर पर भी हमारे संगीत शिक्षण की यही अवस्था है।

संगीत के संस्थागत शिक्षण में प्रारम्भिक दशकों में संस्थाओं में कार्यरत शिक्षकों के अदम्य उत्साह, समर्पण एवं निष्ठा के फलस्वरूप तथा इन संस्थाओं में प्रवेश लेने वाले विद्यार्थियों की सीमित संख्या एवं उनमें प्रतिभा व लगन के कारण बहुत अच्छा कार्य हुआ। उस समय संगीत शिक्षा पाए हुए अधिकांश विद्यार्थियों ने कलाकार या शिक्षक के रूप में ख्याति अर्जित की तथा संगीत के प्रचार–प्रसार में महत्त्वपूर्ण योगदान दिया।

यद्यपि वर्तमान समय में सांस्कृतिक उत्थान के साथ—साथ संगीत की चहुंमुखी प्रगति हो रही है और संगीत शिक्षा के विकास हेतु बहुमुखी प्रयास भी हो रहे है। किन्तु फिर भी शिक्षा संस्थाओं में अपनी स्थिति को सुदृढ़ करने के लिए संगीत विषय को अत्यन्त संघर्ष करना पड़ रहा है। यह विषय अभी भी माध्यमिक स्तर पर छात्राओं के पाठ्यक्रम में ही प्रचलित है। शिक्षण संस्थाओं में अभी भी सुनियोजित पाठ्यक्रम, रोचक व मनोवैज्ञानिक शिक्षण विधि एवं प्रभावपूर्ण सामूहिक शिक्षण हेतु प्रयास तो हो रहे है किन्तु वे सब अपर्याप्त नहीं हैं।"

अन्त में, मैं इतना ही कहूँगी कि संगीत शिक्षण में सुधार हेतु हम सभी को सामूहिक रूप से प्रयास करने होंगे, तभी अच्छे परिणाम सामने आयेंगे। इसके लिए प्रारम्भिक कक्षाओं से ही संगीत को अनिवार्य किया जाए और उनको तानपुरा, तबला की संगति में प्रशिक्षण दिया जाए। प्रारम्भिक कक्षाओं में अलंकार, पलटों के अभ्यास पर विशेष बल दिया जाना चाहिए। रागों का शिक्षण देते समय राग का प्रारम्भ आलाप फिर उसी राग में पलटी व तानों का अभ्यास करवाना चाहिए उसके उपरान्त बन्दिश सिखानी चाहिए। एक राग में कम से कम तीन या चार बन्दिशें सिखानी चाहिए। एक समय में एक ही राग सिखाना चाहिए और कई दिनों तक एक ही राग का अभ्यास करवाना चाहिए जिससे विद्यार्थी का प्रभुत्व उस राग पर हो सके। कहा भी गया है : ''एकै साधे सब सधे सब साधे सब जाए।'' स्नातकोत्तर कक्षाओं में योग्यता—परीक्षण के बाद ही प्रवेश मिलना चाहिए न कि अधिकतम नम्बरों के आधार पर। प्रत्येक श्रेणी में सीखने वालों की संख्या अधिक नहीं होनी चाहिए अर्थात् अधिक से अधिक पाँच या छः होनी चाहिए जिससे शिक्षक को विद्यार्थी को परखने का समय मिल सके। उससे शिक्षक और शिष्य के परस्पर सम्बन्धों में मधुरता लाई जा सकती है। रागों का प्रशिक्षण देते समय पुराने और नए उत्तम गायक को, शिष्यों को समय—समय पर सुनवाने की व्यवस्था होनी चाहिए। समय—समय पर विद्यार्थियों द्वारा मंच प्रदर्शन करवाना चाहिए जिससे उनमें आत्मविश्वास की भावना प्रबल हो और साधना

की प्रेरणा मिले। समय—समय पर संगीत संमेलनों का आयोजन किया जाना चाहिए। सुयोग्य छात्रों के लिए अधिक से अधिक छात्रवृत्तियों की व्यवस्था हो। अच्छे ग्रंथों, उच्च स्तरीय पुस्तको के लेखन और उनके प्रकाशन की ओर विशेष ध्यान दिया जाना चाहिए। शिक्षकों के लिए शिक्षण हेतु ऐसे प्रशिक्षण स्थान होने चाहिए जहां उन्हें संगीत का प्रशिक्षण प्राप्त हो सके। शिक्षकों का चुनाव निष्ठता और योग्यता के आधार पर किया जाना चाहिए। आज छात्रों का भी कर्तव्य है कि वे अपने शिक्षकों के लिए श्रद्धा एवं सत्कार की भावना मन में रखें। ऐसा करने से ही शिक्षक भी उदार हृदय से संगीत का वास्तविक ज्ञान देना चाहेंगे और अन्त में पाठ्यक्रम ऐसा होना चाहिए जिसमें क्रियात्मक पथ पर अधिक बल दिया जाए। संगीत के महान् विद्वान कर्मचारी एवं समाज के प्रतिष्ठित व्यक्तियों को उसमें भाग लेकर नई दिशाएँ खोजने में सहायता करनी चाहिए। ऐसा नहीं है कि संगीत के लिए प्रयास नहीं किये जा रहे है, किए तो जा रहे है किन्तु वे सब अभी अपनी शैशावास्था में है।

Footnotes

१ Edited by Arvinda Biswas and Suren Agrawal – "The Indian Educational Documents Since Independance." The Academic Publishers (India), New Delhi, P.382

२ संगीत का सांस्कृतिक व सामाजिक पथ — डॉ. प्रभा भारद्वाज, पृ.सं.१८५

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नाट्य भाषा का स्वरूप

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लेखन में भाषा का केन्द्रीय स्थान है। नाटक की चुनौती ऐसी नाट्य भाषा तैयार करने की रही है जिसके सहारे सार्थक जीवन अनुभव को नाटक में प्रस्तुत करना सम्भव हो सके। नाटक के पाठ की भाषा एक अलग भाषा होती है जो शाब्दिक होने के साथ रंगभाषा में भी बदलती है। हर रचनाकार अपने अनुरूप नाट्य भाषा का सृजन करता है साथ ही समाज और जीवन से सीधे जुड़ाव के कारण हर भाषा का अपना विशिष्ट युग सन्दर्भ होता है जिससे उसकी सृजनात्मक सम्भावनाएँ सीमित या विस्तृत अथवा निर्धारित होती हैं। आशय यह है कि किसी भाषा के ऐतिहासिक विकास क्रम में उसकी किसी विधा का भाषायी चरित्र एकरूप नहीं होता। हिन्दी नाटक भी इसका अपवाद नहीं है।

नाट्य भाषा भारतेन्दु से अब तक एकरूप नहीं रही। समय के साथ उसमें बदलाव आया।

भारतेन्दु के समय में ही पारसी रंगमंच का आरम्भ हो गया था। भारतेन्दु युग के नाटककार इससे प्रभावित भी हुए।

द्विवेदी युग में आचार्य महावीर प्रसाद द्विवेदी ने चली आती भाषा में परिष्कार एवं सुधार किया। प्रसाद के नाट्य लेखन में द्विवेदी युगीन प्रवृतियां व पारसी रंगमंच दोनों का योग है। पारसी रंगमंच की भाषा व उसके बनावटीपन के प्रति क्षोभ और विरोध प्रकट करते हुए प्रसाद ने संस्कृतनिष्ठ भाषा को अभिव्यक्ति का माध्यम बनाया। फिर भी इस पर कहीं कहीं पारसी

रंगमंच का प्रभाव बना रहा है। प्रगतिवादी या यथार्थवादी आग्रह से कथ्य ही नहीं भाषा के क्षेत्र में भी बदलाव आया। नाट्य के क्षेत्र में इसका प्रमुख कारण पाश्चात्य प्रभाव और उसका अभिग्रहण था। इब्सन और ब्रेख्त के प्रभाव से हिन्दी नाट्य में यथार्थवाद और आम बोलचाल की भाषा का आग्रह बढ़ा।

नाट्य भाषा को समग्र रूप से समझने के लिए नाटक की भाषा का अन्य साहित्यिक विधाओं की भाषा (गद्य—पद्य की भाषा) तथा सामान्य भाषा से अन्तर जानना आवश्यक है। सामान्य भाषा में लिखा गया और बोला गया शब्द वस्तुस्थिति का बोध करवाता है जबकि कविता की भाषा में वर्ण, शब्द, उपवाक्य अलग—अलग अस्तित्व रखत है।

भरतमुनि ने भाषा को नाटक का शरीर माना है क्योंकि नाटक के मूल आलेख/मूल भाषा में ही रंग सम्भावनाएं निहित होती हैं। मुद्राराक्षस भी कहते है कि नाटक की भाषा काफी हाशिया छोड़ देती है इसी कारण एक सामान्य कथन भी अपनी रंग संभावनाओं से विशिष्ट बन जाता है। गिरीश रस्तोगी ने नाटककार द्वारा लिखित भाषा को नाटक की भाषा तथा उस लिखित भाषा में जो संकेत और व्यंजना है, उसे नाट्य भाषा कहा। आधुनिकता के साथ नाट्यभाषा सम्बन्धी अवधारणा बदली। साहित्यिकता के स्थान पर शब्द और ध्वनि को नाट्य भाषा का प्रमुख अंग माना गया। नाटक की भाषा और नाट्य भाषा का मूल अन्तर इस दृष्टि से भी देखा जा सकता है कि जो नाटक पढ़ने पर मात्र पाठ्य की अनुभूति देता है वह मंच पर अभिनीत भी किया जा सकता है और अलग अनुभूति भी देता है।

यह सम्भव होता है नाट्य भाषा के संघटक तत्वों से जो नाटक की भाषा में भी होते है और निर्देशक व अभिनेता द्वारा निर्मित व परिष्कृत भी किये जाते है। आधुनिक (स्वातन्त्र्योत्तर) रंगमंच पर कहानी, कविता, उपन्यास व आत्मकथा तथा पत्रादि के मंचन में यही संघटक तत्व महत्वपूर्ण भूमिका निभाते हैं।

अभिनेता अपनी अभिनय क्षमता से इन तत्वों को नये आयाम देता है और इससे रचना की संप्रेषणीयता

का विस्तार भी होता है। यूं भी नाटक विधा समूह की अपेक्षा रखती है वह अन्य साहित्यिक विधाओं की तरह व्यक्ति तक सीमित न रहकर सीधे समाज में संवाद करती है।

इसीलिए नाट्य भाषा में उन गुणों का समावेश आवश्यक है जो नाटक को मंचोपयोगी बना सके। नाटक के मूल आलेख और नाट्यालेख में यह बुनियादी अन्तर भी है। नाट्य भाषा के संघटक तत्त्व मूल पाठ की पुनर्पाठ के दौरान (निर्देशक के आलेख व अभिनेता के आलेख में) रूपान्तरित करते है।

भारतेन्दु ने काल और परिस्थिति के अनुरूप नाट्य लेखन किया। उनका नाट्य चिन्तन अपने युग के नाटककारों को प्रेरणा देता है और इसी चिन्तन के आलोक में भारतेन्दुयुगीन 'नाट्य' समृद्ध हुआ। संरचनात्मक स्तर पर भी इसमें विविधता आई। उनका समन्वयात्मक दृष्टिकोण हिन्दी नाटक की समृद्धि में सहायक सिद्ध हुआ और इसमें नाट्य भाषा को नये आयाम भी दिए।

भारतेन्दु व प्रसाद के बीच का समय अर्थात द्विवेदी युगीन हिन्दी नाटक, नाट्य भाषा की दृष्टि से अंधकारमय था। भारतेन्दु ने जिस हिन्दी नाटक की परम्परा का शुभारम्भ किया था। वह प्रसाद युग तक आते—आते क्षीण हो गई थी और पारसी रंगमंच व अन्य व्यावसायिक कम्पनियों का नाट्य भाषा पर गहरा प्रभाव पड़ा। प्रतिक्रिया स्वरूप शुद्ध साहित्यिक नाटक लिखे जाने लगे। जो नाट्य में रूपान्तरित नहीं हो सके उन्हें यथारूप रंग भाषा में ढाला जाना था इसी कारण प्रसाद के नाटकों को उस मुश्किल युग में अनभिनेय और पाठ्य मात्र घोषित कर दिया गया था। प्रसाद के निबन्ध अवश्य ही नाट्य भाषा और रंग परिकल्पना का परिचय देते हैं और भारतेन्दु की नाट्य परम्परा को आगे बढ़ाते प्रतीत होते है। किन्तु ये निबन्ध उनके नाटक लेखन के बाद लिखे गये वस्तुतः उनका चिन्तन और उनके नाटक दोनों अलग—अलग दृष्टिकोण के परिचायक है।

प्रसाद युगीन नाट्य परिवेश, शिक्षा का प्रचार—प्रसार, पाश्चात्य साहित्य के अध्ययन, मंचन व अनुवाद ने प्रसाद परवर्ती नाट्य भाषा को विशेष रूप से प्रभावित किया। १९३६ से नाटक साहित्य दो भागों में आगे बढ़ा। प्रसाद के अनुकरण में पौराणिक ऐतिहासिक और पाश्चात्य अभिग्रहण से यथार्थवादी, प्रतीकात्मक, समस्यामूलक नाटक लिखे गये।

ब्रेख्त ने स्वातन्त्र्योत्तर हिन्दी नाटक को सर्वाधिक प्रभावित किया। स्वाभाविक रूप से नवीनता और प्रयोगात्मकता के लिए पश्चिमी रंग शैलियों व विचारों से हिन्दी नाटककार प्रभावित हुआ और अपने नाटक व नाट्य भाषा में परिवर्तन करने लगा। स्वतन्त्रता और अभिमुख हिन्दी नाट्य जगत में पाश्चात्य प्रभाव की अतिशयता से क्षुब्ध प्रबुद्ध रंगकर्मी यथार्थवादी रंग शिल्प की प्रतिक्रिया स्वरूप अपनी जड़ों की ओर लौटना चाहता था। इस परिवेश में ब्रेख्त के नाट्य सिद्धान्त व विचारों ने हिन्दी नाटककार व रंगकर्मी को प्रभावित किया क्योंकि ब्रेख्त के रंग सिद्धान्त कहीं न कहीं भारतीय नाट्य परम्परा के अनुकूल प्रतीत हो रहे थे।

ब्रेख्त का 'एपिक थियेटर' संस्कृत महाकाव्यों के समान ही विकसित हुआ है। जिसने यथार्थवादी परम्परा की कई दशकों की जड़ रूढ़ियों को सहसा झकझोर कर नाटकीयता व प्रदर्शन को प्राधमिकता दी। इसी क्रम में हबीब तनवीर ने भारतीय दर्शकों को ब्रेख्त की शैली से परिचय करवाया। तनवीर का नाटक 'चरनदास चोर' हिन्दी नाट्य भाषा को एक नया मोड़ देता है। यहाँ हिन्दी रंगमंच की मूल प्रकृति का अन्वेषण करने और जनसमूह से जुड़ने की बेचैनी में लेखन और रंगकर्म दोनों लोक नाट्य की ओर मुड़े।

ब्रेख्त के अलगाववादी सिद्धान्त ने रंगभाव को नई आधार भूमि दी। इसमें भावना के स्थान पर तर्क को महत्व दिया। ब्रेख्त चाहते थे कि दर्शक भावनाओं में न बहकर सोचने पर विवश हो। उनके इस सिद्धान्त ने दर्शक की परम्परागत अवधारणा 'साधारणीकरण' को तोड़ा साथ ही अभिनेता को रंगभाषा का महत्त्वपूर्ण आधार बना दिया।

नुक्कड़ नाटक और एब्सर्ड नाटक भी हिन्दी में पाश्चात्य अभिग्रहण के अन्तर्गत ही आते हैं हालांकि इनकी जड़ें हिन्दी नाटक के प्रारम्भ से ही थी किन्तु इसे स्वातन्त्र्योत्तर हिन्दी नाट्य भाषा में विकसित करने का

मुख कारण पाश्चात्य प्रभाव ही माना जा सकता है।

नाटक की भाषा को नाट्य भाषा में रूपान्तरित करने में तथा हिन्दी नाटक को समृद्ध करने में 'जन नाट्य मंच' व 'पृथ्वी थियेटर' का महत्त्वपूर्ण योगदान था। इन दोनो संस्थाओं ने सृजनात्मक रंगमंच की तलाश की और नाटक में लोक तत्त्वों का समावेश कर लोक जीवन से जुड़े नये सौन्दर्य बोध युक्त नाटकों से हिन्दी रंगमंच को समृद्ध किया। यथार्थवाद के सीमित और उपकरणाश्रित मंच के स्थान पर सांकेतिक कल्पनापूर्ण और प्रतीकात्मक मंच पर बल दिया जाने लगा। 'पाठक' के स्थान पर 'दर्शक' को महत्व देते हुए नाट्य भाषा में परिवर्तन किया।

नाटक लेखन की प्रक्रिया में निर्देशक के साथ जुड़कर विचार—विमर्श कर, रिहर्सल देखकर अभिनेताओं से संवाद करते हुए नाटक को रंगभाषा में बदलने का निरन्तर प्रयास आधुनिक हिन्दी नाटककार करने लगे।

नाटककार, निर्देशक और अभिनेता नाटक की भाषा को रंगभाषा में बदलने वाले केन्द्रीय आधार है। इसके अन्तर्गत नाटककार अपने मूल आलेख में नाट्य भाषा को साथ लेकर चलता है, वह रंगमंच को दृष्टि में रखकर सफल नाटक के सृजन हेतु भाषा के सभी उपकरणों का उचित समावेश अपने मूल पाठ में करता है। प्रयोगधर्मी निर्देशक व कुशल अभिनेता मूल पाठ में बदलाव करते हुए अथवा नूतन संभावनाओं को समायोजित करते हुए रंगभाषा का पुनः सृजन करते है। इस प्रक्रिया में नाट्य भाषा मूलपाठ (नाटककार), पुनर्पाठ (निर्देशक का आलेख) तथा अभिनेता के आलेख से गुजरती हुई रंगभाषा में रूपान्तरित होती है।

नवीन रंग दृष्टि, समसामयिकता व चरित्रों की नयी अवधारणा की दृष्टि से धर्मवीर भारती का काव्य नाटक 'अन्धा युग' महत्वपूर्ण कृति है। पाठ्यक्रमीय ढाँचे, सिद्धान्तवादी रूप विधान से निकलकर नाटककार, नाट्य प्रदर्शनों को ध्यान में रखते हुए सम्प्रेष्य रंग नाटक लिखने लगा। धर्मवीर भारती, मोहन राकेश, सुरेन्द्र वर्मा आदि इसी परम्परा के प्रमुख नाटककार है।

१९६० से एक नयी शुरूआत हिन्दी नाटक के क्षेत्र में हुई। हिन्दी नाटककार व रंगकर्मी सक्रियता से मंच से जुड़े और प्रयोगशीलता के साथ नई कृतियों को, नई सम्भावनाओं की तलाश में मंच पर लाने लगे। इस तलाश में देशी—विदेशी भाषाओं के नाटकों का अनुवाद होने लगा और नाट्य रूपान्तरण भी होने लगा।

सातवें—आठवें दशक में कथासाहित्य भी रंगमंच का अंग बन गया। उपन्यास और कहानी जैसी साहित्यिक विधाओं को लेकर नाट्यान्तरण और प्रस्तुतीकरण होने लगे।

इस प्रक्रिया में कहानी, उपन्यास, यात्रा वृत्तांत, रेखाचित्र, पत्र—साहित्य, आत्मकथा एवं काव्य आदि साहित्यिक मूलतः पाठ्य विधाओं को सफलतापूर्वक नाट्य भाषा में रूपान्तरित किया जाने लगा। प्रयोगधर्मी निर्देशक कहीं इन्हें रचनाकार के साथ मिलकर नाट्य में रूपान्तरित कर इनका मंचन कर रहा है तो कुछ निर्देशक नई प्रयोग दृष्टि के साथ अभिनेताओं को केन्द्र में रख इन्हें नाट्य भाषा में बदल रहे हैं।

अन्य भारतीय भाषाओं के नाटकों में भी अखिल भारतीय चरित्र और समृद्ध रंग भाषा ने हिन्दी नाटककार व निर्देशक को आकृष्ट किया है। इसका अनुवाद कर हिन्दी रंगभाषा में रूपान्तरित किया जाने लगा है। देशी—विदेशी भाषाओं की अनूदित कृतियों से भी हिन्दी नाट्य भाषा समृद्ध हो रही है परिणामस्वरूप क्षेत्र विशेष की रंग विशेषता और वहाँ के नाटककार की रंग परिकल्पना से हिन्दी का दर्शक व निर्देशक भी रूबरू हो रहा है।

सहायक ग्रंथ:—

१. 'नाट्य भाषा' गोविन्द चातक, तक्षशिला प्रकाशन।

२. 'रंगभाषा' गिरीश रस्तोगी, राष्ट्रीय नाट्य विद्यालय।

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Women Entrepreneurs in India

* Dr. Mrinali Kankar
** Dr. Vishal Gautam

ABSTRACT

Women entrepreneurs are key players in any developing country particularly in terms of their contribution to economic development. In recent years, even among the developed countries like USA and Canada, Women's role in terms of their share in small business has been increasing. Women entrepreneurs have been making a considerable impact in all most every segment of the economy. Women's have proved themselves to be more commanding than men on various parameters such as hard work, intelligence, systematic, leadership qualities, supervision etc.

Keywords: Women, Entrepreneur, Entrepreneurship, Micro & Small enterprises, Business Ventures

INTRODUCTION

Women perform an important role in building the real backbone of a nation's economy. There is considerable entrepreneurial talent among women. Many women's domestic skills such as people and time management and household budgeting are directly transferable in the business context. Women have the ability to balance different tasks and priorities and tend to find satisfaction and success in and from building relationships with customers and employees, in having control of their own destiny, and in doing something that they consider worthwhile. They have the potential and the will to establish and manage enterprises of their own. These qualities and strengths of women are to be tapped for productive channels. But simultaneous creation and development of small business among women is a difficult task.

Generally the business world is treated as male dominated world but women also occupy a very significant position in the society. They are playing a unique role in its development of society and increase o human needs, women are motivated or forced towards getting into income earning activities. The concept of women entrepreneurship started developing during the decades of fifties and sixties in developed countries whereas the Indian women stepped into entrepreneurship some years later. Earlier, the position of women entrepreneur was not satisfactory. Most of the women in India were not getting the opportunity to show their talent in various fields. Society accepts them to do the jobs of child caring, home-making and fulfilling the family customs only. They have been taught to depend on men for support and to avoid exposure. They were given less education than boys and discouraged to learn more than the male member of the family. For a young girl, marriage and children were considered the only lifelong activity and education was imparted to make her a better wife and mother to secure a better husband preferred educated wives.

Today, when businesses are facing a severe crunch in entrepreneurial talent, if women don't play a meaningful role in business, then half of the country's potential talent pool will remain under-utilized Women entrepreneurs may be defined as the women or group of women who initiate, organize and co-operate a business enterprise. The government of India has defined women entrepreneurs as an enterprise owned and controlled by a woman having a minimum financial interest of 51% of the capital, and giving at least 51% of employment generated in the enterprise to women. This shift in the role of women in business is taking place primarily due to four factors that can be classified as personal and contextual factors of motivation for women entrepreneurs. The personal factors are that, firstly, with the family structures changing to nuclear families, women perceive themselves to be a significant partner in providing for the family. Secondly, with increasing education and competence, the emerging women leaders in business have proven that women can contribute in management and strategy in the same measure as their male counterparts. The two contextual aspects

which are impacting the motivation of women entrepreneurs are firstly, businesses are increasingly becoming gender-neutral and secondly, technological advancements have provided immense flexibility so that women can work from anywhere and at any time when it is convenient to them.

The woman or a group of women who initiate, organize, and operate a business enterprise is known as women entrepreneur. A women entrepreneur has to perform all the activities involved in establishing an enterprise. These include idea generation and screening, determination of objectives, project preparation, product analysis etc. Women entrepreneurship is the process where women organize all the factors of production, undertake risks, and provide employment to others. The definition of women entrepreneurship has never been differentiated on the basis of sex and hence could be extended to women entrepreneurs without any restrictions. Women Entrepreneurs are those female who accept the challenges to meet their individual, family or society needs and one who became economically self-sufficient. Thus, a woman entrepreneur is one who starts business and manages it independently and tactfully, takes all the risks, faces the challenges boldly with an iron will to succeed. Women entrepreneurship is an economic activity of those women who think of a business enterprise, initiate it, organize and combine the factors of production, operate the enterprise and undertake risks and handle economic uncertainty involved in running a business enterprise.

Characteristics that made women successful entrepreneurs:

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OBJECTIVES

1. To analyze the Status of women entrepreneurs in India.
2. To examine the issues and challenges of women entrepreneurs in India.
3. To examine the problems faced by women entrepreneurs in India.

RESEARCH METHODOLOGY

The statistical data for the study have been collected from the secondary sources. Secondary data have been collected from the various publications of economic survey reports, books, journals and periodicals.

ISSUES, CHALLENGES AND PROBLEMS OF WOMEN ENTREPRENEURS IN INDIA

Women entrepreneurship in India is a journey from poverty to prosperity, total dependence to equality, agricultural labour to entrepreneurs in industry and in service sectors and finally, as opportunity entrepreneurs. The women entrepreneurship problems range from mobilizing various resources including problem of capital, marketing, raw material, sales, labor, technical, competition, new technology, problem of land , shed ,water, power ,taxes, lack of family support as well as lack of government support.

There are umpteen problems faced by women at various stages beginning from their initial commencement of enterprise, in running their enterprise. Women entrepreneurs face many problems in their efforts to develop their enterprise. The main problems faced by the women entrepreneurs are as follows:

1. **Patriarchal Society:** Entrepreneurship has been traditionally seen a male preserve and idea of women taking up entrepreneurial activities considered as a distant dream. Any deviation from the norm is frowned and if possible, immediately curbed. Women also have to face role conflict as soon as they initiate any entrepreneurial activity. It is an uphill task for women to face such conflicts and cope with the twin role.

2. **Absence of Entrepreneurial Aptitude:** Many women take the training by attending the Entrepreneurship Development Programmes without entrepreneurial bent of mind. As per a study, involvement of women in small scale sector as owners stands at mere 7 percent. Women who are imparted training by various institutes must be verified on account of aptitude through the tests, interviews etc.

3. **Quality of EDPs:** All women entrepreneurs are given the same training through EDPs. Second-generation women entrepreneurs don't need such training as they already have the previous exposure to business.

4. **Marketing Problems:** Women entrepreneurs continuously face the problems in marketing their products. It is one of the core problems as this area is mainly dominated by males and even women with adequate experience fail to make a dent. For marketing the products women entrepreneurs have to be at the mercy of middlemen who pocket the chunk of profit. Although the middlemen exploit the women entrepreneurs, the elimination of middlemen is difficult, because it involves a lot of running about. Women entrepreneurs also find it difficult to capture the market and make their products popular.

5. **Financial Problems:** Obtaining the support of bankers, managing the working capital, lack of credit resources are the problems which still remain in the males domain. Women are yet to make significant mark in quantitative terms. Marketing and financial problems are such obstacles where even training doesn't significantly help the women. Some problems are structural in nature and beyond the control of entrepreneurs.

6. **Family Conflicts:** Women also face the conflict of performing of home role as they are not available to spend enough time with their families. They spend long hours in business and as a result, they find it difficult to meet the demands of their family members and society as well. Their inability to attend to domestic work, time for education of children, personal hobbies, entertainment adds to their conflicts.

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7. **Credit Facilities:** Though women constitute about 50 per cent of population, the percentage of small scale enterprise where women own 51 percent of share capital is less than 5 percent. Women are often denied credit by bankers on the ground of lack of collateral security. Therefore, women's access to risk capital is limited. The complicated procedure of bank loans, the inordinate delay in obtaining the loans and running about involved do deter many women from venturing out. At the same time, a good deal of self-employment programme has been promoted by the govt. and commercial banks.

8. **Shortage of raw-materials:** Women entrepreneurs encounter the problems of shortage of raw-materials.

9. **Heavy Competition:** Many of the women enterprises have imperfect organizational set up. But they have to face severe competition from organized industries.

10. **High cost of production:** High cost of production undermines the efficiency and stands in the way of development and expansion of women's enterprises, government assistance in the form of grant and subsidies to some extent enables them to tide over the difficult situations. However, in the long run, it would be necessary to increase efficiency and expand productive capacity and thereby reduce cost to make their ultimate survival possible, other than these, women entrepreneurs so face the problems of labour, human resources, infrastructure, legal formalities, overload of work, lack of family support, mistrust etc.

11. **Travelling:** Women entrepreneurs cannot travel from one place to another as freely as men do. Women have some peculiar problems like staying out in the nights at distant places etc.

12. **Legal Formalities:** Women entrepreneurs find it extremely difficult in complying with various legal formalities in obtaining licenses etc.

13. **Lake of Education:** The education level among women in India is very low. Majority of women are not aware about the technological developments, marketing knowledge etc. due to lack of education. Illiteracy further creates problems in setting up and smooth running of enterprises.

14. **Stiff competition:** Women entrepreneurs have to face severe competition from organized industries and male entrepreneurs having vast experience.

There is a need of Government, non-Government, promotional and regulatory agencies to come forward and play the supportive role in promoting the women entrepreneur in India. The Government of India has also formulated various training and development cum employment generations programs for the women to start their ventures.

Source:https://yourstory.com/2016/08/gender-biased-startup-ecosystem

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SCHEMES FOR THE DEVELOPMENT AND PROMOTION OF WOMEN ENTREPRENEURS

- Trade related entrepreneurship assistance and development scheme for women (TREAD)
- Micro & small enterprises cluster development programme (MSE-CDP)
- Credit guarantee fund scheme
- National bank for agriculture and rural development (NABARD)
- The rural small business development center (RSBDC)
- National small industries corporation (NSIC)
- Small industries development bank of India (SIDBI)
- Rural and women entrepreneurship development (RWED)

Source:https://techcrunch.com/2017/04/19/in-2017-only-17-of-startups-have-a-female-founder

CONCLUSION

With relevant education, work experience, improving economic conditions and financial opportunities, more women around the world are creating and sustaining successful business ventures. This will not only have an impact on the economies of the countries in which women own their businesses but also will change the status of women in those societies. It is likely that, as we begin this millennium, this will be the century of the entrepreneurs in general and of the women entrepreneurs in particular. Women entrepreneurship must be molded properly with entrepreneurial traits and skills to meet the changes in trends, challenges global markets and also be competent enough to sustain and strive for excellence in the entrepreneurial arena.

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Impact of Social Determinants on Cancer Patients and Their Caregiver's Well Being: A Study at Cancer Specialty Hospital in Jaipur

*Mohita Chaturvedi Sharma

Abstract

Health is an essential aspect of human life. It is not only restricted to physical state of wellness or absence of any kind of disease but also includes social, psychological and spiritual wellbeing. Cancer is widely acknowledged as a chronic disease, thus, it has an impact on every aspect of life of not only the patient but also his caregiver. Two of the most important criteria of judging wellbeing of an individual are stress and quality of life. Based upon one's own assessment of state of affairs these variables represent the how an individual feels about the situation he or she is in. Social determinants are the socio environmental factors which have an impact on the well-being of an individual. The analysis of these factors shows the extent of influence they have on the health of a person.

Keywords: Health, Social determinants, Stress and Quality of Life

Introduction

The academic discipline of sociology is concerned with the understanding of human societies and human relations. It not only highlights personal troubles and social issues but also emphasizes on individual crisis situations and institutional contradictions.

Medical sociology, a branch of sociology; came into existence during the post second world war era in developed countries like Europe and United states. It has a distinct scope and subject matter which synthesizes information from both medical and sociological point of view. The correlation between health and social structure has been the building block upon which the entire setup of medical sociology is based. Traditionally, the materialistic or structuralism explanation was used to highlighted a correlation between health and social structure investigating how social factors such as the political economy, the corporate structure, the distribution of resources, and the uses of political, economic and social power influence health and illness along with society's response to health and illness.

With the development of new paradigms in the study of health, there were various other factors which were considered equally important in their influence on individual and social health. Gradually importance was given to the complex interactions and relationships between economic conditions, social structure, social relationships and networks, individual behaviour and psychosocial factors.

Theoretical Background

One of the most important contributions towards development and understanding of medical sociology was that of **Talcott Parsons.** He in his book **"The Social System"** in 1951 explicated the relatively complex structural functionalist model of society, in which social systems are linked to corresponding systems of personality and culture. It also contained Parsons' concept of social system and most importantly "the sick role".

The Parson Ian viewpoint insisted on maintaining stability and balance in the society and considered

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sickness as dysfunctional as it threatened to hamper the poise of the system. The sick that are unable to perform their social roles and obligations because of their medical conditions were seen as hindrances. The medical professionals on the other hand provided controlling and curing the disease so that the person could reunite with the society and become functional again by fulfilling his social roles.

Later, social theorist Michael Foucault at this time emphasized on the emergence of two distinct trends in medical practice. They were called "medicine of the species and the medicine of social spaces". While the medicine of species dealt with classification of disease, its diagnosis and treatment and finding cures making the human body an object of study and observation. On the other hand, the medicine of social spaces emphasized on the prevention of diseases rather it's than cure.

To begin with, the very core of medical sociology is the concept of health. The WHO defines health as "A state of complete physical, mental and social well-being and not merely the absence of a disease or injury". This definition understands health as the ability to function to the point that they can do whatever they want to do. Another important aspect related to the study of health is disease. Sociologically, disease is thus seen as deviation from normal values and is accompanies with abnormalities in structure and function of body organs or systems. The disease can be further classified into chronic and acute depending upon its intensity. Acute disease lasts for a short duration but have a prominent impact on the body; chronic disease on the other hand lasts for lifetime. Chronic disease may later content into terminal illness.

Cancer is defined as most common example of chronic diseases. However, cancer can progress from chronic to terminal stage. Cancer is a resultant of abnormal cell growth within the body. It has been distinguished into various stages depending upon the growth and the specific symptoms associated with it gradually transforming from a chronic to terminal stage is usually classified into four stages, each having different parameters to distinguish one stage from another.

Objective

The objective of the research article is to provide a sociological understanding of the concept of health, illness and well-being. It will try and understand the relevance of the social determinants of health and their impact on the individual's life and social health. The study will also analyse the contribution of social stress as a major factor in influencing mental health of the patient as well as the care giver. To understand the psychological traumas which include fears, anxieties, and depressions mood swings etc. of acceptance and adaptation of the disease.

Methodology

The study was conducted by selecting respondents from Bhagwan Mahaveer Cancer Hospital and Research Centre, Jaipur Rajasthan. The study has used sampling method to select the respondents from the above said universe. With the intent to choose selective respondent depending upon the requirement of the research work, purposive sampling method was used with sample size of 50. The sample size was further divided into25 patients and their respective caregivers.

Research Findings

As the interactionism theory evolved after the fading of structural theories, it placed greater emphasis on the relevance of socio ecological factors. Thus, the Socio ecological model constituted the socio -demographic factors which were called the social determinants gained importance. It included age, gender, social class and education important in defining health and illness.

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The research work considers the following as its social determinants which has an impact on health and wellbeing of the respondents. It is necessary to mention here that the research work considers two new factors as social determinants namely area of residence and family structure as it considers them influential on health of respondents.

a) Social class   b) Age   c) Gender   d) Education
e) Area of residence- rural or urban   f) Family structure- nuclear or joint

A) Social Class

A social class is a hierarchical categorization or grouping of people who have approximately the same amount of wealth, status, and power in a society. The study of health and medicine describes social class in terms of Socio economic status (SES) which is used as a parameter to understand the influence of ecological elements on an individual's well-being. In context of this research work, B. G Prasad model was used to assess the Socio – economic status of the respondents of the study. It is an income based scale which is calculated every year on the basis of inflation and depreciation of currency in a financial year. The study uses the classification as determined in December 2016.

Table 1
Socio- Economic distribution of respondents

Social Class	Patient	Percentage (%)	Caregiver	Percentage (%)
Class I	19	79	19	79
Class II	2	5.0	2	5
Class III	4	16	4	16
Total	25	100	25	100

Table 1 suggests that majority of respondents belonged to class I that is their income was more than Rs. 6277 per month which was in accordance with the rate of currency and inflation that year. Also, the reason for similarity between the class distribution of the patient and the caregiver is that all the caregivers were usually the members of the same family as the patient. As a result, they belong to the same social class. However; the next highest category of respondents belonged to class III which earned less than Rs.3138 per month.

Moreover, it is highlighted in the study that the socio economic scale also represented the nature of financial burden by assessing the relation between social class and loan taken for treatment (financial aid) of the patient and how both the patient and the caregiver interpret and assess their financial situation.

Table 2
Relation between Social Class and Financial Aid (Loan)
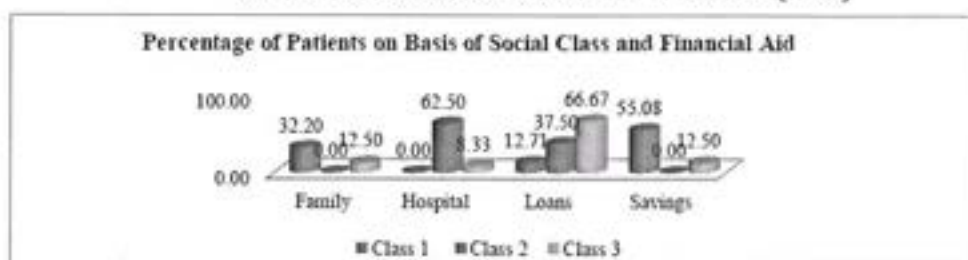
Percentage of Patients on Basis of Social Class and Financial Aid

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Table 2 shows the percentage distribution of respondents belonging to different social classes and the sources from where they have arranged for financial aid during the course of treatment. While the Class I depends on family (32.20) & previous savings (55.08) for financial help, the respondents belonging to Class II (62.50) have financial backup from the hospital itself for not only the treatment but also medicines. Class III (66.67) on the other hand is dependent on private money lenders for financial aid. These figures highlight that the majority of the respondents need financial help at one point of time or another during the course of the treatment.

B) Age

Another important determinant which has a significant impact on health is, age. However, in the study the influence of age is not clearly visible in the patients but its influence can be seen in case of caregivers for whom age influences many issues which may act as a hurdle in the care taking tasks associated with the patients suffering from cancer.

The maximum number of respondents belongs to the age range of 30 to 60 years. This data however, has different interpretation for the patient and the caregiver. To begin with, the analysis of patient data reflects that 77.5% of the patients belonged to the age of 30 to 60 years. Similarly, 78.67 % of the caregivers also belonged to the same age range, making them more physically fit to handle caretaking tasks. The study also found a negative correlation between the age and the quality of life of patients.

Table 3

Relation between Age of Patient and other variables

Variables	Pearson co-relation	P- Value	Significance
Stress	-0.031	0.708	Non-significant
Quality of Life	-0.156	0.057	Significant

Table 3 Shows a negative correlation between the two variables which signifies that an increase in one variable leads to a decrease in the other; that is, an increase in age leads to deterioration in quality of life of the patient. This is not only restricted to physical attribute of well-being along with over dependency on others both psychologically and socially also contributes a feeling of lack of control over one's life. All these factors and more contribute to a low sense of well-being.

C) Gender

The impact of gender specifically in case of cancer is not clearly visible but the individual perception of disease associated stress and ability to cope can be swayed by gender. Moreover, the caretaking tasks associated with the cancer patients can have gender associated connotations.

This research work considers gender as a social entity which is both socially and culturally understood. As stated above, each society has certain kind of roles and behaviours attached to a particular gender. The research tries to understand these roles and their relevance in study of health and care.

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Table 4
T- Test between Gender, Stress and Quality of life

Variable	Male		Female		T-Value	P-Value	Significance
	Mean	Std. Deviation	Mean	Std. Deviation			
Stress	24.26	4.54	22.26	3.50	-2.98	0.003	Significant
Quality of Life	72.24	9.50	77.40	8.38	3.51	0.001	Significant

Table 4 shows the relation between gender and levels of stress found among the respondents. It is important to pinpoint that the influence of gender on stress is visible only on comparing the data of the respondents belonging to the two genders. The impact of stress is more prominent in case of males as compared to females. Contrastingly, the quality of life among male caregivers was found to be better in comparison to the female caregivers. This, as stated above might be due to the burden of responsibilities perceived by the female caregivers. This burden is not merely restricted to physical and mental trauma but social strains as well.

D) Education

The knowledge and skills attained through education may affect a person's cognitive functioning, make them more receptive to health education messages, or better enable them to communicate with and access appropriate health services. Therefore, it captures the long-term influences of both early life circumstances on adult health and the influence of adult resources.

For the purpose of this research the respondents have been categorized based on the definition of literate as put forward by the government of India. Thus, it divides respondents into illiterate, literate and graduate. More than half of the respondents are educated namely 57.33% in case of patients and 62.67% in case of their caregivers. Also, the percentage of respondent who could neither read nor write was 24 % and 20% respectively in case of patients and caregivers.

However, while analysing education as a factor which influenced health of the respondents, it was found that both in case of patients as well as caregivers education did not play a significant role. Contrary to the belief, it was established that the impact of education on stress and quality of life of the respondents was not evident enough as compared to the other social determinants of health.

E) Area of residence: Urban and Rural

To begin with, health seeking behaviour of the individual is influenced by not only by one's attitude towards health illness but also by the accessibility to health care services as well. With growing urbanization, the rural-urban continuum in health became more apparent. However, a thin line still exists which demarcates these two socially as well as culturally.

The difference between the rural and urban health influencing factors is also visible in context of the social environment that is the existence of psychological stressors, the presence of marginalized population with risk behaviours and the influence of socio economic class is more prominent in case of urban societies . Similarly, the physical environment in terms of clean and pollution free air, more space for outdoor activities is more in rural areas.

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Table 5

T- Test between Area of Residence, Stress and Quality of life

Variable	Male		Female		T- Value	P- Value	Significance
	Mean	Std. Deviation	Mean	Std. Deviation			
Stress	34.55	7.416	34.67	9.432	0.01	0.930	Significant
Quality of Life	76.58	8.34	72.96	9.78	5.56	0.020	Significant

Table 5 shows area of residence is significant factor and causes stress among respondents. This might be due to several factors such as making arrangements for travel, arranging for adequate means of transport in accordance with the needs of the patient, the time consumed in travel in case of a hospital visit, leaves required for accompanying the patient in case of a working caregiver and apart from these arranging for financial resources for such visits are major concern of the care givers.

F) Family Structure: Nuclear or Joint Family

In India, the family is the most important institution that has survived through the ages. India, like most other developing, traditional eastern societies is a collectivist society that emphasizes family integrity, loyalty, and unity.

Table 6
Stress and its relation with Family type
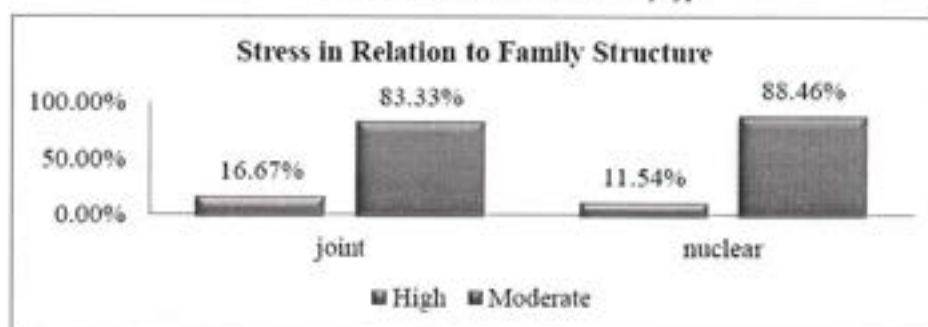
The existence of stress and its relation with the type of family is evident enough in **Table 6**.The family structure can have both positive as well as negative impact on the health of an individual. On one hand, it provides a supportive and caring environment for the patient and the caregiver to help cope with the disease, but in some instances create a disharmonious environment and lack of support to the patient and their caregivers making situation problematic for them. On the other hand, on

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analysing the Quality of life and the family structure among patients the results were completely different. **Table 7** below shows that the quality of life as perceived by the patients in joint families was better than those belonging to the nuclear families.

Table 7
Quality of life and its relation with Family type

Quality of Life in Relation to Family Structure
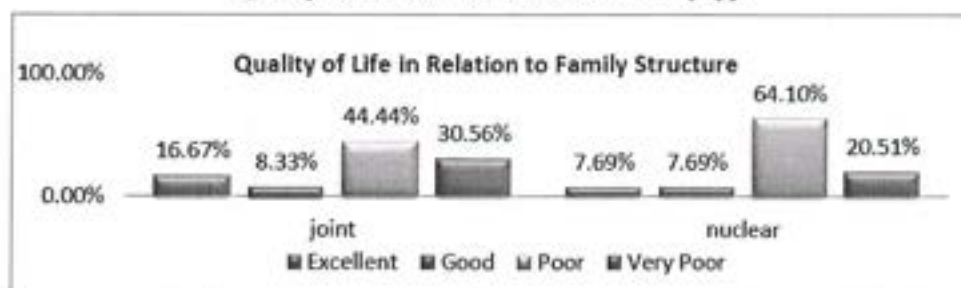
Conclusion

To conclude, it is not incorrect to say that although the social determinants have an impact on health and well-being of the respondents. The study found that the most relevant social determinants were the social class and the family structure. However, the priorities of the respondents vary; the patients are more concerned about financial security in future for their family whereas the caregiver is more worried about the well-being of the patient.

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An assessment of teacher's job satisfaction and its possible effects on student achievements (article.php? numb=2&article=TThDd2RCVkpKTU9CRDRiakEzc1I5Zz09)

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Abstract: ← Click to open/close

The present study was conducted on 160 teachers of different subjects (Hindi, English, Mathematics, & Science) of secondary level under public sector schools to assess their job satisfaction. Results suggested that job satisfaction level was found maximum in mathematics subject teachers and minimum in Hindi. The key findings of this study was lack of better opportunity, low salary and the work that an individual find boring are certain issues which affect teacher's responsibility. Low level of satisfaction was a significant cause to move out from their objectives and it proportionally affects learning methodology of students.

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An assessment of teacher's job satisfaction and its possible effects on student achievements

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Abstract

The present study was conducted on 160 teachers of different subjects (Hindi, English, Mathematics and Science) of secondary level under public sector schools to assess their job satisfaction. Results suggested that job satisfaction level was found maximum in mathematics subject teachers and minimum in Hindi. The key findings of this study was lack of better opportunity, low salary and the work that an individual find boring are certain issues which affect teacher's responsibility. Low level of satisfaction was a significant cause to move out from their objectives and it proportionally affects learning methodology of students.

Key-words: Public sector schools, English, Hindi, Mathematics, Science, Job satisfaction.

Introduction

A job is not only a main source of income but also an important component of life and takes away a large part of each worker's day. Because work plays a central role in many people's life, satisfaction with one's job is an important component in overall wellbeing (Smith, 2007). Job satisfaction refers to a collection of positive and/or negative feelings that an individual hold toward his or her job. Job satisfaction is a part of life satisfaction. It is the amount of pleasure or contentment associated with a job (Singh and Jain, 2013). Job satisfaction and dissatisfaction not only depends on the nature of the job, it also depends on the expectations what the job supply to an employee (Hussami, 2008). It is closely linked to that individual's behaviour in the work place (Davis and Nestron, 1985)

Teaching is one of the best and noble professions and the teacher is a prominent personality in this world. Teachers are a knowledge ambassador and arguably the most important group of professionals for nurturing the young minds. The teacher has a powerful and abiding influence in the formation of the character of every future citizen.

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The teachers of today are facing new challenges in education calling for greater efforts on their part to discharge challenging roles and functions but are ill equipped due to various reasons (Suresh and Haseen, 2015). Teachers in Indian society are suffering from economic problems, negligence, insecurity and low status. Because of such obstacles and obstructions teachers become victims of stress, which affects their efficiency, rational thinking, emotional reaction, in fact, the totality of their behavior. If teachers are not satisfied then it may lead to absenteeism and excessive turnover (Melamed et al., 1995; Chen et al., 2006). If the teachers have to perform their different roles effectively they must be satisfied with their job. Otherwise decline in job satisfaction may lead to strikes, negligence of work, giving up the job and poor adjustment. Hence, the researchers have made an attempt to study the job satisfaction among teachers of secondary school in Alwar district.

Hypothesis of the study

There is no significant difference between job satisfaction levels among secondary school teachers of different subjects.

There is no significant relation between teacher's job satisfaction and student achievement levels.

Methodology
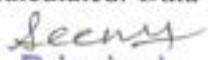
The present study was undertaken to evaluate the job satisfaction levels among secondary level school teachers. The study was conducted in Alwar district. A total of 160 teachers of four different subjects (English, Hindi, Mathematics and Science) from 40 schools of secondary levels were part of the present study. The schools were chosen based on convenience sampling. The researcher personally visited the schools and obtained permission from school authorities. Those who did not wish to take part were excluded.

Tools used

Data were collected using Teacher Job Satisfaction Scale developed by Singh and Sharma (1986). This tool contains 30 items comprising 24 positive and 06 negative items to be responded on 5 points scale having 4 to 0 score for positive items and 0 to 4 score for negative items. The maximum score on the scale will be 120.

Statistical analysis

For the analysis of data Mean, Standard Deviation and "t" ratio was calculated. Data was further analysed with descriptive method and ANOVA.

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Results and observations

Table 1: Comparison of job satisfaction levels among teachers of different subjects.

Subject	N	Mean	SD
English	42	81.95	6.59**#
Hindi	38	63.44	6.88**@@••
Mathematics	40	90.25	7.37#@@□
Science	40	78.54	5.84**□

(Significant level 0.05 and Highly significant level 0.001)

* significant ** highly significant between English and Hindi; # significant ## highly significant between English and Mathematics; + significant ++ highly significant between English and Science, @ significant @@ highly significant between Hindi and Mathematics; • significant •• highly significant between Hindi and Science; □ significant □□ highly significant between Mathematics and Science

The obtained values of mean and standard deviation from table 1 revealed that the mean score for job satisfaction among English teachers was found to be 81.95, for Hindi teachers was 63.44, for Mathematics teachers was 90.25, for Science teachers was 78.54 and the standard deviation was 6.59, 6.88, 7.37 and 5.84 respectively. There was insignificant difference in job satisfaction among teachers of English and Science subjects after the analysis of data. It means both groups of teachers were almost similar in their job satisfaction.

Table also indicates that there is a significant difference in the job satisfaction between Mathematics and English as well as Science teachers. Highly significant difference was found among every subject teacher in comparison to Hindi subject teachers. Hence, our null hypothesis revealed that there is no significant difference in job satisfaction levels between different subject teachers of secondary school is not accepted.

The results as revealed by the study are following:

1. There was highly significant difference in the job satisfaction of English and Hindi teachers.

2. There was significant difference in the job satisfaction of English and Mathematics teachers.

3. There was no significant difference in the job satisfaction of English and Science teachers.

4. There was highly significant difference in the job satisfaction of Hindi and Mathematics teachers

5. There was highly significant difference in the job satisfaction of Hindi and Science teachers

6. There was significant difference in the job satisfaction of Mathematics and Science teachers.

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Discussion

On the basis of results of the study it can be concluded that teachers of Mathematics had more job satisfaction as compared to other subjects. Similarly, teachers of English and Science had more job satisfaction in comparison to Hindi subject. But there was no significant difference in the job satisfaction of the teachers of English and Science as a whole. It was hypothesized that there would be no significant difference in job satisfaction among different subject teachers working. Keeping this in view, it was predicted that different subject teachers would be on same satisfactory levels. On the basis of the results discussed above, the hypothesis that no significant difference would exist on job satisfaction among teachers working for different subjects i.e. Hindi, English, Science and Mathematics, is rejected.

Porter and Lawler (1968) have made tremendous effort in analyzing this proposition (performance causes satisfaction), when they said that satisfaction, rather than being a cause, is an effect of performance i.e. performance causes satisfaction. According to Mafini and Dlodio (2014) work motivation is defined as the willingness of an individual to put forth high levels of effort toward organizational goals and objectives, necessitated by the individual's ability to satisfy some need. A widely acknowledged theory that tries to address the relationship between job satisfaction and life satisfaction is Chacko's spill over model (Kumah and Boachie, 2017). This model suggests that satisfaction in one territory of an individual's life, which extends into other areas of life such that a positive correlation between life and job satisfaction is implied (Ignat and Clipa, 2012). It was seen that in studied schools, salary of mathematics teachers was much higher than other subject teachers. Therefore, low salaries are one of the factors that cause teachers to quit the teaching profession. Challenges such as low salary and poor working conditions are thus among the reasons for teachers' job dissatisfaction.

Asif and his co-workers (2016) revealed that teacher's greatest indicator of fulfillment was student's achievement, and there is a modest relationship between job satisfaction and academic performance in other words, happy workers are more productive ones, at least to some extent (Judge et al., 2001). Our study is consistent with recent evidence that the job satisfaction–performance relationship is strongest in complex jobs in which employees have additional autonomy to complete their work (Judge et al., 2001). It was seen among with English and Science teachers, which were at same levels of job satisfaction. The present study also reported that teacher's years of experience is significantly negatively related to teacher's career satisfaction. This is similar to the report of Gosnell (2000). This report is contrary to Bishay's (1996) study which concluded that increased length of service is correlated with higher reported satisfaction with pay. There is possibility that the expressed lower

satisfaction among teachers with more tenure of service may also be related to other factors of the teacher's service conditions not investigated in this study. Lack of future opportunity and fear of losing job were also some factors for low levels of satisfaction among teachers, which affects their teaching skills and ultimately affects students learning. It may also hamper the achievement levels of learners.

The implication of these findings is that it is imperative for all stakeholders in education to ensure a high level of career satisfaction for the all highly qualified and experienced teachers not on the basis of subject. One of the ways to ensure a high level of career satisfaction for these teachers is by enhancing their salary. This is needed to satisfy the materialistic need of the teachers and also improve the public image and self-esteem of teachers in public sector schools. Better working conditions are also advocated. These measures are necessary in order to ensure that highly qualified and very experienced teachers are retained in the schools. It is also important to note that implementation of these measures will minimize teacher's turn over and burnout.

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CHALLENGES TO INDIAN FEDERALISM IN SPECIAL REFERENCE TO GOODS AND SERVICES TAX

Dr. Palu Joshi*

ABSTRACT

The essence of Indian federal arrangement lies in the fact that, the State governments are not subsidiaries of the Central Government. The Central and State governments have been made autonomous as both of them draw their authority from the Indian Constitution. Our Constitution elaborately discusses the details the power sharing arrangement between the Union and the States across Article 245 to 300 in Part XI and XII. While Part XI (Articles 245-263) states the legislative and administrative relations, Part XII (Articles 246-300) deals with the financial relations.

KEYWORDS: *Federal Arrangement, Centre-state Relations, Federalism, Territorial Pockets, Foreign Affairs.*

Introduction

A Federation simply means two sets of Governments. It is a system of governance wherein there is a territorial division of power between the Centre and the State. This division is done through a written and rigid constitution which ensures that power and authority are not concentrated with a particular level of government. There is also an independent judiciary to keep a check on the powers of both the governments along with the provision of dual citizenship for the state subjects.

Concept of Indian Federation and Centre-State Relations

India gained independence in 1947 after a prolonged independence struggle and in the backdrop of the goriest partition violence. Moreover, the challenge of balancing of diversity with integration to transform India as a nation state was enormous, in wake of uncooperative princely rulers. Therefore, the constitution makers provided for a federal system of government without mentioning it explicitly anywhere in the Constitution. Article 1 of the Indian Constitution states "India, that is Bharat, shall be a Union of States". This means that unlike the USA the Indian federation is not the result of an agreement between the units and also the right of secession from the union has been denied to the states. This arrangement has earned a new name for Indian System when Prof. K. C. Wheare called it a 'Quasi- Federation'. Granville Austin has described the Indian federation as a new kind of federalism peculiar to Indian needs. This arrangement was adopted by the Indian Constitution makers because of the following considerations:

- Keeping in mind the territorial expanse and a wide variety of race, religion, language and other diversities of India a federal state was deemed to be apt for the country
- When it comes to satisfy the needs and demands of diverse groups of its population who live in separate territorial pockets, a federal system is a better option as it provides unity vis-à-vis assuring the autonomy in the matters of local importance.

Legislative Relations (Articles 245-255): The area old Jurisdiction of the State Legislatures is restricted to their respective territorial stretches. But the Parliament has been entrusted the power to legislate for the whole or any part of the territory of India i.e. States, Union Territories or any other areas included for the time being in the territory of India. Moreover, the laws made by the Union Parliament govern not only persons and property within the territory of India, but also Indian subjects' resident and

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their property situated anywhere in the world. Only some provisions for scheduled areas, to some extent, limit the territorial jurisdiction of Parliament. As for the subjects of legislation the Constitution has divided them in three lists, the Union list, the State list and the Concurrent List:

- **List I,** or the **Union List,** includes 99 items which are exclusively within the jurisdiction of the Union Legislature, for example, defence, armed forces, arms and ammunition, atomic energy, foreign affairs, coinage, banking and insurance.
- **List II** or the **State List,** contains 61 items or subjects over which the State Legislature enjoys exclusive authority of legislation. These are those subjects of local importance, where variations in law because of local situations are inevitable, for example, State taxes and duties, police, administration of justice, local self-government, public health, agriculture, forests, fisheries, industries and minerals.
- **List III** also called the **Concurrent List,** consists of 52 items, such as criminal law and procedure, civil procedure, marriage, contracts, port trusts, welfare of labour, economic and social planning. Both the Centre and the State governments enjoy equal power of legislation on these subjects. In case of a clash between the laws made by the two governments, the prominence has been given to the Union Laws. However, if the State law was reserved for the assent of the President and has received such assent, then the State law may prevail. But the Parliament is authorized to override such State law by subsequent legislation.

The Constitution vests the residuary power, i.e., the power to legislate with respect to any matter not enumerated in any one of the three Lists in the Union Legislature (Art. 248).

Administrative Relations:

The administrative relations between the Union and the States are studied as under: (i) normal and (ii) emergency conditions:

- **In normal Times:** Even in normal times, the Indian Constitution has allowed the UNION to effectively control the states to ensure that they do not interfere with the legislative and executive policies of the union. Some of these control techniques are implicit in the executive and legislative powers vested in the President, in relation to states, for example, the President of India has power to appoint and dismiss the Governor, (Art. 155-156) and other dignitaries in the state. In the case of legislative relations, the previous sanction of President, to introduce legislation on certain matters is required in the state legislature (Art. 304); assent to specified legislation which must be reserved for his consideration (Art. 31A), instruction of President is required for the Governor to make ordinances relating to specified matters (Art. 213), veto power in respect of other State bills reserved by the Governor (Article 200). Various other arrangements have been made in the Indian Constitution to ensure the control of the Union over States:
- **Directions to the State Governments:** The Union Government has been authorized to give directions to a state government and to secure compliance with them, failing to which, the State Government will have to face imposition of President's rule.
- **Delegation of Union Functions:** The Constitution has also provided for the exchange of mutual administrative functions between the union and the state governments. For example, the President with the consent of the State government may entrust any executive function of the union to the states (Art. 258(1)). While legislating on a Union Subject, Parliament may delegate powers to the state governments and their officers in so far as the statue is applicable in respective states(Art. 258(2)). Conversely, a State government may, with the consent of the Government of India, confer administrative functions upon the latter relating to State Subjects [Art. 258 A].
- **Disputes Relating to Water:** Article 262 authorizes the Parliament to provide by law for adjudication of any dispute or complaint with respect to the uses, distribution or control of the waters of any Inter-State rivers and River Valleys under clause (2) of this Article. Parliament may by law provide that neither the Supreme Court nor any other court shall have any jurisdiction in respect of such disputes and complaints relating to water of Inter-State rivers and River Valleys. Under the Article 262, Parliament passed Inter-State Water Disputes Act, 1956. This Water Disputes Act empowers the Central government to set up a Tribunal for the adjudication of such disputes. The decision of the Tribunal shall be final and binding on the parties to the disputes. Neither Supreme Court nor any other court shall have jurisdiction in respect of any water dispute which may be referred to such a Tribunal under that Act.

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- **Inter-State Council (Art. 263):** The President of India is empowered to establish Inter-State Council, if at any time it appears to him that the public interests would be severed thereby. The duty of Inter-State Council is to inquire and advise upon disputes which may have arisen between states. It also investigates and discusses subjects of common interest between the union and states or between two or more states, for instance, research in such matters as agriculture and forestry.

- **Grants-in-aid (Art. 275):** The Constitution of India has given the Parliament the power to make such grants as it may deem necessary to give financial 60 assistance to any state which is in need of such assistance. By means of this, the union can correct Inter-state disparities in financial resources and can exercise control and co-ordination over the welfare schemes of the states on a national scale. The Union government also provides for specific grants for welfare of Scheduled Tribes and development of tribal areas.

- **All India Services (Art. 312):** There are certain services common to the union and the states called 'All India Services', of which the Indian Administrative Service and the Indian Police Service are the existing examples. "The constitution also gives the power to create additional All India Services, if the Council of States declares by a resolution supported by not less than two-thirds of the members present and voting that is necessary or expedient in the national interests".

- There are a few **advisory bodies** at the union level which co-ordinate the activities of the states in India, for example, National Planning Commission (1950) and National Integration Council (1986).

- **In Emergencies:** The Indian Constitution provides for three kinds of emergency situations where the provisions available in the constitution can be pressed into service. These three situations are related to 61 impositions of **National Emergency (Art. 352)** when there is war, threat of war or internal rebellion. The second situation is related to the breakdown of the constitutional machinery in the state where the centre intervenes through the President of India for the imposition of **President's Rule** in the state under **Article 356**. The third situation is related to grave financial crisis and there is need to impose **Financial Emergency** under **Article 360**. The Government of India, under proclamation of emergency, shall acquire the power to give directions to a state, on any matter. Though the state government will not be suspended, but it will be under the complete control of the union executive. During the operation of emergency, Parliament shall have the power to legislate on any matter in the State List. It can modify the provisions of the constitution relating to the allocation of financial resources.

Financial Relations

The financial relations between the Union and the State have been completely overhauled after the Constitution Amendment Act, 2016 (101st Amendment) providing for Goods and Services Tax across the nation. Let us have a look at the arrangements which existed prior to the amendment. The Indian Constitution made a distribution between the legislative power to levy a tax and the power to appropriate the proceeds of a tax so levied.

Distribution of Legislative Powers to levy taxes

The Legislative power to make a law for imposing a tax is divided between the union and the states by means of specific entries in the union and state Legislative Lists in the VII Schedule of the Indian Constitution. For instance, the State Legislature has the power to levy an estate duty in respect of non-agricultural land belongs to Parliament. Similarly, it is the State Legislature which is competent to levy a tax on agricultural income, while the Parliament has the power to levy income tax on all incomes other than agricultural. The residuary power as regards taxation belongs to Parliament and the Gift Tax and Expenditure Tax have been held to derive their authority from this residuary power. There is no concurrent sphere in the matter of tax legislation.

The Distribution of the Tax-Revenue between the Union and the States

Taxes assigned to the Union	Taxes assigned to the State	Taxes levied by the Union but collected and appropriated by the States	Taxes levied and collected by Union but assigned to the States	Taxes levied by the Union but shared with the States
Customs and Exports Duties, Income tax, excise duties on tobacco, jute, etc., corporation tax on value of assets of individual	Land revenue, stamp duty except on documents included in the Union List; Succession duty and Estate duty in respect of agricultural land, Income tax on	Stamp duties on Bills of exchange, Cheques, Promissory Notes, Bills of Landing, Letters of Credit, Policies of Insurance, transfer of Shares, etc; Excise	Duties in respect of succession to property other than agricultural land; estate duty in respect of property other than agricultural land; terminal taxes on goods or passengers	Taxes on income other than agricultural income; excise duties, other than those on medicinal and toilet preparations

| companies; estate duty and succession duty in respect of property other than agricultural land. | agricultural land, taxes on goods and passengers carried by road or island waters, taxes on vehicles used on roads, animals, boats; Taxes on the consumption or sale of electricity; Tolls, taxes on employment; duties on alcoholic liquors for human consumption, opium, Indian hemp and other narcotic drugs; taxes on the entry of goods into a local area; taxes on luxuries, entertainments, amusements, betting and gambling, etc. | duties on medical, toilet preparations, containing alcohol or opium of Indian hemp or other narcotic drugs | carried by rail, sea or air; taxes on railway freights and fares; taxes other than stamp duties on transactions in stock exchanges and future markets; taxes on the sale or purchase of newspapers and on the advertisement published therein. | |

Changes after GST

Since the Goods and Services Tax (GST) is a comprehensive indirect tax on manufacture, sale, as well as consumption of goods and services throughout the country, it will replace taxes collected by Central and state governments. Consequently, it will remove service tax, central excise, VAT and other taxes levied by state governments, incurring loss of revenue on these governments.

Central taxes that would be subsumed under the GST are	State taxes that would be subsumed under the GST are
• Central Excise duty • Duties of Excise (Medicinal and Toilet Preparations) • Additional Duties of Excise (Goods of Special Importance) • Additional Duties of Excise (Textiles and Textile Products) • Additional Duties of Customs (commonly known as CVD) • Special Additional Duty of Customs (SAD) • Service Tax • Central Surcharges and Cesses so far as they relate to supply of goods and services	• State VAT • Central Sales Tax • Luxury Tax • Entry Tax (all forms) • Entertainment and Amusement Tax (except when levied by the local bodies) • Taxes on advertisements g. Purchase Tax • Taxes on lotteries, betting and gambling • State Surcharges and Cesses so far as they relate to supply of goods and services

Critical Evaluation of GST's effect on Indian Federalism

The major concern at this point is the effect this new tax regime is going to have on Indian Federalism. Besides subsuming the rights of the Sates to collect certain taxes by the Union, the States' right to collect tax revenues from firms that have a turnover of up to 1.5 crores or lessis also being brought under central control. GST, appears to bean attempt to encroach upon the rights of States to decide taxes according to their socio-economic situations. Moreover, in the wake of national disasters or to acquire funds for welfare schemes to improve people's livelihood, State governments are now at the mercy of the Central government to avail funds.

This new reform also takes away the States' rights or powers to design their tax structure on what rates to impose on what all commodities including on luxury goods and necessity goods. The GST, thus, will block all other options available with the state governments to make up with their deficits and overdrafts, something that the States have been till now relying upon hugely to cope up in accordance to their fiscal policies. With such overarching powers of fund collection at the disposal of the Centre, the State governments, have been brought forcibly under the power of the Union. Such an arrangement is detrimental to the Indian Federal System which was designed to facilitate co-operation between the Centre and the State units irrespective of their respective political controls. The arguments that all these problems regarding the implementation of GST at the Central level and the sharing of revenue with the States shall be solved through the GST appears goofy owing to the fact that the council will remain as a centrally run institution and the major stakeholder will be the centre. There is little or no hope that the State concerns will be properly heard/ addressed in such a body.

This centralized arrangement will have serious outcomes with respect to fiscal autonomy; the States would be deprived of their important source of revenue and their right to decide the tax structure.

Moreover, States would become more dependent on the Centre and this will decrease their responsibility and accountability towards fiscal consolidation. Also, this will reduce the status of the States to a mere spending unit raising serious concerns over fiscal accountability. In a federal system like India (as discussed above), the GST which is bein seen as a revolutionary move to unify the taxation mechanism raises alarming structural, procedural and administrative issues. It is also a general observation that no country with a federal structure has been able to have a fully harmonized system of GST. In the Indian System where Centre is collecting 62% of the total tax revenue, assignment of GST to the Centre will increase the power of Centre to collect 83% of the overall tax revenue, giving it a lion's share and leaving the States with menial resources. under our federal set-up, such a proposition is unacceptable because our Constitution only seeks to control the possible irresponsible behavior of the State Governments, without compromising with their autonomy. GST will be a blow on the financial autonomy of States reducing the Finance Ministries, of the States and at the Centre to distributing agencies with having no power to take policy decisions. Budgets will be mere papers and the GST council, controlled by the Centre, will be all-powerful fiscal authority in the country.

The GST is being imposed at two levels: firstly, at the Central level (CGST) and secondly at the States' level (SGST). But the actual problem under the dual GST pertains to vertical tax externality, i.e., when both the levels of government, Centre and States, levy tax on same base, the tax policy decisions of one, affects the tax base of the other. It can be understood as: when the central government increases the tax levied on a commodity, it adds to the tax payable by the consumer. This is turn results in the decline of the demand for that particular commodity, thus reducing the total tax amount which was to be collected by both the levels of government. Thus, there is a reduction in tax base, which is unhealthy for the tax revenue of the States as well as the Central government. Another drawback of this arrangement is that, the rates for both, the CGST and the SGST, will be fixed by the GST Council, whose members shall comprise of State finance/revenue ministers and chairman will be the Union finance minister. Once the tax rates are fixed by the GST Council, the individual States will no longer enjoy their power to tax whichever commodities they want and at whatever rates they want. This implies that even though the GST will be helpful in expanding the tax net, curbing tax evasion and increasing revenues from tax, it will be highly detrimental to the financial autonomy and State-specific financial planning by governments. Moreover, there is a strong apprehension that the GST will end up profiting big corporate houses only. Similarly, a unilateral approach is against the spirit of Indian federalism.

The beauty of a federal polity is that different political parties can hold power in different states and at the Centre, but they should be able to pursue their different programmes as per their ideologies, without damaging the integrity of the country, and therefore, they are given the freedom to pursue their preferred fiscal policies: while some states may be ready to provide incentives to corporate capital to invest in the state, others may be inclined to raise their tax rates to gather more revenue in order to undertake more welfare expenditure; while others may utilize their fiscal authority for raising revenue for worthwhile programmes. The revenue sources at the disposal of the state governments are indeed limited; they rely heavily on the sales tax which accounts to 80 per cent of the revenues for most states. the states did have a degree of freedom in deciding the rates of the sales tax. the value added tax attempted to curtail that freedom, but like the GST it could not tie the states down to a single uniform rate for all goods and all states. Once it is introduced, the state governments will have no freedom to decide on the rates at which they choose to tax commodities. (If they wish to raise some rate, they would have to approach the GST council where theirs will be only one voice among many, and hence likely to be quite inconsequential). With a uniform GST, and fiscal responsibility legislation restricting the size of their fiscal deficits, the freedom of state governments to pursue divergent economic trajectories will be greatly curtailed for the following simple reason.

The base level of resources available to a state government will be more or less predetermined and not subject to any increase. As the tax rates will also be pre-decided, the only option they are left with for obtaining larger revenue would be to expand the tax base. in a situation where the states have no power to raise tax rates has reduced the scope for enlarging public investment, they would be forced invite private corporate capital to set up plants in their states to expand the level of activity. This will greatly hamper the scope of state/ [public enterprises while directly favouring expansion of big corporate houses. Talking about the benefits of the GST, which appear more of sheer hype. In fact, Finance Minister's assertion that a shift to the GST will add 2 per cent to the growth rate of the gross domestic product, is based on such assumptions which are never made fully explicit to the people and which are not fully comprehensible. The two major substantial arguments have been advanced : firstly, the GST will simplify and rationalize

the indirect tax system, and secondly, that it would prevent the rat race among states to lower tax rates as a means of attracting private investment The second argument can be easily written off as a uniform tax rate for all states and all commodities is not adequate for preventing unhealthy competition among the states. But , the real question pertains to the first argument: should we sacrifice a basic feature of our federalism for some unspecified benefits that may arise from the "simplification and rationalization" of our system of indirect taxation? The biggest benefit of the GST is being touted as unifying the "national market"; but the example of USA is worth mentioning. The US does not have a uniform taxation scheme like the GST. The States in the US tax commodities by value, not value added, at different rates, which, vary across commodities within each state. There are a vary of taxes on commodities, within each state. And even the exemption limits for the value of business turnover, below which indirect taxation is not imposed, are not the same across the states. The world's largest capitalist economy has thus functioned well without having a unified national market according to the criteria advanced by the advocates of the GST; and it plans to continue with the same in the future. The therefore, question naturally arises: if the US can get along without apparently a unified national market, why are we so adamant on it, even at the cost of sacrificing our federal structure?

In fact, the reason why the US functions smoothly with a wide variety of of taxes and tax-rates across states is due to the fact it values its federalism. A clear indication of this is the composition of its Senate where each state has an equal number of senators, i.e., two whether it a big state like New York or California or a small state like Delaware or Rhode Island; no state therefore can complain about its voice not being heard. And it is solely because of this fierce commitment to federalism that keeps the structure intact despite the economic arguments advanced by corporate spokespersons in a country where corporate-financial interests have an overarching impact on the polity. Such commitment to federalism, has never been apparent in India. The Centre uses all kinds of tactics to subjugate the state governments; and the state governments are so exclusively concerned with whatever resources they can occupy that they overlook the principles which are the foundation of Indian Federal structure. But since, the Federal system has been included in the basic structure of our constitution, as propounded in the Keshavanada Bharati verdict, even if all the state governments along with the Central government, at any given time, agree on some measure to abridge it, they have no power to do so. The implementation of the GST, as currently visualized, shall amount to an interference with the "basic structure" of our Constitution. The fact that it may have the support of all the state governments, is definitely not a healthy sign for the federal spirit of our political system. A few existing governments, even if they decide to compromise their freedom and authority to pursue economic trajectories of their choice, should not be warranted to decide for all future governments.

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MORPHOLOGICAL EVALUATION TRIGONELLAFOECUMGRAECUM UNDER THE INFLUENCE OF COLCHICINE WITH SPECIAL REFERENCE OF ITS VEGETATIVE CHARACTERISTICS

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ABSTRACT

Trigonellafoecumgraecum (TFG), commonly known as methi, comes under leguminous crops and self pollinating. India is the leading producer of TFG in the world. It is orally consumed as a leafy vegetable. It has been used as a medicinal plant since more than 4000 years in various parts of the world. Due to this reason, it is regarded as oldest medicinal plant in the history of mankind. An experiment was conducted to investigate the morphological changes through different colchicine treatments. The seedlings developed from treated seeds with colchicine at concentration range (0.2-0.6%) showed variations in plant growth (plant height, stem diameter, number of leaves, leaf length, leaf width, root length and number of lateral roots). The result of the present study demonstrates that at lower doses (0.2 and 0.4), significant changes in morphological characteristics were obtained. Among various concentrations 0.6% was found highly effective in all morphological characters. There was significant reduction in percentage germination in all concentrations as compared to the control.

Keywords: Trigonellafoecumgraecum, colchicine, morphological characteristics, seed germination.

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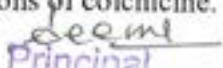
Introduction

Fenugreek (*Trigonellafoenum-graecum, TFG*) is an annual legume crop belonging to the family of Fabaceae. It is native to an area extending from Iran to Northern India. The crop has now been introduced to parts of Africa, Mediterranean Europe, West and South Asia, North America, South America and parts of Australia (Acharya et al 2006 &Acharya et al 2008). India, is the leading producer of fenugreek in the world. It is best known for the presence of pungent aromatic compounds in their seeds that gives colour, flavour and aroma to food. It is orally consumed as leafy vegetable. It has been used as a medicinal plant in various parts of world. Due to this region, it is regarded as oldest medicinal plant in history of mankind (Bano et al 2016). Seeds of fenugreek spice have medicinal properties such as hypocholesterolemic, lactation aid, antibacterial, gastric stimulant for anorexia, antidiabetic agent, galactogogue, hepatoprotective effect and anticancer. The beneficial physiological effects of fenugreek including the antidiabetic and hypochlesterolemicactivity which are mainly attributable to the intrinsic dietary fibre constituent which have promising nutraceutical value (Srinivasan, 2006).

Polyploidy is widely acknowledged as a major mechanism of adaptation and speciation in plants (Osborn et al 2003). Chromosome doubling is a critical step in producing polyploids. Colchicine is the most frequently used chemical to produce autotetraploids in economically important crop species (Reinbergs&Shabeski 1958). The drug inhibits the formation of microtubules by binding to tubulin, the protein subunit of microtubules with the inactivation of spindle which is formed by microtubules, the polar migration of chromosome is inhibited producing "restitution" nuclei, thus resulting in a cell with a doubled chromosome number (Wan et al 1991). There are several methods for polyploidy induction by colchicine treatments in plants such as seed (Hanzelka&Kobza 2004, Quan et al 2004), flower bud (Wu et al 2007), apical meristem (Lavania&Srivastava 1991, Saharkhiz 2007) and root treatments (Taira et al 1991).

The colchicine concentrations usually applied ranged from 0.1 – 0.8% (Adaniya et al 2001). Keeping these facts in consideration, the present investigation was carried out to find out the response of *Trigonellafoenum-graecum* against various concentrations of colchicine.

Materials and Method

1. Plant material and growth conditions

   Seeds of *Trigonella* were purchased from local market of Jaipur, Rajasthan, India

2. Treatments

   Seeds of *Trigonella* were surface sterilized with 0.1% (W/V) $HgCl_2$ for 10 minutes. They were washed several times with distilled water to remove excess of $HgCl_2$. Seeds were soaked in distilled water for 24 hours. After this the pre-soaked seeds were subjected to varying concentration (0.2%, 0.4% and 0.6%) for 6 hours and control was maintained by pre soaking in distilled water.

   The soaked seeds were taken washed under running tap water. 30 seeds of each treatment were sown in the field following randomized block design (RBD) with three replcations along with control.

3. Growth measurements

   Growth measurements, (Table 1 & Table 2), for the plants exposed to colchicine and control, were taken after 15 days and 21 days of germination. The replicates taken for each treatment and control were used to calculate mean of each measurements.

Results & Discussion

Chemical mutagens have been reported to have inhibitory effects on seed germination leading to low percentage germination (Dhakhanamoorthy et al. 2010, Pande and Khetmalas, 2012). The percentage of seed germination was reduced on increasing doses of colchicine. Reduction in germination and survival percentages due to the effect of mutagens on various crop plants have earlier been documented (Mensah2005, Mensah&Akomeah 1997and Mensah et al 2005).

After 15 days of germination

In the control group plant height was 14.7 cms. It was observed that different concentrations of colchicine treatments (i.e. 0.2%,0.4% & 0.6%) employed in the present study succeeded in affecting the plant height. The effect of colchicine on different growth parameters are presented in table 1. The results revealed that increasing the concentrations of colchicine led to decrease in the plant height, leaf length, leaf width, root length and fresh weight. Control plants showed growth of nine lateral roots while treatment with colchicine led to absence of any lateral root development (Figure 1 A).

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After 21 days of germination

The number of surviving plants on the 21st day followed similar trends as that of germination of earlier plants. Plants treated with 0.6% of colchicine had lowest germination percentage i.e. only 40%. These plants had better growth rate in comparison to the plants treated with other concentrations. These plants attained the height of about 11.96 cms. which is maximum among all concentrations.

A comparison of the control plants with the plants treated with colchicine is shown in Table 2. Plants treated with 0.6% colchicine produced more leaves with reduced leaf length and width and long roots (Figure 1 B).

Colchicine application reduced germination percentage significantly. Similar results were obtained by Lepengue et al (2012) and Sourour et al (2014). They showed a reduction in germination percentage of about 30.55% and 43.42% in Zea mays and barley respectively. Similar findings were obtained by Hassein et al (2001) and Bakry et al (2007) in Musa accuminata and Viciahardonensis respectively. It was found that percentage of seed germination decreased with increasing the doses of colchicine. In addition, among the surviving seedlings some were noticed to gradually die, especially those seedlings receiving high colchicine doses.

A linear trend between concentration of colchicine on germination and survival rate was observed. The mortality appeared to be due to poor seedling vigour resulting in inability of seedling to overcome the toxic effect of colchicine (Zlesak et al 2005). Addink (2002) stated that high concentration of colchicine could inhibit the development of living part resulting in mortality of organism. Generally, an average plant height is directly proportionate to the time period of growth. As a matter of fact, plant height decreased with increment in concentration of colchicine (Tiwari and Mishra 2012). Trigonella plants induced with colchicine treatment were visibly shorter and had broader stem. They had reduced number of leaves and shorter leaves. Treated plants are easily characterized by plant height, root length and number of lateral roots. Similar observations were reported by Nigel et al (2007), Grouh et al (2011) and Sourour et al (2014). Seed treatment with higher concentration of colchicine solution was noticed to cause the treated seeds to give low height plants. It works by disrupting the polymerization of microtubules which in turns disrupts spindle fibre development in mitosis. Cells arrested at metaphase may recover and enter the mitotic cycle

with twice as many chromosomes (Zlesak et al 2005). Jensen (1974) mentioned that in addition to the negative side effects of colchicine such as mitotic irregularities, growth retardation etc., other mutagenic effects including quantitative changes have been reported for various crops. Polyploid plants usually have thicker roots and shoots (Rose et al 2000).

After 21 days of germination, 0.6% concentration of colchicine treatment supports the plant height, root length and number of leaves. Essel et al (2015) reported that colchicine Induced marked vegetative growth, leading to the formation of large plants and more number of leaves, branches and seeds per plant. These characters were highest as compared to other concentrations. It could be further used and be helpful in breeding programs.

In conclusion, colchicine application reduced germination percentage. Increasing ploidy often results in increasing cell size that in turn results in thicker stems and broader leaves. Shoots are often thicker and can have shortened internodes. Morphological variations directly correlated with concentration of colchicine.

Table1: Morphological parameters after 15 days of growth.

S.No	Growth Parameters	Control	0.2%	0.4%	0.6%
1	Plant length (cms)	11.7±0.05	6.95±0.50	4.43±1.01	5.43±0.04
2	Stem diameter (cms)	0.1±0.07	0.16±0.02	0.26±0.05	0.25±0.04
3	No. of leaves	3±1.02	2±0.05	2±0.05	2±0.07
4	Leaf length (cms)	2±1.00	1.06±0.07	0.93±0.05	0.90±0.57
5	Leaf width (cms)	0.7±0.69	0.48±0.54	0.45±0.41	0.42±0.30
6	Root length (cms)	5.3±1.25	2.93±0.91	2.48±1.01	0.93±0.94
7	No. of lateral roots	9±0.05	0	0	0
8	Fresh weight	0.21±0	0.12±0.04	0.12±0	0.11±0.04
9	Germination%	100	94	80	73

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Table 2: Morphological parameters after 21 days of growth.

S.No	Growth Parameters	Control	0.2%	0.4%	0.6%
1	Plant length (cms)	16.8±0	6.71±0.05	4.8±0	11.96±0
2	Stem diameter (cms)	0.2±0.01	0.23±0.02	0.25±0	0.35±0
3	No. of leaves	6±0	3±0	4±0	5.2±0.02
4	Leaf length (cms)	2.1±0.05	1.17±1.04	0.96±0.96	0.73±0.58
5	Leaf width (cms)	1.5±0	0.70±0	0.65±0	0.47±0.06
6	Root length (cms)	5.3±1.25	1.83±1.06	1.58±0	3.13±.63
7	No. of lateral roots	6±0	1±0	1±0	0
8	Fresh weight	0.28±1.02	0.14±1.25	0.11±0	0.30±0.90
9	Germination%	100	81	78	40

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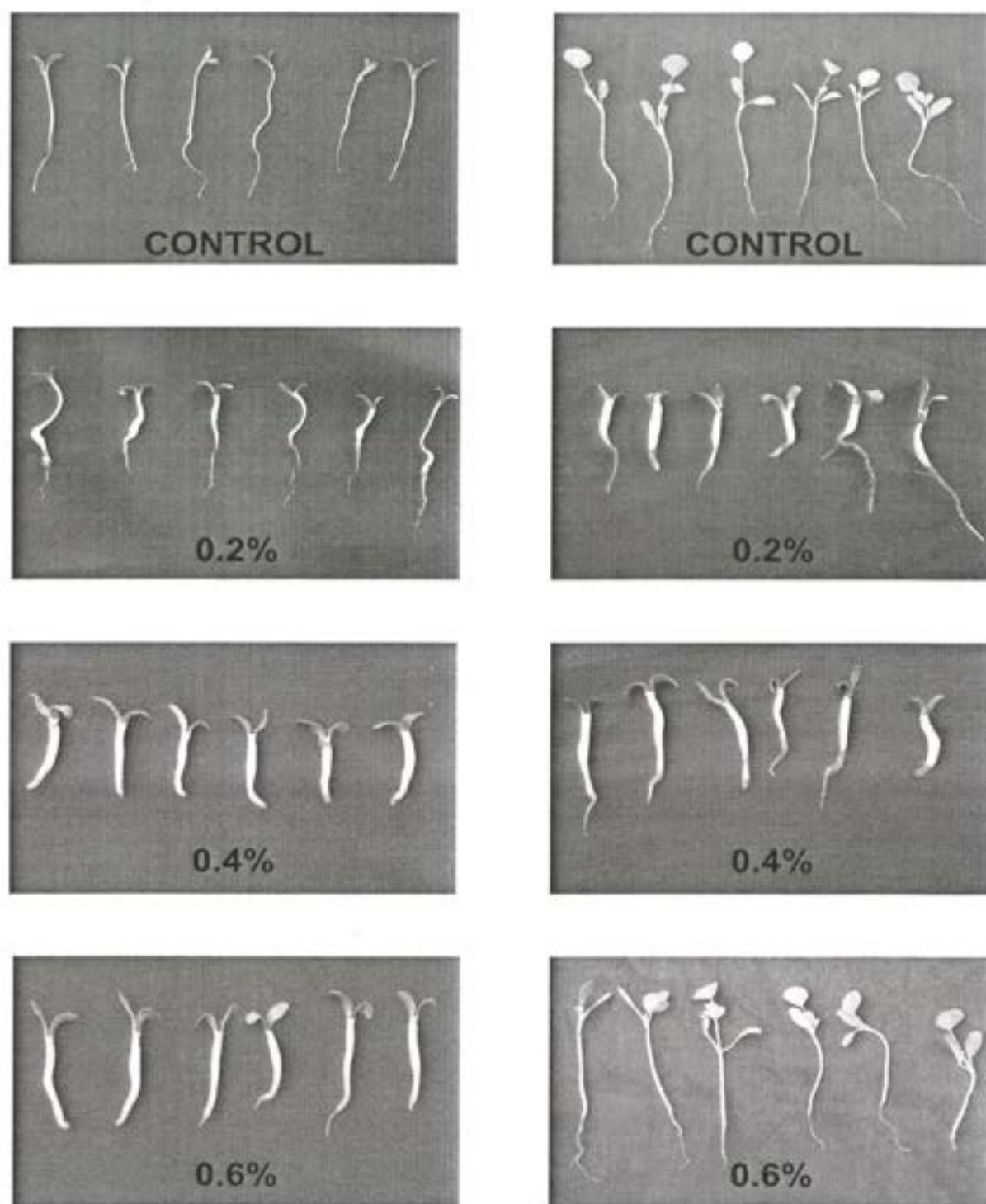
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Figure 1-A) Seedlings after 15 days of germination
B) Seedlings after 21 days of germination

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14 सितम्बर, 2018

अनुक्रमणिका

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युगद्रष्टा कवि : कमलाकर 'कमल'

– डॉ. शीताभ शर्मा

'सिर पर चोटें पड़ने पर ही, कुछ निर्माण हुआ करता है।
जब संघर्ष हुआ करते हैं, तब कल्याण हुआ करता है।''

– (कमलाकर)

ब्रह्माण्ड में आदित्य- तेज तम को नष्ट करता है, किन्तु महान विभूतियाँ धरा पर देह धारण कर दिव्य गुण तेज से हृदय अंधकार को विदीर्ण करती हैं। धरा पर वही देश धन्य है जहाँ महान् विभूतियाँ पैदा होती हैं। सम्पूर्ण सृष्टि में भटकते लोगों को रास्ता दिखाने का महान् कार्य; व्यथित मनों पर मरहम का कार्य महान् विभूतियों ने किया है। जिन्होंने निःसंकोच व निःस्वार्थ रूप से अपने समग्र जीवन दर्शन, अपनी समस्त क्षमताओं को मानव कल्याण हेतु समर्पित कर दिया। इसी परम्परा में उदार विभूति कवि कमलाकर 'कमल' हैं।

आपका जन्म 28 जनवरी, 1915 को रेवई ग्राम (म.प्र.) में हुआ। जब आप ढाई माह के थे तो मातृ सुख छिन गया और 14 वर्षीय किशोरावस्था में पितृ साया भी न रहा तत्पश्चात् काका–गोविन्दराव व काकी–कृष्णा के साथ जयपुर (राजस्थान) में पले–बढ़े। अपने काका से ही आपने काव्य शिक्षा ग्रहण की और अपने कुल के ध्येय ''कर कलम रुके तो कर कलम कराइये'' के अनुरूप आप जीवन पर्यन्त साहित्य साधना में रत रहे और आज भी आपका ज्येष्ठ पुत्र 'मधुकर' इस कुल वाक्य को सार्थक कर रहा है।

कमलाकर जी को वंश परम्परा से ही कवित्व गुण प्राप्त हुआ किन्तु आपकी कविता युगानुरूप आधुनिक संदर्भों की अभिव्यक्ति है। यह रीतिकालीन महाकवि पद्माकर की पांचवीं पीढ़ी के सशक्त हस्ताक्षर हैं। आपकी पूर्व परम्परा (महाकवि पद्माकर से पिता व चाचा तक सभी) राज दरबार आश्रय की रही किन्तु इन्होंने अंग्रेजों की गुलाम राजशाही का आश्रय कभी स्वीकार नहीं किया, परिणाम स्वरूप आपको परिवार से निष्कासित कर दिया गया और जीवन भर फक्कड़ संतों की तरह गृहस्थ को साथ लिये भटकते रहे। तत्कालीन युग पुरुष गाँधी जी से प्रेरित आपने आजादी की लड़ाई में तथा हिन्दी को राष्ट्र भाषा बनाने के संघर्ष में जयपुर का प्रतिनिधित्व किया।

वंश परम्परा के अनुरूप रीतिकालीन काव्य शैली में आपकी रचनाएँ आरम्भ हुई। पुष्टिमार्गीय भक्ति–भावधारा में राष्ट्रीय आन्दोलन व समसामयिक रचनाओं की युगानुकूल भावना का समावेश होकर राष्ट्र–प्रेम, धर्मनिरपेक्षता, श्रमदान, त्याग, बलिदान की कर्मप्रधान अभिव्यक्ति प्रेरणादायी एवं यथार्थपरक है। मानवीय मूल्यों की एक-एक ईंट से चुन-चुनकर

रखी गयी, इनके काव्य की नींव जो सदाचरण, दया, करूणा, परोपकार, सात्विकता, जनकल्याण भाव तथा कर्मप्रधान मानव की परिकल्पना है। कमलाकर ने मानव को सृष्टि की श्रेष्ठतम कृति माना है अर्थात् इनका काव्य मानवीय मूल्यों का संवाहक है जिसकी अन्तर्वस्तु का आधार प्रगतिशील चेतना है।

आप पुष्टिमार्ग में दीक्षित ब्राह्मण, मन से संत मस्तिष्क से दार्शनिक थे। आप आस्तिक रहे पर अंधविश्वासों से परे। बाह्याडम्बरों व रूढ़ियों का विरोध आप जीवन भर करते रहे। आपकी निम्न पंक्तियों में यही भाव व्यक्त हुआ है–

'मनुष्य हो मनुष्य की उदारता लिये रहो।
इसीलिए सभी सुनो, सभी मनुष्य एक हैं।
न जातियां अनेक हों, न पांतियां अनेक हों।''

आपके जीवन पर गाँधीजी का तथा काव्य पर भारतेन्दु, महावीर प्रसाद द्विवेदी, मैथिली शरण गुप्त, हरिऔध, माखन लाल चतुर्वेदी तथा प्रेमचंद आदि का प्रभाव स्पष्ट लक्षित होता है। निम्न पंक्तियाँ देखिए–

''न देव काम आयेगा, न दैव काम आयेगा।
मनुष्य को मनुष्य ही, सदैव काम आयेगा।''

आपके जीवन व काव्य के गहन अध्ययनोपरांत हिन्दी विकास के आपके प्रयासों के लिए यदि मैं यह कहूँ तो अतिशयोक्ति नहीं होगी कि **"आप जयपुर के महावीर प्रसाद द्विवेदी थे।"**

प्रातः चार बजे से रात्रि ग्यारह बजे तक पाँच सौ के लगभग विद्यार्थियों को निःशुल्क हिन्दी काव्य शास्त्र, हिन्दी साहित्य इतिहास पढ़ाते रहना तथा उनके अन्दर के साहित्यकार की खोज कर उसका परिष्कार करना आपकी दिनचर्या थी। आपकी 'अभिनन्दन'

कविता इसे प्रमाणित करती प्रतीत होती है–
'चाह नहीं है मालाओं से, मेरा कण्ठ सजाया जाये।
जहाँ गरीबी बसी हुई हो, वहीं चाहिए एक बसेरा।
सेवक ही रहने दो मुझको, सेवा दो–मत सेव्य बनाओ।
मुझे याद है कभी आज तक, मैंने झोली नहीं पसारी।
दया करो हे दाता मुझ पर, मुझको मेरा श्रम ही प्यारा।'

हिन्दी उत्थान हेतु आपने साहित्य सदावर्त नामक संस्था की स्थापना की और हिन्दी की सेवा में रत रहे। आपने 'प्रकाश' मासिक हिन्दी पत्रिका का सम्पादन किया जो 1938 ई. से 1942 ई. तक साहित्य संवर्द्धन करती रही। पत्रिका में उच्च कोटि के निबन्ध लिखकर गद्य के क्षेत्र में भी अपना स्थान बनाया। हिन्दी की उपेक्षा से आप व्यथित थे–
''हिन्दी को अधिकार चाहिए। सब लोगों का प्यार चाहिए॥
निभने और निभाने वाला वैचारिक व्यवहार चाहिए॥''

आपकी साहित्य सेवा और असाधारणता का भान इस बात से सहज ही हो जाता है कि आपके पुत्र–पुत्री आपको 'गुरु' संबोधन करते हैं। आपने सन् 1933 से 1956 तक लगभग पैंतीस हजार हिन्दी अध्येता तैयार किए।

कमलाकर के काव्य की मूल संवेदना राष्ट्रीयता है। स्वतंत्रता पूर्व व परवर्ती स्थितियों को इनके काव्य में सफल अभिव्यक्ति मिली है। यह पुष्टिमार्ग में दीक्षित कृष्ण भक्त कवि थे। इनके कृष्ण–गोपी–उद्धव संवाद परम्परा के काव्य 'भावात्मक उद्धव-शतक' में भी राष्ट्रीय चेतना का समावेश सुन्दर बन पड़ा है। ब्रजवर्ती, उद्धव से भारतीय धर्म–निरपेक्षता का दंभ भरते हुए अधर्म को नष्ट कर देने की बात कहते हैं यह कवि

देखिए—

"वीरता के वर्म[1] कौ भरोसौ धारि भाखत[2] हैं,
बैरन कौ बैरन कौ, बाट उठ जायगौ।
जग में हमारी दृढ़, धर्मनिरपेक्षता सौं,
व्यापक अधर्मन कौ ठाठ उठ जायगौ।
धारौ नैंक धीरज, धरा पै सुभ कर्मन सौं,
निश्चय कुकर्मन कौ, हाट उठ जायगौ।
नैंक जनजीवन की आंगुरी लगावतई,
ऊधौ ! पाकसासन[3] कौ, पाट उठ जायगौ।"

हमारा प्यारा भारतवर्ष वसुधैव कुटुम्बकम् की संस्कृति का पालक है। यहाँ सभी संस्कृतियों व धर्मों का बराबर आदर होता रहा है। यही इसकी हृदय विशालता का प्रमाण है—

"यह हिन्दुस्तान हमारा है।
यहाँ राम की पूजा होती है, यहाँ श्याम की सेवा होती है।
यहाँ मोहम्मद ईसा मूसा सबकी बातें मानी जाती।
यहाँ सभी की मनोवृत्तियाँ तुरन्त पहचानी जाती।।"

इनके द्वारा ब्रजभाषा में रचित काव्य तो प्रकाशित हो चुका है किन्तु हिन्दी भाषा काव्य आज भी प्रकाशन की बाट जोह रहा है। आपकी हिन्दी रचनाओं में— त्रेता (खण्ड काव्य), प्रताप बावनी। कवि (महाकाव्य)—1955 की अग्रगामी मासिक पत्रिका में धारावाहिक रूप में प्रकाशित हुआ। किन्तु पुस्तक रूप में अप्रकाशित। यह महाकाव्य हिन्दी साहित्य में स्वच्छंद मनोभावों पर आधारित कामायनी परम्परा का एक श्रेष्ठ महाकाव्य है। कमल-पदावली (भक्ति

रचना), अमर-भारती (राष्ट्रीयता का विशद् मुक्तक काव्य) तथा अष्टदल (लघु कविता-संग्रह)।

ब्रजभाषा और खड़ी बोली हिन्दी दोनों में ही आपने काव्य रचना की। आपका सम्पूर्ण साहित्य आधुनिक भाव बोध से युक्त है। यह बड़े शोक का विषय है कि आज भी आपका साहित्य प्रकाशन की बाट जो रहा है। कवि कमलाकर का साहित्य जिस दिन साहित्य की मुख्य धारा से जुड़ेगा, निश्चय ही वह दिन हिन्दी विद्यार्थियों व अध्येताओं के लिए सौभाग्य का दिन होगा।

इस दिव्य आत्मा के व्यक्तित्व व कृतित्व से जयपुर तो परिचित है किन्तु हिन्दी साहित्य अध्येता व विद्यार्थी जगत अभी तक अपरिचित है। जो जीवन भर साहित्य का सदावर्त बाँटते रहे, हिन्दी रथ के सारथी और साहित्य के महारथी रहे, कई संस्थाओं और सम्मेलनों के सिरमौर रहे, जिन्होंने जयपुर को हिन्दी के कई बड़े साहित्यकार दिये तथा स्वयं विपुल साहित्य के सृजक रहे; महाकवि पद्माकर की पाँचवी पीढ़ी के सशक्त हस्ताक्षर अमल, धवल, कमलाकर 'कमल' की अभिलाषा कर्म के द्वारा ज्ञान के आंलोक में निष्काम होकर रहने की रही। इसी अभिलाषा के साथ साहित्य के इस महारथी ने 19 मार्च, 1995 को जयपुर में हुए विश्व हिन्दी सम्मेलन के स्वागत उद्बोधन के पश्चात् इस लोक से महाप्रयाण किया।

"नन्दनों के स्वर्ग की मुझको नहीं परवाह है।
कुछ कहीं पर भी नहीं, अभिनन्दनों की चाह है।।

Principal
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1. वर्म—कवच
2. भाखत—कहते हैं।
3. पाकसासन—इन्द्र का शासन

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अब ना मेरे भाल पर कोई तिलक चन्दन करे।
चाह बिल्कुल भी नहीं जन चरण वन्दन करे॥
कर्म के द्वारा पहुँचकर ज्ञान के आलोक में,
चाहता हूँ मैं रहूँ निष्काम होकर लोक में।''

मुझे इस दिव्य विभूति के व्यक्तित्व और कृतित्व पर शोध कार्य करने का जो सुअवसर प्राप्त हुआ इसके लिए मैं स्वयं को धन्य समझती हूँ। शोध ग्रन्थ का प्रकाशन 2014 में यू.जी.सी. व वनस्थली विश्वविद्यालय के आर्थिक सहयोग से हो चुका है किन्तु इनके हिन्दी भाषा काव्य प्रकाशन की ओर मेरे प्रयासों को निश्चित ही सफलता प्राप्त होगी। इसी

आशा के साथ श्रद्धा सुमन अर्पित–
''कमल तुम तो कमल हो
ऐसे कैसे गल जाए।
तुम कोई सुबहो नहीं,
तुम कोई शाम नहीं,
जो पलकों में ही ढल जाए।''

कानोड़िया महिला महाविद्यालय
जयपुर

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Regular article

Development of an effective electrochemical platform for highly sensitive DNA detection using MoS₂ - polyaniline nanocomposites

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HIGHLIGHTS

- As a new electrochemical platform, 2D MoS₂-Polyaniline was applied for DNA sensing.
- Perfect blend to achieve high conductivity with addition of DNA adsorbing properties.
- DPV was performed in the range of 10^{-6} to 10^{-15} M of DNA in label-free method.
- Ability to detect mismatch in analytes DNA.

ARTICLE INFO

ABSTRACT

Molybdenum disulfide (MoS₂) and its associated nanocomposites are widely explored in different applications like capacitance, batteries, sensing etc. However, the nanosheet formation of MoS₂ exhibits excellent properties for DNA adsorption without any further surface or probe DNA modification which makes it a suitable matrix for the less explored DNA sensing application. In this present work, an ultrasensitive electrochemical DNA biosensor, based on few layered MoS₂ nanosheets blended with conducting polymer, polyaniline is constructed as a sensing platform and used as a DNA sensing probe via differential pulse voltammetric technique. The sensor works well even at concentrations as low as 10^{-15} M of target DNA without labeling or any use of amplifiers. The sensing performances show highly satisfactory results in case of serum samples and in presence of other interferrants. In addition, the sensor can successfully recognize any positional mismatch in a known concentration of targeted DNA which can lead to a DNA mismatch senor in near future. The detection method described here expands the application of MoS₂ in the biosensor field with a viable alternative for easy, cost effective electrochemical DNA detection technique with mismatch identification capability.

1. Introduction

In the past few years, genetic revolution has introduced exceptional utilization of devices for the diagnosis of particular biomolecules. Various methodologies have been applied for the development of highly sensitive and economically feasible biosensors to detect the presence of different biomolecules like glucose, urea, cholesterol, DNA etc. [1–3]. Inclusion of available genetic information for advances in medicine and disease treatment requires efficient biosensing technologies like accurate DNA detection with high sensitivity [4]. Thus, DNA sensing with high sensitivity are of great scientific and economic interest in recent sensing technologies. Detection of DNA sequence requires vast chemical methodologies including optical DNA sensing, mass sensing technology and electrochemical DNA sensing [5]. Generally optical biosensors are extraordinarily sensitive towards analytes with very low detection limit [6,7]. However, the instrumentation required for this is very

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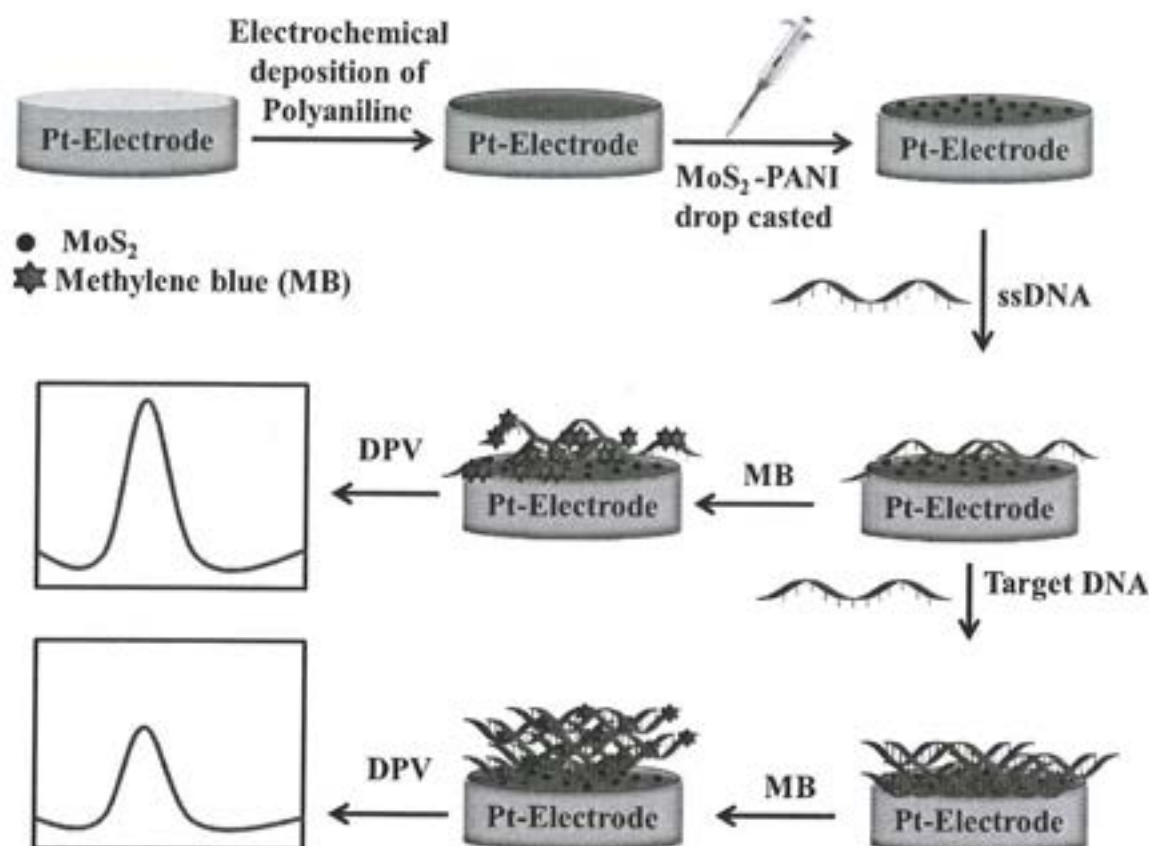
Scheme 1. Schematic representation of the fabrication steps of the electrochemical sensor for DNA hybridization and DPV metric detection.

sophisticated and expensive. In addition, the massive data accumulated is not fully essential for clinical diagnosis still these can be fruitful in laboratory use. An alternative sensing technology is readout where change of mass on immobilized recognition layer is monitored using quartz crystal microbalance (QCM) or micro fabricated cantilevers [8]. This technology is also associated with expensive instrumentation and includes technical difficulties. Whereas the detection technique of DNA sequence through electrochemical biosensors has been rapidly developing for its theoretical and practical significance [9,10]. The use of nanostructured materials in electrochemical detection of biomolecules offers unique opportunities for electrochemical transduction of DNA sensing events. Presently, 0D or 2D thin-layered nanomaterials such as quantum dots or graphene have been investigated enormously for its long-range nanoscale energy transfer property [11–14]. The unique DNA-graphene interaction forms the basis of a convenient and versatile strategy for DNA analysis. During past few decades some graphene analogues were used as sensor matrix and have generated particular interest in the most emerging field like biosensor. On the other side, being a typical layered transition-metal dichalcogenide compound, MoS_2 has a structural analogy to that of graphene. The metal atom of MoS_2 occupies the center of trigonal prism and is bound to the closest sulphide ligands [15]. The trigonal prisms are interconnected whereas the Mo atom is sandwiched between two layers of chalcogen atoms (S). There is a strong covalent bond between metal and chalcogen atom, but it has weak van der waals force between the layers of sulphur atom [7]. The sliding layers of MoS_2 provide more effective surface area so that more immobilization of biomolecules may occur on the exposed surface of the sheets. Preparation of MoS_2 nanocomposite and its application in energy storage devices have acquired significant attention recently but, biological applications have not been explored yet. In the year 2013, Zhu et al. reported capability of fluorescence quenching of MoS_2 nanosheets towards the dye-labeled ssDNA for the detection of DNA and small molecules [16]. Later many researchers have reported various

applications of MoS_2 and its composites in sensing technologies [17–20]. Though MoS_2 has huge range of applications in different direction including biomedical, still it has some significant limitations to use as an electroactive material for biosensor owing to its lower conductivity and change in electrical and optical properties in the presence of atmospheric moisture and oxygen [20]. Hence to overcome these problems, researchers had focused to incorporate conducting polymers like polyaniline, polypyrrole, PEDOT etc. within the MoS_2 to increase its conductivity and to provide more chemical stability and protect it from ambient environment [21–24] Though the usage of conducting polymer in the field of biosensing specially in DNA sensing is already well established, but plenty of research is still required to get more accurate results for its real application [25]. Zhu et al. explored the analytical performance of DNA sensor based on polyaniline-nanowire [26]. Later in few reports, polyaniline has been used in a variety of biosensors for electrochemical sensing of bio molecules [27–30]. The graphite like structure of the MoS_2 facilitates the probability of the successful insertion of the conducting polymers which makes the composites suitable for the electrochemical applications. In addition, MoS_2 nanosheet exhibits very good properties for DNA adsorption without further surface modification, which is superior to any other graphene analogues. These individual properties of MoS_2 and polyaniline inspired us to make the nanocomposites of the MoS_2-polyaniline for the application in electrochemical DNA detection.

In this present work, we have fabricated a label-free and convenient sensor using MoS_2-polyaniline nanocomposites with improved technique for immobilization of single stranded DNA (probe ssDNA) and the detection of hybridization with targeted DNA with much ease. We have carried out the investigation with Differential Pulse Voltammetry (DPV) using platinum electrode coated with nanocomposites of MoS_2-polyaniline. This has been used to determine the concentration of target DNA even at low concentration of 10^{-15} M as well as differentiate between a single base mismatch compared in different position to that

of a perfectly matched double stranded DNA (dsDNA), using methylene blue (MB) as a redox indicator (as depicted in Scheme 1). The sensor electrode is optimized thoroughly in different pH, temperature and interfering conditions. The sensing performances of this system show highly satisfactory results in case of human serum as well as in presence of other interferrant DNAs. This simple, low cost, small sized and uncomplicated implementation of MoS_2-polyaniline based electrochemical DNA sensor might provide important opportunities in clinical diagnosis in near future.

2. Experimental

2.1. Reagents

Methylene blue, oligonucleotides were obtained from Sigma. For the synthesis of MoS_2, Molybdenum trioxide (MoO_3), potassium thiocyanate (KSCN) and Sodium dodecyl sulphate (SDS) were also purchased from Sigma. Doubly distilled water collected from milipore and tris buffer (Sigma) was used for the preparation of aqueous solutions throughout. All the above chemicals were used without further purification.

2.2. Preparation of the MoS_2

Few layered MoS_2 nanosheets were prepared by hydrothermal route of standard chemical synthesis [31]. 20 mmol of MoO_3, 50 mmol of KSCN and 128 mg of SDS were dissolved in 60 mL DI water using sonicator for 30 min and homogeneous solution was kept in 100-mL teflon coated autoclave at 220 °C for 24 h. After cooling naturally, the product was washed several times by centrifugation at 2000 rpm for 25 min with DI water and ethanol. Sample was then collected and kept in vacuum drying oven at 60 °C for 24 h.

2.3. Preparation of the MoS_2-polyaniline nanocomposites

Aniline monomer and ammonium persulfate (APS) were used in 1:1 M ratio for the polyaniline synthesis [32]. 1 mL of aniline (predistilled) and distilled water was taken in a container and was sonicated in a bath sonicator for 5 min. After sonication, few drops of hydrochloric acid (HCl) was added to the solution and stirred for 30 min on magnetic stirrer at 600 rpm in ice bath. Measured amount of MoS_2 was dispersed properly in distilled water by sonication and added to the stirring solution. Further solution of APS in distilled water was prepared with few drops of HCl and transferred to the stirring solution and kept to stir for next 3 h. Now the whole sample was set aside for 30 min. The product was centrifuged at 2000 rpm for 5 min and washed with distilled water for several times and 50% ethanol afterwards. The black product was then collected and dried in vacuum oven at 70 °C overnight.

2.4. Characterizations of nanocomposites

As prepared materials were characterized to know the morphology and microstructure using a high resolution transmission electron microscope (HRTEM, JEM-2010) with an accelerating voltage of 200 kV. Topography as well as the thickness of MoS_2 nanosheets were measured from atomic force micrograph images obtained from VEECO di CP-II AFM. X-ray diffraction (XRD) patterns were recorded on a Rigaku Miniflex X-Ray diffractometer with Cu-Kα radiation (λ = 1.5406 Å).

2.5. Electrical property measurements by DC conductivity

Pressed pellet of MoS_2 and MoS_2-polyaniline (10 mm diameter) were prepared having the thickness of 0.48 and 0.38 mm respectively. A piece of rectangular shape from each pallets were cut and connected with copper wire using silver paint for four probe I–V measurement. I–V measurements were carried out using a constant current source from source meter and a 2182 A nanovoltmeter (Keithley).

2.6. Preparation of the electrode

A Platinum electrode, with a diameter of 2 mm, was polished to a mirror surface with Al_2O_3 slurry, followed by ultrasonication in distilled water and acetone successively. A thin layer of conducting polyaniline film was then deposited on the cleaned Pt-electrode surface by cyclic voltammetric method, using a solution of 45 µl aniline in 5 mL of 0.5 M H_2SO_4. Only 10 cycles were performed at the scan rate of 100 mV s^{-1} within the potential window of 0–1 V. Subsequently, a thin layer of the as synthesized MoS_2-polyaniline nanocomposites solution is drop-casted on to the electrodeposited polyaniline coated Pt electrode. The electrochemically active thin layer of polyaniline has some porous nature which helps to attach the drop-casted MoS_2-polyaniline nanocomposites over it and simultaneously to stick the Pt electrode surface for the advance analysis. To prepare the DNA sensor, the Pt||MoS_2-polyaniline electrode was immersed into 2.5 µM ssDNA solution made with tris buffer (pH 6.9), that acts as probe DNA (single stranded 38 mer oligonucleotide of specific sequence). Due to strong adsorption of DNA with the MoS_2 layer, the ssDNA was attached with the electrode to build the sensor surface Pt||MoS_2-polyaniline/ssDNA. Then, the electrode was coated with BSA protein solution to cover up any un-mounted area of the electrode. Finally, the electrode was washed several times with DI water to remove loosely bounded DNA strand and stored in 4 °C prior to use.

2.7. Preparation of oligomeric solution

The following single stranded oligonucleotides, calf thymus DNA and human serum were purchased from Sigma, Germany.

(Probe oligonucleotide) 1:

5′-TAGCGCAAGAAGAAAAATCACCTTGCGCTAATGCTCTGTT-3′

(Target complementary oligonucleotide):

5′-AACAGAGCATTAGCGCAAGGTGATTTTTCTTCTTGCGCTA-3′

(Mismatched oligonucleotides):

5′-AACA [C] AGCATTAGCGCAAGGTGATTTTTCTTCTTGCGCTA-3′ (5th)

5′-AACAGAGCATTAGCGCAAGG [C] GATTTTTCTTCTTGCGCTA-3′(20th)

5′-AACAGAGCATTAGCGCAAGGGATTTTTCTTCTTG [G] GCTA-3′ (35th)

(Noncomplementary oligonucleotide):

5′-AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA-3′

Solutions of ss-oligonucleotide were prepared by adding required amount of 0.1 M tris buffer (pH 6.9) into appropriate strands for a final concentration of 0.1 mM.

2.8. Immobilization and hybridization of DNA

Hybridization reaction was conducted by immersing the Pt||MoS_2-polyaniline-ssDNA electrode into a solution (pH 6.9) containing different concentration of target ssDNA for 20 min at 37 °C. After that, the electrode was rinsed three times with water to remove the non-hybridized target DNA from the electrode surface. For melting point detection by UV–vis absorption spectroscopy, equimolar amount of two oligonucleotides are added to form fully complementary and single base mismatched duplexes.

For the electrochemical measurements, the Pt||MoS_2-polyaniline-ssDNA electrode was immersed into the solution of 1 mM methyelene blue (MB) for 10 min before and after incubation with target DNA to get maximum loading on ssDNA coated electrode surface. In the various concentration measurements of DNA, the electrode was immersed into the MB solution and washed with buffer before each DPV scan.

2.9. Electrochemical measurements

The hybridized electrode was placed in the analyte solution (pH 6.9) for 5 min. Then the electrode was rinsed with water for several times to remove the loosely adsorbed molecules. The electrochemical measurement of hybridization was performed in electrochemical cell with hybridized Pt||MoS$_2$-polyaniline-ssDNA working electrode with Ag/AgCl as reference electrode and a platinum wire as a counter electrode in Autolab 30 potentiostat/galvanostat workstation. The differential pulse voltammetry measurements were conducted from $-0.2\,V$ to $+1\,V$ (versus Ag/AgCl) in 0.1 M tris buffer (pH 6.9). Under these conditions, a peak found in the CV for the concentration of DNA combined MB at about $+0.05\,V$ which was taken for the further electrochemical measurement signal in DPV analysis.

3. Results and discussions

The central theme in this work is to modify the functionalized MoS$_2$-polyaniline nanocomposites in an easy and efficient technique so that it can be used for immobilization of oligomers or DNA and subsequently apply for DNA sensing. For this purpose, nanocomposite loaded electrode surface having specific affinity towards the target DNA with additional conducting properties is required. The MoS$_2$-polyaniline platform is therefore used for biosensing which can admirably detect not only the oligomers or DNA concentration in femtomolar range but also can distinguish the mismatch in the oligomer with a very sharp sensitivity in the micromolar concentration range.

3.1. Characterizations: TEM and XRD

Initially, we have synthesized the MoS$_2$ and MoS$_2$-polyaniline nanocomposite by chemical routes described elaborately in the experimental section. The layer structure of the as synthesized MoS$_2$ sheet is clearly observed in the TEM image (Fig. 1(a)). The high resolution TEM image (Fig. 1(b)) reveals the hexagonal lattice structure with the lattice spacing of 0.27 nm assigned to the (100) planes which is perfectly matched with the literatures [33,34]. The fringes found after deciphering the HRTEM image is also presented in the inset of the Fig. 1(b) and the calculated d-spacing from this image is 0.27 nm. The lattice pattern found in the high resolution TEM image perfectly corroborate with the results found in the XRD pattern of the MoS$_2$ nanosheet. Fig. 1(c) displays the XRD pattern of the MoS$_2$ and the diffraction peaks in the pattern at 32.4° (100), 39.26° (103) and 58.65° (110) are corresponded to the hexagonal phase of MoS$_2$ [35]. The sharp peak (002) with high intensity obtained at 2θ value of 14° confirms the nanosheet formation of MoS$_2$. In the TEM image of MoS$_2$-polyaniline nanocomposites (Fig. 1(d)), it clearly indicates that the dark shaded cluster of the polyaniline is deposited on the light shaded sheet of MoS$_2$ indicating the successful formation of the nanocomposite. In the high resolution image of the relatively clear region of the nanocomposite (shown in small box in the inset of the image), reveals the lattice structure of MoS$_2$ similar to the bare nanosheet, shown in Fig. 1(b). It indicates that even after the polyaniline deposition, the MoS$_2$ surface did not alter its lattice pattern which is a good indication for its DNA adsorbing property, desired for biosensing. For further confirmation, EDS is also carried out in the whole region of the MoS$_2$-polyaniline nanocomposites, shown in Fig. 1(e). We have used several composition of MoS$_2$:polyaniline for the optimizing purpose of sensor performances, discussed later (Section 3.3). However, here the best optimized composition of 40:60 MoS$_2$-polyaniline has been characterized for EDS analysis to get the exact elemental information in the as synthesized nanocomposites. The atomic percentage calculation from their peak area found in EDS, the actual composition has been estimated to 36:64 of MoS$_2$-polyaniline which is very close to the precursor ratio of 40:60, confirming successful synthesis of the nanocomposites.

3.2. AFM images of MoS$_2$ and MoS$_2$-polyaniline nanocomposites

The morphology and the topography of MoS$_2$ nanosheets and as well as MoS$_2$-polyaniline nanocomposites were further investigated by AFM study. Fig. 2 shows the AFM images of bare MoS$_2$ nanosheet and MoS$_2$-polyaniline nanocomposite respectively, acquired on mica substrate. Inset of Fig. 2(a) is the height profile along the line which shows the height of MoS$_2$ nanosheet is 2.9 nm. After nanocomposite formation, the height increases to 19.8 nm, indicating the clumsy deposition of the polyaniline, shown in the inset of Fig. 2(b). As the thickness of mono layered MoS$_2$ is around 0.71 nm [36], the nanosheet showing in the Fig. 2(a) is considered as a four layered of MoS$_2$ sheet. 3-D image in Fig. 2(a) shows smooth surface morphology of MoS$_2$ nanosheet under AFM, which suggest the formation of layered structure. However the surface roughness after nanocomposite formation is increased significantly in some portion due to the growth of polyaniline on the surface of MoS$_2$ nanosheets which is clearly shown in the AFM image in Fig. 2(b).

3.3. Electrical conductivity of as synthesized MoS$_2$ nanosheet and MoS$_2$-polyaniline nanocomposites

Fig. 3 shows the current-voltage (I–V) characteristics of the MoS$_2$ and the MoS$_2$-polyaniline nanocomposites. The as synthesized MoS$_2$ is poorly conducting in nature whereas the polyaniline is a well-known for its semi-conducting behavior which can even act like a metallic conductor in its optimized state. Here, the linear relationship of I–V indicated the ohmic nature of these nanocomposites. The conductivity value of bare MoS$_2$ is found to $8.4 \times 10^{-4}\,S\,cm^{-1}$ at 300 K which is quite low for any kind of electrochemical process whereas the conductivity of the nanocomposite after polyaniline incorporation is found to be $1.19\,S\,cm^{-1}$, which is almost 10^3 fold higher than as synthesized MoS$_2$. In the DPV metric experiments, a good conductivity value of the transducer or electrode matrix is essential to get the best sensitivity results. So, higher amount of polyaniline loading should work best in this regard. However, in this DNA detection technique, high amount of MoS$_2$ is desired as a surface to adsorb more amount of probe ssDNA which makes the sensitivity towards maximum. Therefore, we have to choose a perfectly optimized composition ratio of the MoS$_2$ and polyaniline, which shows a moderate conductivity required for the electrochemical response as well as good MoS$_2$ loading for maximum amount of ssDNA adsorption. After several optimizations, presented in Table 1, we have found the 60:40 ratio of polyaniline with MoS$_2$ shows the best result in our experiment. Fig. 3(b) shows the comparative I–V characteristic curve of the selected composition which is used as an excellent platform for the electrochemical DPV metric sensing.

3.4. Complementary target DNA detection by differential pulse voltammetric process

Differential pulse voltammetric measurements were carried out to obtain the detection sensitivity of the sensor electrode after performing hybridization with the probe as well as target DNA. Methylene blue (MB) was used as a redox indicator for its specific binding with ssDNA and dsDNA. Initially, the sensor electrode loaded with MoS$_2$-polyaniline nanocomposite was attached with the probe ssDNA and treated for different concentration of target DNA solutions as depicted in Fig. 4(a). The sensor electrode was efficiently measured the target DNA in the concentration range of 10^{-6} (micromolar) to 10^{-15} M (femtomolar) which is the most desired concentration for DNA sensing. As the MoS$_2$ nanosheet surface can adsorb the ssDNA horizontally, the intercalated MB on the ssDNA can give strong DPV signal through the closely packed electrode, resulting high sensitivity in detection. After addition of targeted DNA, it can pluck out the bounded MB with the formation of complete duplex, resulting gradual decrease in DPV signal. The incorporated polyaniline into the MoS$_2$ matrix enhances the conductivity
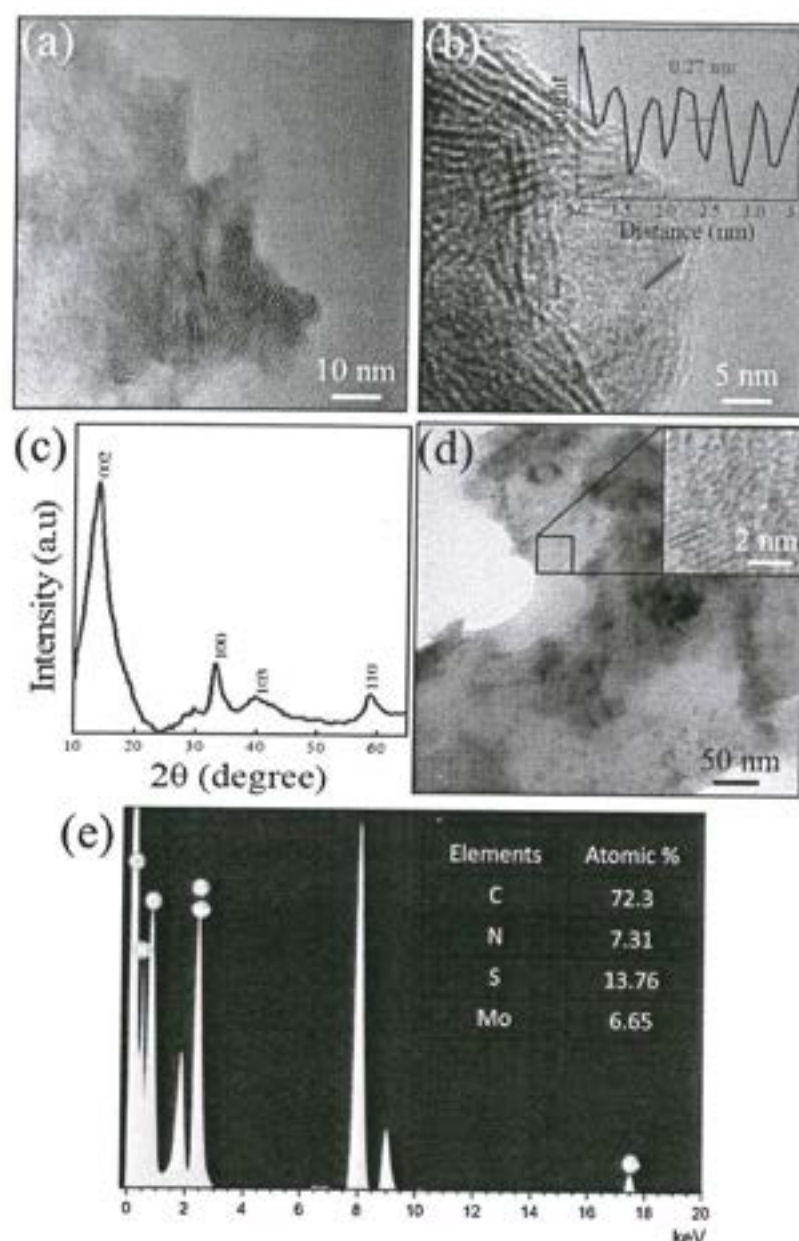
Fig. 1. (a) TEM image of MoS₂ sheet on carbon grid. (b) Higher resolution of the MoS₂ sheets displays clear fringes of the crystal (inset) lattice spacing of MoS₂ nanosheet, deciphered from the red line in the HRTEM image. (c) XRD pattern of the MoS₂ crystal which gives characteristic peaks, confirming the hexagonal structure (100) and (110) and sharp peak (002) with high intensity (d) TEM image of MoS₂-polyaniline nanocomposite (inset, high resolution image of MoS₂ matrix in between the nanocomposites clearly shows the fringes) and (e) Elemental composition from the EDS of the MoS₂-polyaniline nanocomposite. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

of the supported matrix which can also transduces the electrochemical signal significantly. When the analyte concentration was gone down to the 10^{-18} M, the electrode could not be able to detect properly due to unavailability of the analyte. The sensor was also not efficient above micromolar concentration range where the saturation took place. In the micromolar range, the electrode surface was fully covered up with the analyte DNA molecules. So, any further higher concentration (10^{-3} M taken) could not affect its delectability anymore. So, from Fig. 4(a), we can conclude that our sensing electrode can detect the analyte DNA concentration in the micro to femto molar range, maintaining a linear calibration curve, presented in Fig. 4(b). The sensitivity of the electrode is found to be 1.7 μA mM^{-1} cm^{-2} which is quite satisfactory with respect to other recently reported MoS₂ based biosensors [17,37,38]. To observe the stability of the sensor electrode, we have prepared and preserved several Pt||MoS₂-polyaniline/ssDNA electrodes in 4 °C and measured their sensing performances with 10^{-6} M target DNA over a period of 14 days. It is found from the Figure S1 that the electrode shows quite stable performance (only 32% decrease from its day 0 signals) even after 14 days of incubation. To attain the best optimized condition for the sensor, the sensing performances of the Pt||MoS₂-

polyaniline/ssDNA electrodes were studied with 10^{-9} M DNA on different pH. As expected, the performances are quite stable in the range of pH 4 to 9 because all of the reacting components of MoS₂-polyaniline and the DNAs are not altered too much their chemical properties in case of little changes of proton condition (Figure S2a). However, in case of extreme acidic (pH < 2) and basic (pH > 9) condition, the electrostatic interaction of DNAs on the MoS₂ matrixes interrupts largely, resulting lowering sensitivity. Similarly, temperature is also one of the important factors for the sensing application. As the MoS₂-polyaniline nanocomposites can slowly degrades above 50 °C, it is recommended to perform the test in the normal range of room temperature (up to 35 °C) (Figure S2b). In addition, to confirm the role of the polyaniline in the nanocomposites, another control experiment of bare Pt||MoS₂/ssDNA electrode was also carried out with the same target DNA in identical conditions shown in Fig. 4(c). Interaction between probe DNA and target DNA was manifested in regular decrease of electrochemical signal of MB from only ssDNA (highest) to single mismatched DNA (moderate) to completely matched DNA (lowest). DPV responses were noted for bare Pt||MoS₂/ssDNA electrode with 10^{-6} M concentration of target DNA (Fig. 4(c)) where the DNA got adsorbed on MoS₂ surface
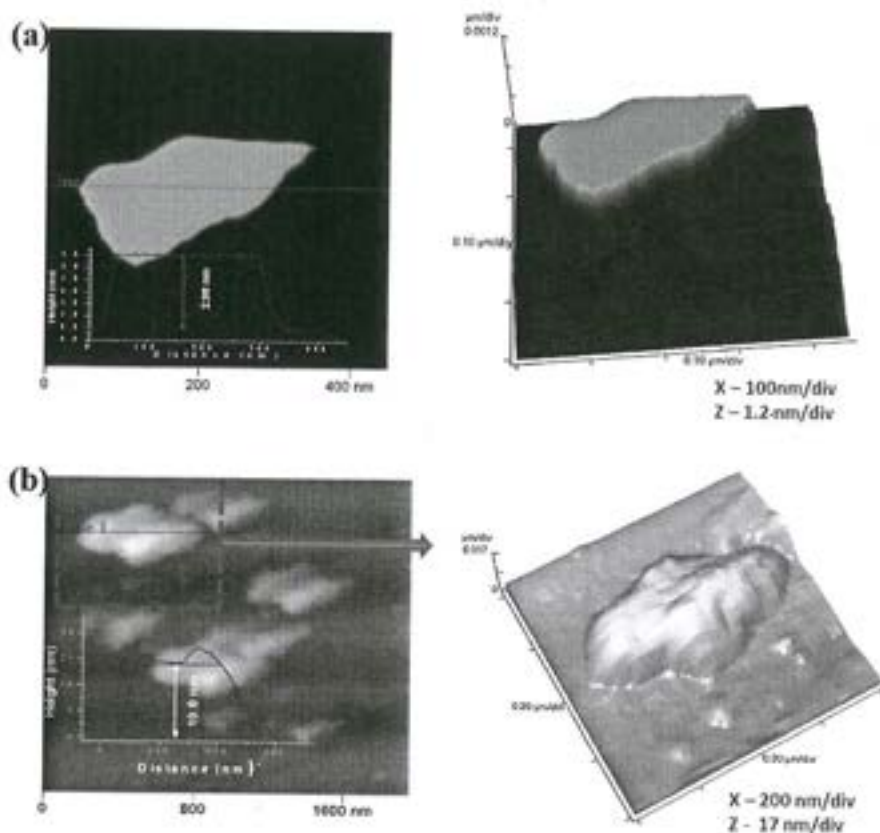
Fig. 2. AFM images of (a) MoS$_2$ nanosheet and (b) MoS$_2$-polyaniline nanocomposites with their corresponding height profile.
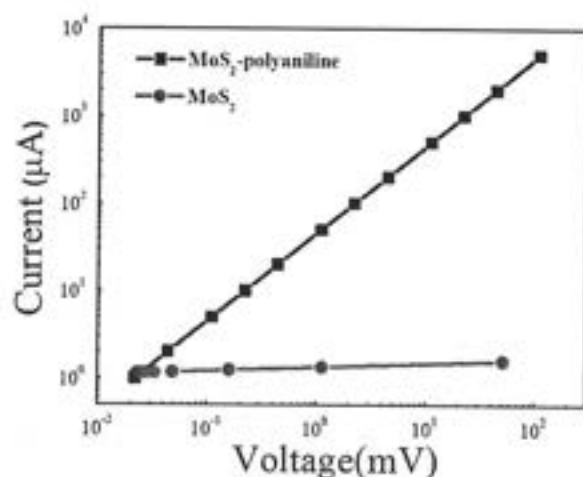
Fig. 3. I–V characteristics of MoS$_2$ nanosheet and comparison between MoS$_2$ and MoS$_2$-polyaniline nanocomposite of selected composition.

Table 1
Electrical conductivity and DPV response of MoS$_2$-Polyaniline nanocomposite at different composition:

Polyaniline:MoS$_2$	Electrical conductivity (S cm^{-1})	DPV signal after DNA and MB loading (µA)
30:70	0.085	38
40:60	0.168	51
50:50	0.86	61
60:40	1.19	63
70:30	1.94	54

due to its sheet like structure. However, being less conducting matrix, the peak intensity is very low in case of bare MoS$_2$ electrode (Fig. 4(c)). In case of small concentration differences or mismatch detection, these small intensity differences could be insufficient for detection. For completely matched target sequence (−9 µA) and for single base mismatched target DNA (−11 µA), the redox peaks are relatively closer. Thus, we cannot distinguish completely matched and mismatched peak clearly. In case of several positional mismatch identification discussed later, the bare MoS$_2$ platform will not be suitable. However, MoS$_2$-polyaniline nanocomposites are highly conducting in nature and the obtained peak intensities for Pt||MoS$_2$-polyaniline/ssDNA electrode are also very high in the similar situation (Fig. 4(d)), at about 68 µA for probe DNA, 31 µA for completely matched DNA and for mismatched DNA it is about 52 µA. This follows the obvious distinction of completely matched and mismatched peak as the range of redox current measured with MoS$_2$-polyaniline (about 30–70 µA) and as MoS$_2$ (about 8–13 µA). The hybridization of DNA was monitored by DPV using the redox properties of MB which was already explained in previous studies [5,39]. The lowering phenomenon of electrochemical response of MB with the formation of duplex can be understood from the nature of interaction of MB with ssDNA and dsDNA. MB is an organic dye belongs to the phenothiazine family. Generally, three kinds of binding modes including electrostatic, groove and intercalative binding takes place between MB and DNA [40,41]. Under the selected conditions, ssDNA had stronger binding ability due to mainly groove binding with MB than that of dsDNA [42]. From Fig. 4(c) and (d), it can be seen that the redox peak current decreased with the formation of dsDNA while incubated with target DNA. In case of mismatched target DNA, the duplex formation leads to the incomplete intercalation of MB that accounts for the increase of redox peak current compared to the completely matched target DNA.
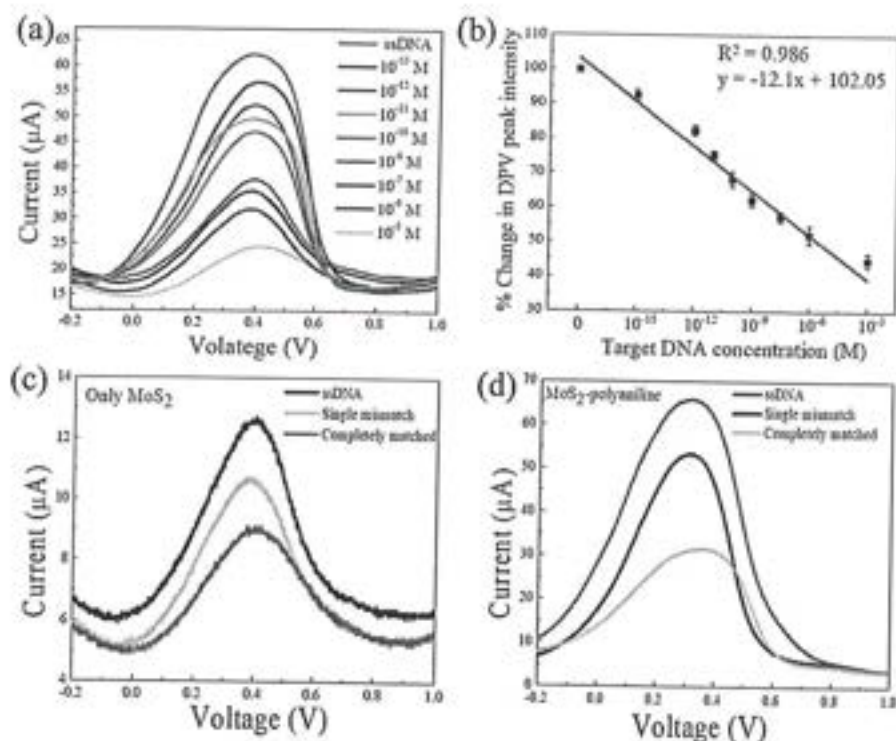
Fig. 4. DPV curves obtained for (a) Pt||MoS$_2$-polyaniline-ssDNA electrode with different target DNA concentration (b) Calibration curve of DNA detection in term of percentage change in DPV intensity with respect to target DNA concentration, (c) DNA detection of bare Pt||MoS$_2$-ssDNA electrode and (d) Pt||MoS$_2$-polyaniline-ssDNA electrode with 10^{-6} M of single mismatched and fully matched DNA.

3.5. Selectivity test of Pt||MoS$_2$-polyaniline-ssDNA in various interferrants

The selectivity in presence of common interferrants or matrixes is one of the most important parameters for sensing application. Therefore, we have studied a wide range of responses in DPV signals for the Pt||MoS$_2$-polyaniline-ssDNA electrode in only complex matrix like serum and other interferrants along with their sensitivity in presence of 10^{-9} M of target DNA, presented in Fig. 5. It is quite evident from the red bar diagram of Fig. 5 that all the matrixes of only DI water, 0.1 M non-complementary long calf-thymus DNA (ctDNA) containing DI water, human serum and 10^{-6} M poly A (dA) containing DI water (completely unmatched with probe DNA) showed negligible interference (less than 16% compared with the 100% DPV change in presence of target DNA). In addition, the sensitivity performances of the Pt||MoS$_2$-polyaniline-ssDNA electrode towards the fully complementary target DNA of 10^{-9} M concentration has been also monitored in presence of those mentioned matrixes to check their
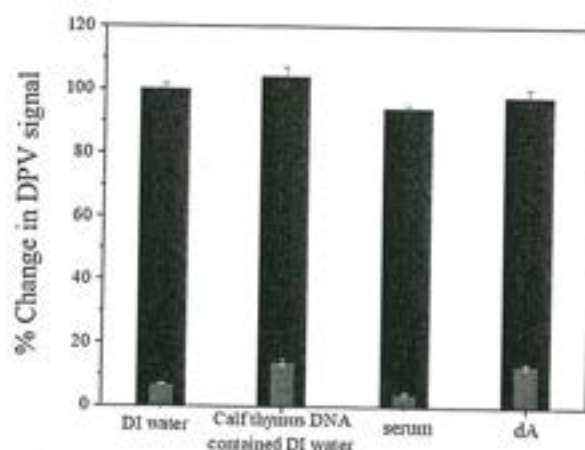
interfering role during the DNA sensing analysis, showed in blue bar diagram. Due to the electrostatic affinity of DNA's backbone on MoS$_2$ surface, the only ctDNA and dA has some DPV responses towards the Pt||MoS$_2$-polyaniline-ssDNA electrode. However, their slight responses could not significantly alter the sensing responses in case of target DNA analysis.

3.6. Mismatch detection

To make a correlation between the mismatch detection and the concentration dependent sensing output is little difficult as in both cases, the signal of DPV is decreased depending on the MB loading on the ssDNA strand. As presented in the scheme of Fig. 6(a), the MB loading is depended on the availability of single stranded formation of the sensor electrode. For the mismatched target DNA, the MB can bind on the mismatched duplex region largely even after incubation of target DNA, resulting relatively high amount of signal in DPV. This may be due to the adjacent effect of the nucleotides on the mismatched position. The single mismatch positioned in the middle of the duplexes forms a domain of single stranded DNA which vastly affects on the bonding of its adjacent nucleotides (Fig. 6 (c)). Though the adjacent 2–3 nucleotides are perfectly matched with the complementary one, however, the single mismatched nucleotides domain restricts them to form perfectly duplexes due to its adjacent position. As a results, 4–6 nucleotides region centered by the mismatched nucleotide forms a loosely bounded duplexes like single stranded DNA domain which is also corroborated from their melting point data, presented in Figure S3, supporting information. The boiling point of completely matched DNA of 40 mers shows 81.8 °C, calculated by its UV–vis melting point calculation whereas the single mismatched at 20th position (middle) of the same duplexes shows as low as 77.1 °C due to the adjacent effect. In case of 5th and 35th position (Fig. 6(b) and (d)), single mismatches are at identical distance from the 5′ and 3′ end with respect to the 40-mer target DNA. Here, the peak current decrease patterns are nearly same. This indicates the effect of a single mismatch on the stability of the duplex formation which is also reflected in the DPV results of DNA detection. In Fig. 6(e), the change in DPV signal is monitored with respect to the target DNA concentration in the range of femto to

Fig. 5. DPV response of the Pt||MoS$_2$-polyaniline-ssDNA electrode in variable matrix of DI water, in presence of calf thymus DNA, human serum and poly A containing DI water, in absence and presence of 10^{-9} M fully matched DNA concentration.
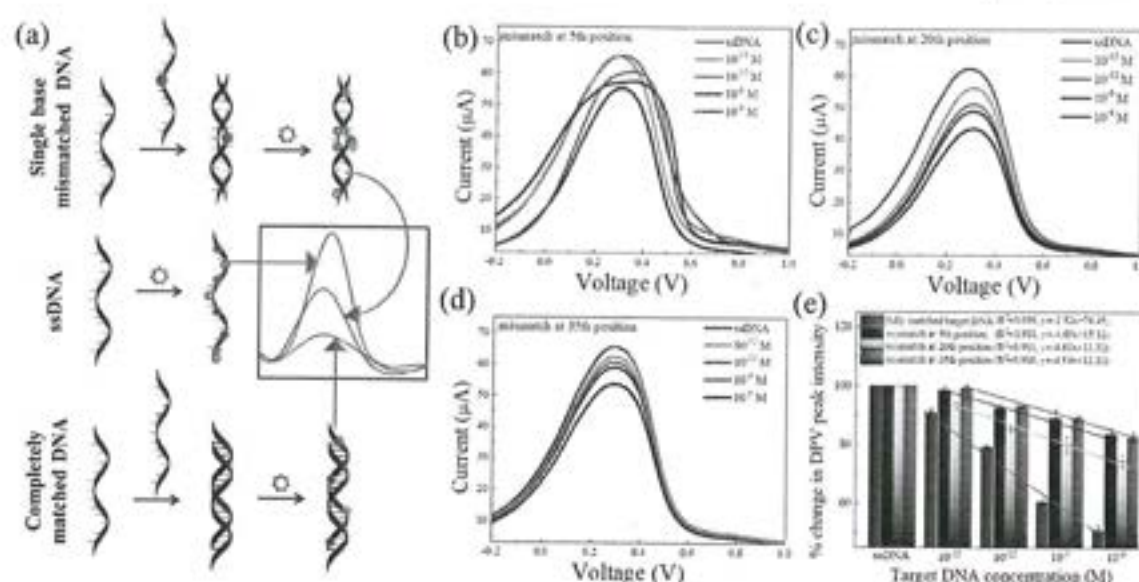
Fig. 6. (a) Schematic illustration of the DPV signal of Pt||MoS$_2$-polyaniline-ssDNA electrode with completely matched and single base mismatched DNA, DPV of Pt||MoS$_2$-polyaniline-ssDNA electrode with different concentration of single mismatched DNA at position of (b) 5th, (c) 20th and (d) 35th, (e) comparative bar diagram of percentage change of DPV signals with completely matched and three positional single mismatched target DNA in a concentration range of 10^{-15} to 10^{-6} M.

Table 2

Comparison of this MoS$_2$-Polyaniline sensor with recently published electrochemical DNA sensors:

Materials	Detection method	Method of fabrication	Detection range	Limit of detection	Response time	References
PEG[f]/AuNPs	EIS	Au-thiolated DNA	$10^{-15} - 10^{-9}$ M	1.72×10^{-13} M	–	[1]
PPy–PANi–Au	EIS	Au-thiolated DNA	10^{-15} -10^{-6} M	1×10^{-13}	–	[28]
NGS-HPCS[a]	Immunosensor	Antibody based sandwich assay	$10^{-13} - 10^{-9}$ g/mL	0.33×10^{-13} g/mL	–	[43]
MPA[b]/ssDNA	PCR	Au-thiolated DNA	$10^{-12} - 10^{-9}$g	14×10^{-9} M	–	[44]
PVP-GS[c]/thionin	Amperometric	Electrode fabrication with antibody	$10^{-13} - 10^{-9}$ g/mL	4.86×10^{-13} g/mL	10 sec	[45]
Gold electrode	EIS	Au-thiolated DNA /ferrocyanide	$10^{-15} - 10^{-9}$ M	0.05×10^{-9} M	–	[46]
MCN–TB[d]/GCE	SWV	Electrode fabrication with antibody	10^{-11} –10^{-6} g/mL	3.97×10^{-13} g/mL	–	[47]
GCE[e]/AuNP/ssDNA	DPV	Au-thiolated DNA	10^{-11}-10^{-9} M	1×10^{-12} M	40 min	[48]
G-Quadruplx DNAzyme	Absorbance	HRP-DNAzyme amplified	10^{-13} –10^{-6} M	0.1×10^{-12} M	–	[49]
AuNPs/PANI/CS-GS[g]	PCR-DPV	Au-thiolated DNA	$10^{-11} - 10^{-6}$ M	2.11×10^{-12} M	2 h	[50]
SLP-SENS[h]	Amperometric	Biotin-avidin	$10^{-13} - 10^{-3}$ M	0.1×10^{-12} M	–	[51]
GCE/Gr/DNA-c/AuNP	Amperometric	Au-thiolated DNA	$10^{-16} - 10^{-9}$ M	1×10^{-15} M	–	[52]
MoS$_2$-thionin	SWV	MoS$_2$-DNA interaction	$10^{-10} - 10^{-9}$ g /mL^{-1}	0.21×10^{-9} g/mL	–	[53]
Au/MNP-CNT[i]	Resistance	Au-thiolated DNA	10^{-11} -10^{-6} M	8.4×10^{-12} M	–	[54]
MoS$_2$-Polyaniline	DPV	MoS$_2$-DNA immobilization	$10^{-15} - 10^{-6}$ M	10^{-15} M	8 min	This work

[a] N-doped graphene- hydroxypropyl chitosan.
[b] 3-mercaptopropionic acid.
[c] Polyvinylpyrrolidone-graphene.
[d] Mesoporous carbon nanospheres-toluidine blue.
[e] glassy carbon electrode.
[f] poly ethelene glycol.
[g] gold nanoparticles/polyaniline/chitosan/graphene sheets.
[h] stem loop probe-sensor.
[i] magnetic nanoparticle-carbon nanotube.

micromolar. Though the signal responses over this concentration range are not significantly decreased, the calibration lines can be found with flattered slopes for all three cases. In addition, two different linear relationships are found for the concentration variation as well as mismatch detection, presented in Fig. 6(e). If we know the concentration of the analytes, then we can trigger the sensor for the detection of mismatch for target DNA and can assume the position of the mismatch. The comparative bar diagram of percentage change of DPV signal in a concentration range of 10^{-15} to 10^{-6} M shows the decreasing trend of completely matched and three different positional single mismatched target DNA with significant change in slopes. This present study can be an initial step in the field of positional mismatch detection. The ability of finding positional effect in very short chained oligonucleotides has been focused here by the electrochemical process. As an extension of

the present work, the effect of chain length and identity of the mismatched bases at a particular position is being studied in future.

From these given data of the electrochemical plot, we can conclude that the bare MoS$_2$ platform can bind the DNA or oligonucleotide sequences via adsorption on its surface but fail to build an efficient electrochemical sensor due to its poor conductivity. To overcome this limitation, the successful blend of the MoS$_2$-polyaniline platform at a perfect composition of 40:60 is used here for electrochemical biosensing which can admirably detect not only the oligomers or DNA concentration in femtomolar range but also can perfectly recognize any mismatch in known concentration of target DNA. Comparing with recently published electrochemical DNA sensors, as mentioned in Table 2, the present work has a wide linear range of linear detection (10^{-15} to 10^{-6} M) with femtomolar detection limit. Moreover, the DNA

entrapment process is solely depended on the availability of the only MoS$_2$ surface which makes the system label free as well as easy fabricated process compared to others labeled or thiolated modified DNA sensors. In spite of its easy fabrication on the sensor electrode, it can able to recognize any positional mismatch in targeted DNA which can be applied for DNA mutation detection in future.

4. Conclusion

The electrochemical DNA detection method, presented in this report, has led to high-resolution recognition and detection of target DNA sequences. Not only the DNA detection, it will also detect the mismatch in the target DNA strand of a single DNA base mismatch which could be the primary step of mismatch identification in DNA. Compared to the harsh chemical methods, an easy and hazardless method of immobilization was implemented and at the same time the technique appeared to be simple but versatile for biomolecular detection and quantification as the component modifies the electrode surface itself rather than the biomolecules. A thin-layer MoS$_2$ nanosheet was prepared via a standard route of chemical synthesis method which is simpler and no distortion compared with mechanical cleavage. After that, to enhance the electrical or electrochemical property which is very a crucial requirement for the electrochemical DNA sensing, the MoS$_2$ was incorporated with polyaniline. Based on the high electrochemical activity and different affinity toward ssDNA versus dsDNA of the redox indicator methylene blue (MB), DPV metric analysis can be performed in the range of 10^{-15} M to 10^{-6} M of target DNA without any labeling or use of amplifiers. In brief, the novelty of this present work is based on its easy fabrication route using MoS$_2$-Polyaniline for labeled or pretreatment free electrochemical DNA sensing with positional mismatch detecting ability with enhanced performances in terms of low LOD (femtomolar), wide concentration range of detection (10^{-6} to 10^{-15} M) and fast response time (8 min). In addition, the detection method implemented in serum samples here not only expands the application of MoS$_2$, but also offers a viable alternative for DNA analysis, which has the priority in sensitivity, simplicity, and cost effectiveness.

Acknowledgements

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.bej.2018.09.016.

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Strong lensing and observables around 5D Myers–Perry black hole spacetime

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We study the motion of massless test particles in a five-dimensional (5D) Myers–Perry black hole spacetime with two-spin parameters. The behavior of the effective potential in view of different values of black hole parameters is discussed in the equatorial plane. The frequency shift of photons is calculated which is found to depend on the spin parameter of black hole and the observed redshift is discussed accordingly. The deflection angle and the strong deflection limit coefficients are also calculated and their behavior with the spin parameters is analyzed in detail. It is observed that the behaviors of both deflection angle and strong field coefficient differs from Kerr black hole spacetime in four dimensions in General Relativity (GR), which is mainly due to the presence of two-spin parameters in higher dimension.

Keywords: 5D Myers–Perry black hole; null geodesics; cone of avoidance; frequency shift.

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1. Introduction

The black holes (BHs) in Einstein's General Relativity (GR) are one of the most strangest and mysterious objects in the universe.[1–4] The most general spherically symmetric, vacuum solution of the Einstein field equations in GR is the well-known

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Schwarzschild BH spacetime[5,6] in four dimensions. The study of Schwarzschild BH solution and its applications to the solar system is one of the accurate tests to verify the predictions made by GR. Further, a static solution to the Einstein–Maxwell field equations, which corresponds to the gravitational field of a charged, non-rotating, spherically symmetric body is the Reissner–Nordström spacetime.[5,6] The rotating generalization of the Schwarzschild BH spacetime is Kerr BH spacetime in GR while the spacetime geometry in the region surrounded by a charged rotating BH is represented by the Kerr–Newman BH spacetime as a solution of Einstein–Maxwell equations in GR.[7,8]

The GR which has revolutionized our understanding of the universe as a whole is now more than 100 years old and the recent advancements in understanding the gravitational collapse and nature of BH solutions in diversified scenario are remarkable.[9–12]

The deflection of light ray in a gravitational field is one of the crucial predictions of GR and the gravitational lensing is an important phenomena resulting due to the bending of light in the gravitational field of a massive object while passing close to that object. The strong gravitational lensing is caused by a compact objects like BHs with a photon sphere has distinctive features. It is worth mentioning that when the photons pass close to the photon sphere, the deflection angles become so large that an observer would detect two infinite sets of faint relativistic images on each side of the BH, which are produced by photons that make complete loops around the BH before reaching the observer. These relativistic images may therefore provide us not only some important signatures about BHs in the universe, but might also be helpful in verification of the alternative theories of gravity in their strong field regime. The gravitational lensing in weak field approximation studies the properties of galaxies and stars, but when BH is treated as a lens, it is no longer valid and the strong field limit is needed which is referred to as a strong deflection limit. Thus, it acts as a powerful indicator of the physical nature of the central celestial objects and then has been used to study in various theories of gravity. The study of the strong field limit lensing due to different BHs have received considerable attention in recent years.[13–19] The development of lensing theory in the strong-field regime started with the study of gravitational lensing due to a Schwarzschild BH spacetime[13,14] and it is also shown that a supermassive BH like at the center of our Galaxy may be a suitable lens candidate.[14]

In recent years, various interesting BH solutions in higher spacetime dimensions, especially in five dimensions,[20] have been the subject of intensive research, motivated by various ideas in brane-world cosmology, string theory and gauge/gravity duality.[21] It is worth to note that the uniqueness theorem does not hold in higher dimensions due to the fact that there are more degrees of freedom as compared to the usual four dimensions in GR. However, the discovery of black-ring solutions in five dimensions asserts that the nontrivial topologies are allowed in higher dimensions.[22] In particular, the Myers–Perry black hole (MPBH) spacetime[23] is a

higher-dimensional generalization of the four-dimensional (4D) Kerr BH spacetime in GR. The study of geodesic structure of massless particles in a given BH spacetime is one of the important ways to understand the gravitational field around a BH spacetime. The geodesic motion around various BH spacetimes in a variety of contexts (for time-like as well as null geodesics), both in GR and in alternating theories of gravity, is widely studied time and again.[24-53] The motion of both massive and massless particles in Myers–Perry[54] and Myers–Perry anti-de Sitter BH spacetime[56] with equal rotation parameters has been studied in detail. Further, the complete set of analytical solutions of the geodesic equations in the general 5D Myers–Perry spacetime in terms of the Weierstrass function, for the case of two independent angular momenta, have been derived and discussed in Ref. 55. Diemer *et al.* also studied massive as well as massless test particles in the general 5D MPBH spacetime.[53-55] The main objective of this paper is to study the strong lensing in a 5D MPBH spacetime. We have calculated the deflection angle and other strong lensing parameters by using Bozza's method and the variation of deflection angle with spin parameter is investigated. We have used the units that fix the speed of light and the gravitational constant via $8\pi G = c^4 = 1$.

The paper is organized as follows. In Sec. 2, the first integral of the geodesic equations and the effective potential in 5D MPBH spacetime are discussed. We have discussed the optical properties like frequency shift and the cone of avoidance from the null geodesics in Sec. 3. The gravitational lensing aspects in the strong field limit are then discussed in detail in Sec. 4. Finally, the results obtained are summarized in Sec. 5.

2. Equations of Motion in 5D MPBH Spacetime

To study the geodesics and strong lensing in 5D rotating MPBH spacetime background, we begin with the following metric of MPBH spacetime in the Boyer–Lindquist coordinates[20]:

$$ds^2 = \frac{\rho^2}{4\Delta} dx^2 + \rho^2 \, d\theta^2 - dt^2 + (x + a^2)\sin^2\theta \, d\phi^2 + (x + b^2)\cos^2\theta \, d\psi^2$$

$$+ \frac{2m}{\rho^2}[dt + a\sin^2\theta \, d\phi + b\cos^2\theta \, d\psi]^2, \tag{1}$$

with ρ^2 and Δ are defined as

$$\rho^2 = x + a^2 \cos^2\theta + b^2 \sin^2\theta, \tag{2}$$

$$\Delta = (x + a^2)(x + b^2) - 2mx. \tag{3}$$

The metric (1) is singular when $\Delta = g_{rr} = 0$ and $\rho^2 = 0$. Here a and b are two-spin parameters, and ϕ and ψ are angles bounded by the limit $0 \leq \phi \leq 2\pi$ and $0 \leq \psi \leq \pi/2$. Following Ref. 57, we use the coordinate $x = r^2$ instead of the radius r in order to simplify the calculations. It is worth noticing here that the metric (1)

reduces to 5D Tangherlini solution[15] for $a = b = 0$. For the horizon structure of MPBH spacetime with $\Delta = 0$, we obtain

$$x_{\pm} = \frac{1}{2}\left[2m - (a^2 + b^2) \pm \sqrt{[2m - (a^2 + b^2)]^2 - 4a^2b^2}\right].$$

Here, x_+ and x_- denote the outer horizon and the inner horizon, respectively. The metric (1) describes non-extremal BH for $x_+ > x_-$ and when $x_+ = x_-$, one can obtain an extremal BH spacetime. The horizon exists when $a^2 + b^2 < 2m$ and $[2m - (a^2 + b^2)]^2 \geq 4a^2b^2$. For the metric (1)

$$\sqrt{-g} = \frac{1}{2}\sin\theta\cos\theta\,\rho^2.$$

To study the geodesic structure of the 5D rotating MPBH, we begin with the Lagrangian which reads

$$L = \frac{1}{2}g_{\mu\nu}\dot{x}^{\mu}\dot{x}^{\nu}, \tag{4}$$

where an overdot denotes the partial derivative with respect to an affine parameter. Therefore, the momenta calculated for the metric (1) are

$$p_t = \left(-1 + \frac{r_0^2}{\rho^2}\right)\dot{t} + \frac{r_0^2}{\rho^2}\dot{\phi} + \frac{r_0^2 b\cos^2\theta}{\rho^2}\dot{\psi},$$

$$p_{\phi} = \frac{r_0^2 a\sin^2\theta}{\rho^2}\dot{t} + \left(x + a^2 + \frac{r_0^2 a^2\sin^2\theta}{\rho^2}\right)\sin^2\theta\,\dot{\phi} + \frac{r_0^2 ab\sin^2\theta\cos^2\theta}{\rho^2}\dot{\psi},$$

$$p_{\psi} = \frac{r_0^2 b\cos^2\theta}{\rho^2}\dot{t} + \frac{r_0^2 ab\sin^2\theta\cos^2\theta}{\rho^2}\dot{\phi} + \left(x + b^2 + \frac{r_0^2 b^2\cos^2\theta}{\rho^2}\right)\cos^2\theta\,\dot{\psi}, \tag{5}$$

$$p_x = \frac{\rho^2}{4\Delta}\dot{x},$$

$$p_{\theta} = \rho^2\dot{\theta},$$

where $p_t = -E$, $p_{\phi} = L_{\phi}$ and $p_{\psi} = L_{\psi}$ correspond to energy and angular momentum with respect to the respective rotation axis, respectively.

Now, considering the case for the equatorial plane, i.e. $\theta = \pi/2$, which results in the conserved quantity along ψ direction, i.e. $L_{\psi} = 0$. Henceforth, we will be using $L_{\phi} = L$ in our calculation. Thus, the metric (1) in the equatorial plane reads as

$$ds^2 = -A(x)dt^2 + B(x)dx^2 + C(x)d\phi^2 - D(x)dt\,d\phi, \tag{6}$$

where the metric coefficients are described as follows:

$$A(x) = \left(1 - \frac{2m}{\rho^2}\right), \tag{7}$$

$$B(x) = \frac{\rho^2}{4\Delta}, \tag{8}$$

Fig. 1.   Variation of effective potential with radius (a) at different values of spin parameter a for a fixed value of spin parameter ($b = 0.1$) and (b) at different values of spin parameter b for a fixed value of spin parameter ($a = 0.1$). Here, $E = 1$ and $L = 3$.

$$C(x) = x + a^2 + \frac{2ma^2}{\rho^2}, \tag{9}$$

$$D(x) = \frac{-4ma}{\rho^2}. \tag{10}$$

The first integral of geodesic equations may then be expressed in terms of the above-mentioned metric coefficients,[16] in the following form:

$$\dot{t} = \frac{4C(x)E - 2D(x)L}{4A(x)C(x) + D(x)^2}, \tag{11}$$

$$\dot{x} = \pm 2\sqrt{\frac{C(x)E^2 - D(x)EL - A(x)L^2}{B(4A(x)C(x) + D(x)^2)}}, \tag{12}$$

$$\dot{\phi} = \frac{2D(x)E + 4A(x)L}{4A(x)C(x) + D(x)^2}. \tag{13}$$

For null geodesics, $\dot{x}$ from Eq. (12) can be reconstructed as

$$\dot{x}^2 + V_{\text{eff}} = 0, \tag{14}$$

which gives,

$$
\begin{aligned}
V_{\text{eff}} &= -4\left[\frac{C(x)E^2 - D(x)EL - A(x)L^2}{B(x)(4A(x)C(x) + D(x)^2)}\right] \\
&= \frac{1}{x + b^2}(-4E^2(2ma^2 + x^2 + xb^2 + a^2x + a^2b^2) \\
&\quad - 16maEL + 4L^2(x + b^2 - 2m)).
\end{aligned} \tag{15}
$$

The general behavior of effective potential as a function of x for different values of rotation parameter is presented in Fig. 1. In particular, Fig. 1(b) represents the variation of potential with the spin parameter b for fixed value of a ($= 0.1$) while

Fig. 1(a) represents the variation of the potential with spin parameter a for fixed value of b ($=0.1$). The effective potential shows a maxima which corresponds to an unstable circular orbit. It is also observed that with the increase in the value of parameter b, the maximum of the effective potential is shifting towards the left (see Fig. 1(b)), i.e. the circular orbits also shift towards the central object accordingly whereas with the increase in the value of spin parameters a at fixed b, the peak is shifting towards the right (see Fig. 1(a)), which signifies the shifting of circular orbit away from the central object.

3. Observables for Photons

In order to discuss the optical properties in 5D MPBH spacetime, the frequency shift and cone of avoidance are discussed below.

3.1. Frequency shift

The angular frequency associated with photons in a circular geodesic is one of the meaningful physical quantities. The angular frequency relative to a distant observer for unequal spin parameters is defined as follows:

$$\Omega = \frac{d\phi}{dt}. \tag{16}$$

Thus, using Eqs. (11) and (13), the angular frequency given by Eq. (16) can be calculated as follows:

$$\Omega = \frac{(x + b^2 - 2m)d - 2ma}{(x^2 + (a^2 + b^2 - 2m)x + a^2b^2 + 2ma)d + 2mx + 2ma^2}, \tag{17}$$

where $d = L/E$. The frequency shift may however be expressed as

$$g = \frac{k_\mu u_o^\mu}{k_\mu u_e^\mu}, \tag{18}$$

where k_μ are the covariant components of the photon four-momentum and u_o^μ (u_e^μ, respectively) are the contravariant components of the four-velocity of the observer (emitter). In case of static distant observer, the four-velocity reads $u_o = (1, 0, 0, 0, 0)$ and in the case of emitter the four-velocity reads as $u_e = (u_e^t, 0, 0, u_e^\phi, 0)$. The frequency shift then acquires the following form:

$$g = \frac{1}{u_e^t(1 - d\Omega)}. \tag{19}$$

The temporal component of the emitter four-velocity can be obtained from the norm of the four-velocity

$$u_e^t = \left[1 - \frac{2m}{\rho^2} - \left(x + a^2 + \frac{2ma^2}{\rho^2}\right)\Omega^2\right]^{-1/2}, \tag{20}$$
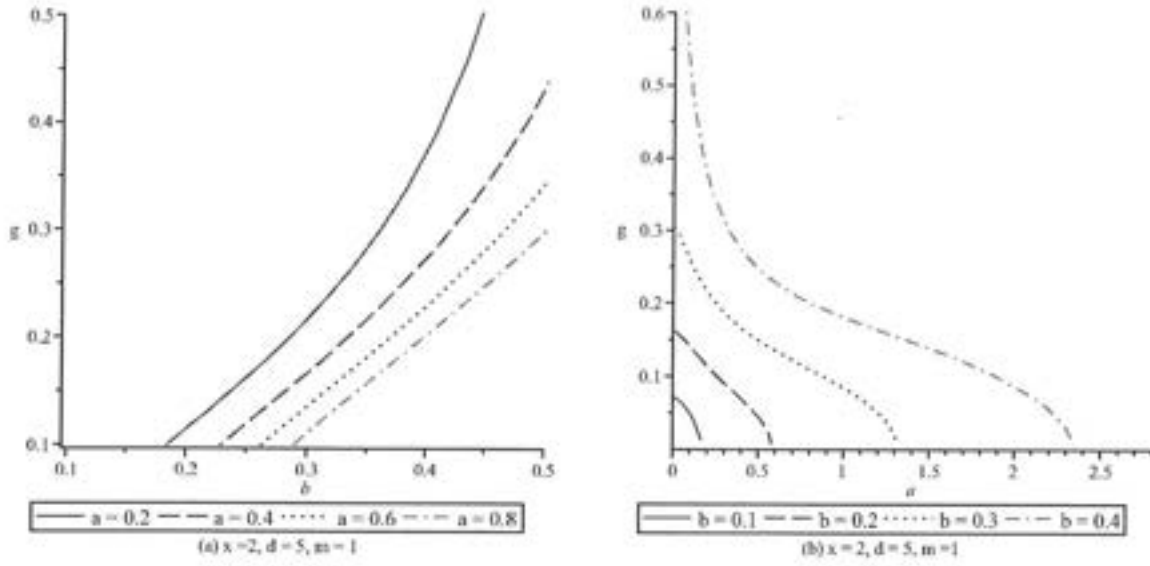
Fig. 2. Variation of frequency shift: (a) with spin parameter b for different values of spin parameter a and (b) variation of frequency shift with spin parameter a for different values of spin parameter b.

such that the expression for frequency shift now reads as

$$
g = \frac{\left[1 - \frac{2m}{\rho^2} - \left(x + a^2 + \frac{2ma^2}{\rho^2}\right)\Omega^2\right]^{1/2}}{1 - d\Omega}. \tag{21}
$$

Here, by considering the value of a in between 0 and 1, one automatically has a range for b (from the expressions $a^2 + b^2 < 2m$ and $[2m - (a^2 + b^2)]^2 \geq 4a^2 b^2$) with $m = 1$ as, $-0.4 \geq b \geq 0.4$ or $-2.412 \geq b \geq 2.412$. The behavior of the frequency shift for different values of different spin parameters is illustrated in Figs. 2–4. In particular, in Fig. 2, we have presented the frequency shift for different values of spin parameter a and b while keeping the other parameter constant, respectively. Figure 2(a) shows the variation of frequency shift with spin parameter b at different values of spin parameter a, whereas Fig. 2(b) shows the variation of frequency shift with a at different values of b. As the frequency shift increases, the observed frequency of the photon decreases, which in turn gives an equivalent increase in the corresponding wavelength of the photon. Hence, for the increasing frequency shifts, the photons get redshifted. One may note that the stronger the gravitational field of a source, the larger the energy loss of an incoming photon, and also larger the observed redshift.

From Fig. 2, it can also be observed that for a particular value of parameter a, the redshift for photons around a MPBH spacetime increases with an increase in the value of spin parameter b while it decreases with an increase in the value of parameter a. It therefore signifies the strength of gravitational field which depends strongly on both the parameters at a fixed value of x. In Figs. 3 and 4, the variation of frequency shift with x for different values of spin parameters a and b is shown, respectively. It is also observed that for a particular value of spin parameter b,

For the radial trajectories of the observer in equatorial plane, i.e. $\chi = \pi/2$, $\tanh q = \frac{D(x)}{2\sqrt{G}}$. However, for $\chi = \pi/4$, the relation $\sinh q = \frac{D(x)}{\sqrt{2G}} \cosh q$ holds and therefore the observer's velocity vector u takes the following form:

$$u = \sqrt{\frac{-C(x)}{G}} \cosh q\,, \qquad \partial_t + \frac{D(x)}{2\sqrt{-B(x)G}} \cosh q\, \partial_x \tag{40}$$

and from the condition of velocity vector field one can easily obtain $\cosh q = \frac{\sqrt{G}}{\sqrt{A(x)C(x) - \frac{D(x)^2}{4}}}$. Thus, the expression (29) now reads as

$$\tan \psi = \frac{1}{\sqrt{G\left(A(x)C(x) - \frac{D^2(x)}{4}\right)}} \times \frac{G_t D(x) - \left(\sqrt{\frac{WC(x)}{G}} - L\right)G}{\left(\sqrt{\frac{WC(x)}{G}} + L\right)}\,, \tag{41}$$

which clearly indicates that the angle ψ depends on the two parameters of the null geodesics, i.e. E and L.

4. Strong Field Lensing by 5D MPBH Spacetime

In this section, we investigate the strong field lensing by a 5D MPBH spacetime given by Eq. (1) for the case where both the observer and the source lie in the equatorial plane, i.e. $\theta = \pi/2$.[16,17] The impact parameter is related to the minimum distance reached by the photon. In general, a light ray coming from infinity approaches the BH, reaches the minimum distance and then leaves again towards infinity. Using the geodesic equations, we find an implicit relation between angular momentum and the closest approach distance. Here, for simplicity, we are considering $E = 1$, and at the minimum distance (say x_0) of photon trajectory (where $V_{\text{eff}} = 0$), we have[16]

$$L = \frac{-D(x_0) + \sqrt{4A(x_0)C(x_0) + D(x_0)^2(x)}}{2A(x_0)}$$

$$= \frac{2ma - \rho\sqrt{x_0\rho^2 + a^2\rho^2 - 2mx_0}}{2m - \rho^2}\,. \tag{42}$$

Now, following Ref. 17, the condition for the radius of photon sphere is

$$A(x_p)C'(x_p) - A'(x_p)C(x_p) + L(x_p)(A'(x_p)D(x_p) - A(x_p)D'(x_p)) = 0\,. \tag{43}$$

Thus, the equation for the radius of photon sphere takes the following form:

$$x_p^4 + (-8m + 4b^2)x_p^3 + (6b^4 - 20mb^2 + 16m^2 - 8ma^2)x_p^2$$

$$- (16mb^4 - 4b^6 - 16b^2m^2 + 16b^2ma^2)x_p$$

$$+ b^8 - 8b^4ma^2 - b^6m + 4b^4m^2 = 0\,. \tag{44}$$

In the limit $a = 0$ and $b = 0$, the radius of the photon sphere comes out as $x_p = 4m$, i.e. the radius of photon sphere for the Tangherlini spacetime.[19] The radius of the

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PAYMENT METHODS AND SECURITY OF MOBILE COMMERCE

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ABSTRACT

Mobile E-commerce is the new E-commerce in this era of digitization. Mobile E-commerce applications are still in the growing phase due to the limitations in the development of new and secure payment methods. This paper explains the safe methods of payments in mobile E-commerce from the society's point of view and the security challenges lying in front of us to fight with.

Internet e-commerce and mobile e-commerce are the branches of the same tree. Data integrity, Data confidentiality, non-repudiation of transactions, and the authentication and authorization; these are the basic features it needs. The basic needs of mobile e-commerce cannot be met by the existing cable network security technology, due to the special nature of wireless transmission. A number of researches and implementation of new security technology has become the need of the hour because of stimulated market demands.

Business-to-business and business-to-customer experiences have been simplified and smoothed by new technologies such as mobile payments, e-wallets, and contactless cards. As the online payment processing market grows, growth is led in multiple directions because of user demands of additional payment options and features.

It is a huge challenge in front of developers and suppliers to provide payment methods beyond traditional banking methods. It is still a huge task for a growing country like India to form a cashless society which can make transactions without any fear and limitations. This demands new technological interventions and throws a challenge to developers, providers, and users to create a safe and smooth cashless payment environment.

KEYWORDS: *Mobile E-Commerce, Data Integrity, Non-Repudiation, E-Wallets*

INTRODUCTION

No longer a theoretical concept but a development entity, Mobile E-Commerce will grow into a substantial dynamism of the forthcoming profitable progress. Because of the many new things of similar nature emerging at the same time, people consider this as a process. The wireless communication techniques and the Internet together act as the backbone of Mobile E-Commerce. After the user has availed the services provided by Mobile E-Commerce, how to ensure they pay through a secure and safe medium and it becomes a win-win situation for the payment organizing agencies also, this is the major concern to be looked upon. It is an imperative problem to the market to come up with the new feasible and secure payment methods for Mobile E-Commerce in the times of everyday changing technology.

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DATA SECURITY IN THE DIGITAL ERA: ISSUES AND CHALLENGES

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ABSTRACT

Data plays a critical aspect in our daily routine, whether it is for getting access to the bank account or it is for paying the bill over the network. At present, in the digitalization era, personal information vulnerabilities have increased so far. So security becomes a crucial part of any online transaction. This information can keep private by various security measures, including strong authentication, encryption and digital signatures; each ensuring that valuable information is available only to those who have authorized access rights. These security measures are very capable to prevent unauthorized access of personal data. There are two major concerns for both e-commerce customers and websites one is Privacy which means the control over one's own data and other is Security which prevents unauthorized access to the data over the network. Clients will lose their faith towards e-commerce if their valuable data is compromised at any level. Today due to its global nature, E-Commerce sites are accessed by anyone at anywhere. As customers increase, the risk has also increased in such a way that we need to considered security as a major challenge. This paper would throw light on E-commerce security, its purpose, different security issues and challenges and the way they affect trust and behavior of a customer within the environment of purchasing or buying the product.

KEYWORDS: E-Commerce, Authentication, Encryption, Digital Signature, Privacy, Security.

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Introduction

E-Commerce or electronic commerce is broadly considered as buying and selling the goods and services over the network. It includes a significant business area such as shopping, banking, tickets booking, paying bills and taxes, food delivery and much more other option available. E-commerce is subdivided into three categories: business to business or B2B (Cisco), consumer to consumer or C2C (eBay) and business to consumer or B2C (Amazon). E-commerce Security is a part of the Information Security framework and it includes Data security, Computer Security, and other wider areas of the information system framework. Web e-commerce applications that take care of payments such as electronic transactions using credit cards or debit cards, online banking, PayPal or other tokens have more compliance issues. Mule, Trojan horse and worms pose the greatest threat to e-commerce privacy and security because if they launched against client systems, they can threaten most of the authorization and authentication mechanisms used in an ecommerce transaction. To influence consumer behavior trust is an important element and has high significance toward merchants in internet-based environments. Therefore in E-commerce transactions trust would be favorably influenced by an increase in perceptions of security and privacy.

Purpose of Study

The purpose behind this study is:

- To understand the process behind online shopping.
- To deal with the purpose of security in e-commerce.
- To discuss the different security issues which are faced during e-commerce transactions

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A new fractional exothermic reactions model having constant heat source in porous media with power, exponential and Mittag-Leffler laws

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ABSTRACT

The present article deals with the exothermic reactions model having constant heat source in the porous media with strong memory effects. The Caputo, Caputo-Fabrizio and Atangana-Baleanu fractional operators are used to induce memory effects in the mathematical modeling of exothermic reactions. The patterns of heat flow profiles are very essential for heat transfer in every kind of the thermal insulation. In the present investigation, we focus on the driving force problem due to the fact that temperature gradient is assumed. The mathematical equation of the problem is confined in a fractional energy balance equation (FEBE), which furnishes the temperature portrayal in conduction state having uniform heat source on steady state. The fractional Laplace decomposition technique is utilized to obtain the numerical solution of the corresponding FEBE describing the exothermic reactions. Some numerical results for the fractional exothermic reactions model are presented through graphs and tables.

1. Introduction

A chemical or a physical reaction that provides energy in the configuration of light and heat is known as an exothermic reaction (ER). The ER supplies net energy to its backgrounds. Thus, the energy desired to activate the reaction is not as much as the energy is discharged after completing the reaction. The energy is acquired from chemical bonds. It is well known that when bonds are composed, energy is freed and at the time bonds are decomposed, energy is required. Each kind of bonds has fixed bond energy. It is to be observed that whether the physical and chemical reactions would give heat by making use of the bond energies. If higher energy is generated to compose the bonds in comparison to utilization of energy to decompose the bonds, then the heat is given away in this process. This process is well known as an exothermic reaction. On the other hand, if in a reaction, energy is required, then it is termed as an endothermic reaction. We know that the calculation of absolute amount of energy in a system is very difficult. On the other hand the calculation of enthalpy change ΔE in a chemical reaction is very much straightforward. The enthalpy change is

equivalent to the sum of the variation in inner energy of the structure and the work desired to alter the volume of the structure in the presence of fixed ambient pressure. A bomb calorimeter is very appropriate for estimating the energy change ΔE, of a combustion reaction. The estimated and computed ΔE values are associated with bond energies and is presented as

ΔE = The energy utilized in breaking bond in reactions – The energy given away in forming bond in manufacturing products.

In view of concept of the ER the enthalpy change has a negative value i.e. $\Delta E < 0$ in an ER. In order to illustrate, we take a reaction that if hydrogen burns:

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

and $\Delta E = -483.6$ KJ/mol of O_2.

As we know that most of the hand warmers are based on the concept of the oxidation of iron to attain an ER:

$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(g).$$

Convection is an event happened in numerous physical and chemical problems, which is the outcome of the flow of air in the neighborhood of the surfaces of the liquids or solids such as the airflow in double glazing doors of display refrigerators, the airflow in

double pane windows and the airflow in gaps or cavities of building walls. In order to interpret this process, many scientist and engineers have paid their attention to examine this event to augment the mode of heat transfer. In nowadays convection has earned great attention in numerous regions due to its wide applicability such as atmospheric dynamics, katabatic winds, atmospheric fronts, solar collectors, free ventilation, cooling of electronic apparatus, dense gas dispersion, nuclear reactors, insulation with double pane window, solar energy conversion and ground water contaminant transport. In a study, Beck [1] examined the convective flow of a fluid through a rectangular box made of porous material that was heated from below. An excellent work based on Rayleigh-Bernard-type convection and convective instabilities that arise due to the ER model via a porous media was presented by several authors [2–5]. In this sequence, many scientists and engineers paid their attention to examine the non-uniform flow of convective motion that is created with the aid of the heat sources [6–8]. The 2 and 3-D problems of free convection between distinct kinds of porous media have been analyzed [9–13]. Mabood and Poachai [14] applied the optimal homotopy asymptotic technique to obtain the solution of ER model having fixed heat source in porous media. Sharma et al. [15] used the homotopy analysis transform technique to acquire the approximate solution of ER model having fixed heat source in porous media. In recent years, it has been observed that the mathematical models of integer order do not narrate the natural phenomena in better manner due to local property of integer order derivatives [16–21]. In a recent work the Caputo–Fabrizio (CF) fractional operator [22] involving the exponential function is introduced to remove the trouble of the singularity of kernel. It is very important to mention that, the CF fractional operator contains non-singular kernel [23–25]. They have applied the CF fractional operator and shown that this operator is very suitable to examine physical problems. Singh et al. [26] applied the concept of CF fractional derivatives to the giving up smoking dynamics. They conducted numerical simulations to demonstrate the stability and convergence of the solution of the model. Firoozjaee et al. [27] employed the CF fractional operator to modify the Fokker–Planck equation. The numerical approach based on the Ritz scheme with known basis functions is used obtain the solution of fractional Fokker–Planck equation. Recently, in 2018, Atanacković et al. [28] presented the properties of the CF operator of fractional order and its distributional settings. Though, some matters were also pointed out against the CF fractional operator, such as its kernel was non-singular but it behaves as integer order operator. In addition to it, the associated integral of CF fractional operator was not of a fractional order. To overcome all these shortcomings and drawbacks of CF fractional operator, a fractional operator namely Atangana-Baleanu (AB) fractional derivative was proposed by Atangana and Baleanu [29] involving the Mittag-Leffler type function. The theory of AB fractional derivative to a long-wave equation is employed by Kumar et al. [30] and demonstrated the existence and uniqueness of the solution of the fractional long-wave model. Singh [31] presented the fractional rumor spreading dynamical model to interpret the spreading of rumor. He obtained the numerical solution of the model by making use of the homotopy analysis transform algorithm. Owolabi [32] presented the numerical patterns in reaction–diffusion problem involving both of the CF and AB derivatives of fractional order. For more details of fractional derivatives having non-singular kernel and their applications one can see the work by many more research workers [33–38].

Motivated by ongoing investigations on fractional derivatives having non-singular kernels, the present paper aims to use the efficiency of Caputo, AB and CF fractional derivatives together to ER

model having fixed heat source in the porous media. The present work uses the fractional Laplace decomposition method (FLDM) to obtain the numerical results for the fractional ER model having invariable heat source in the porous media. The FLDM is a mixing of Adomian's decomposition scheme [39,40] and Laplace transform technique [41,42], which is one of the most powerful and convenient scheme for determining the numerical solutions of nonlinear problems of fractional order. The results obtained by making use of the FLDM are compared with the results obtained by using FDM [5] and HATM [15], which asserts the authenticity and accuracy of the suggested technique.

2. Mathematical modeling with memory effects

We assume a homogeneous model to portray convection directed by an ER. In the case of a porous medium wall thickness $(0 < z' < L)$ is concentrated. The usual supposition in the equation of continuity and equation momentum in the steady-state energy balance display a dimensionless form of a two point boundary value problem (TPBVP) to describe the temperature profile [5,13]:

$$\frac{d^2\psi_0}{dz^2} + \alpha\varepsilon^2\left(1 - \frac{\psi_0}{\alpha}\right)\exp\left(\frac{\beta\psi_0}{\beta + \psi_0}\right) = 0. \tag{1}$$

In the Eq. (1) ψ_0 indicates the temperature, α stands for the maximum feasible temperature in the non-existence of free convection, ε^2 denotes the ratio of the characteristic time for diffusion of heat generator and β stands for the non-dimensional activation energy. If we assume the invariable heat source, then the TPBVP (1) can be presented as

$$\frac{d^2\psi_0}{dz^2} + \alpha\varepsilon^2\left(1 - \frac{\psi_0}{\alpha}\right) = 0, \tag{2}$$

along with the boundary conditions (BCs)

$$\frac{d\psi_0}{dz} = 0, \quad at\ z = 0$$

$$\psi_0 = 0, \quad at\ z = 1. \tag{3}$$

The integer order derivatives are nonlocal in nature so mathematical model (2) does not contain the full memory of the systems. It is well proven that derivatives having arbitrary order such as Caupto, CF and AB fractional derivatives are nonlocal in nature and very useful in mathematical modeling of natural and engineering processes, so to include full memory effects and describe the physical system in better and accurate manner, we suggest the fractional extensions of mathematical model (2) by using Caupto, CF and AB fractional derivatives.

2.1. Fractional exothermic reactions model with power law and its solution

In this section we consider a fractional exothermic reactions model by using Caputo fractional derivative. To formulate the fractional exothermic reactions model having fixed heat source in the porous media with memory effect, we replace ordinary derivative with respect to z by Caputo fractional operator of order μ, the Eq. (2) reduces in the following form:

$$_0^C D_z^{\mu+1}\psi_0 + \alpha\varepsilon^2\left(1 - \frac{\psi_0}{\alpha}\right) = 0, 0 < \mu \leqslant 1. \tag{4}$$

with the BCs

$$\frac{d\psi_0}{dz} = 0, \quad at\ z = 0$$

$$\psi_0 = 0, \qquad at \ z = 1. \tag{5}$$

In Eq. (4) ${}^C_0 D_z^{\mu+1} \psi_0$ indicates the well known Caputo fractional derivative [17] of the function $\psi_0(z)$ defined as:

$$^C D_0^\mu \psi_0(z) == \frac{1}{\Gamma(n-\mu)} \int_0^z (z-\tau)^{n-\mu-1} \psi_0^{(n)}(\tau) d\tau, \tag{6}$$

for $n-1 < \mu \leqslant n, z > 0$.

To examine the fractional exothermic reactions model (4), we apply the FLDM. The process of FLDM is as follows:

Step I: Apply the Laplace transform on Eq. (4), it yields

$$L[\psi_0] = \frac{a}{p} - \alpha \varepsilon^2 \left(\frac{1}{p^{\mu+2}}\right) + \varepsilon^2 \left(\frac{1}{p^{\mu+1}}\right) L[\psi_0]. \tag{7}$$

where $a = \psi_0(0)$.

Step II: On applying the inversion of Laplace transform on Eq. (7), we get

$$\psi_0(z) = a - \alpha \varepsilon^2 \frac{z^{\mu+1}}{\Gamma(\mu+2)} + \varepsilon^2 L^{-1}\left[\left(\frac{1}{p^{\mu+1}}\right) L[\psi_0]\right]. \tag{8}$$

Step-III: We write the solution as an infinite series in the following form

$$\psi_0(z) = \sum_{m=0}^\infty \psi_{0,m}(z). \tag{9}$$

Step-IV: On using Eq. (9) in Eq. (8), we have

$$\sum_{m=0}^\infty \psi_{0,m}(z) = a - \alpha \varepsilon^2 \frac{z^{\mu+1}}{\Gamma(\mu+2)}$$
$$+ \varepsilon^2 L^{-1}\left[\left(\frac{1}{p^{\mu+1}}\right) L\left[\sum_{m=0}^\infty \psi_{0,m}(z)\right]\right]. \tag{10}$$

Step-IV: On making use of the FLDM process, we get

$$\psi_{0,0}(z) = a - \alpha \varepsilon^2 \frac{z^{\mu+1}}{\Gamma(\mu+2)}, \tag{11}$$

$$\psi_{0,1}(z) = \varepsilon^2 L^{-1}\left[\left(\frac{1}{p^{\mu+1}}(L(\psi_{0,0}))\right)\right], \tag{12}$$

$$\vdots$$

$$\psi_{0,m}(z) = \varepsilon^2 L^{-1}\left[\left(\frac{1}{p^{\mu+1}}(L(\psi_{0,m-1}))\right)\right]. \tag{13}$$

Finally, the FLDM series solution of fractional model (4) is expressed as

$$\psi_0(z) = \psi_{0,1}(z) + \psi_{0,2}(z) + \psi_{0,3}(z) + \cdots. \tag{14}$$

2.2. Fractional exothermic reactions model with exponential law and its solution

To develop the fractional exothermic reactions model having fixed heat source in the porous media with strong memory effect, we replace ordinary derivative with respect to z by CF fractional operator of order ρ, the Eq. (2) takes the following form:

$$^{CF}_0 D_z^{\rho+1} \psi_0 + \alpha \varepsilon^2 \left(1 - \frac{\psi_0}{\alpha}\right) = 0. \tag{15}$$

with the BCs

$$\frac{d\psi_0}{dz} = 0, \quad at \ z = 0$$

$$\psi_0 = 0, \qquad at \ z = 1. \tag{16}$$

In Eq. (15) ${}^{CF}_0 D_z^{\rho+1} \psi_0$ indicates the CF fractional operator [22] of the function $\psi_0(z)$ defined as:

$$^{CF}_0 D_z^\rho (\psi_0(z)) = \frac{M(\rho)}{1-\rho} \int_0^z \psi_0'(s) \exp\left[-\rho \frac{z-s}{1-\rho}\right] ds. \tag{17}$$

In Eq. (17) $M(\rho)$ stands for a normalization of the function holding the result $M(0) = 1 = M(1)$.

To solve the fractional exothermic reactions model (15), we use the FLDM.

Step I: On applying the Laplace transform to Eq. (15), it gives

$$L[\psi_0] = \frac{a}{p} - \alpha \varepsilon^2 \left(\frac{p + \rho(1-p)}{p^3}\right) + \varepsilon^2 \left(\frac{p + \rho(1-p)}{p^2}\right) L[\psi_0]. \tag{18}$$

where $a = \psi_0(0)$.

Step II: On applying the inversion of Laplace transform to Eq. (18), we have

$$\psi_0(z) = a - \alpha \varepsilon^2 \left((1-\rho)z + \frac{\rho z^2}{2}\right)$$
$$+ \varepsilon^2 L^{-1}\left[\left(\frac{p + \rho(1-p)}{p^2}\right) L[\psi_0]\right]. \tag{19}$$

Step-III: We express the solution as an infinite series in the following form

$$\psi_0(z) = \sum_{m=0}^\infty \psi_{0,m}(z). \tag{20}$$

Step-IV: On using Eq. (20) in Eq. (19), we have

$$\sum_{m=0}^\infty \psi_{0,m}(z) = a - \alpha \varepsilon^2 L^{-1}\left((1-\rho)z + \frac{\rho z^2}{2}\right)$$
$$+ \varepsilon^2 L^{-1}\left[\left(\frac{p + \rho(1-p)}{p^2}\right) L\left[\sum_{m=0}^\infty \psi_{0,m}(z)\right]\right]. \tag{21}$$

Step-IV: On using the FLDM process, we get

$$\psi_{0,0}(z) = a - \alpha \varepsilon^2 \left((1-\rho)z + \frac{\rho z^2}{2}\right), \tag{22}$$

$$\psi_{0,1}(z) = \varepsilon^2 L^{-1}\left[\left(\frac{p + \rho(1-p)}{p^2} L(\psi_{0,0})\right)\right], \tag{23}$$

$$\vdots$$

$$\psi_{0,m}(z) = \varepsilon^2 L^{-1}\left[\left(\frac{p + \rho(1-p)}{p^2} L(\psi_{0,m-1})\right)\right]. \tag{24}$$

Table 1
Comparison of temperature $\psi_0(z)$ obtained by FDM [5] and HATM [15] and FLDM for $\varepsilon^2 = 0.5$, $z = 12$ and $\mu = 1$.

z	FDM [5]	HATM [15]	FLDM
0.0	2.4804	2.480661817	2.480661817
0.1	2.4566	2.456853554	2.456853554
0.2	2.3851	2.385309674	2.385309674
0.3	2.2655	2.265672308	2.265672308
0.4	2.0972	2.097343021	2.097343021
0.5	1.8793	1.879479815	1.879479814
0.6	1.6109	1.610992918	1.610992919
0.7	1.2904	1.290539342	1.290539342
0.8	0.9164	0.9165161446	0.9165161446
0.9	0.4870	0.4870524345	0.4870524344
1.0	0.0000	0.0000000000	0.0000000000

Table 2

Comparison of temperature $\psi_0(z)$ obtained via integer order, Caputo, CF and AB fractional derivatives for $\varepsilon^2 = 1$ and $\alpha = 10$.

z	Integer order derivative ($\mu = 1$)	Caputo fractional derivative ($\mu = 0.98$)	CF fractional derivative ($\rho = 0.98$)	AB fractional derivative ($\sigma = 0.98$)
0.0	3.51945727	3.569556762	3.584107691	3.632834257
0.1	3.487027546	3.535233640	3.539757531	3.586737389
0.2	3.389413803	3.433791322	3.431893082	3.475229109
0.3	3.225639092	3.265210635	3.259328193	3.298048610
0.4	2.994064300	3.028290512	3.020239125	3.053795877
0.5	2.692371748	2.720968764	2.712145356	2.740238316
0.6	2.317541998	2.340384200	2.331883940	2.354367256
0.7	1.865823626	1.882883681	1.875577049	1.892401335
0.8	1.332695683	1.344004535	1.338592505	1.349766139
0.9	0.7128224402	0.7184412956	0.7154967692	0.7210587191
1.0	0.000000000	0.000000000	0.0000000000	0.000000000
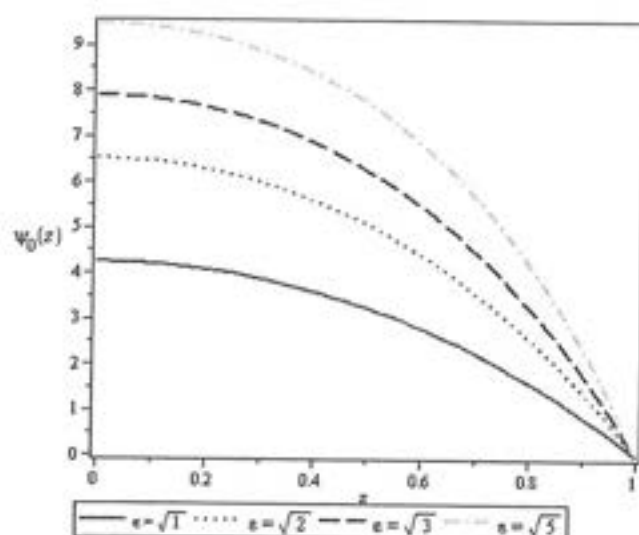
Fig. 1. Plots of temperature $\psi_0(z)$ with respect to z at $\alpha = 12$ and $\mu = 1$ for various values of ε.
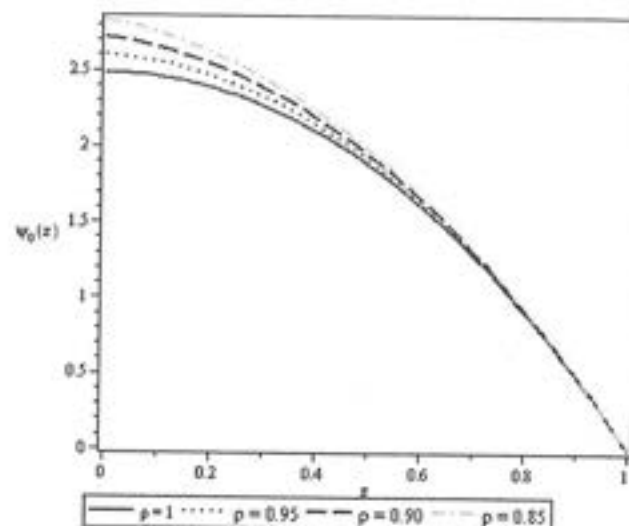
Fig. 3. Plots of temperature $\psi_0(z)$ with respect to z at $\alpha = 12$ and $\varepsilon^2 = 0.5$ for different order of CF fractional derivative.
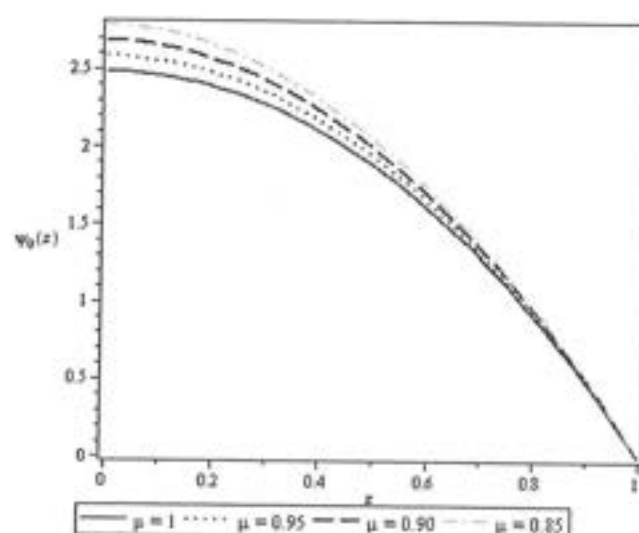
Fig. 2. Plots of temperature $\psi_0(z)$ with respect to z at $\alpha = 12$ and $\varepsilon^2 = 0.5$ for different order of classical Caputo fractional derivative.
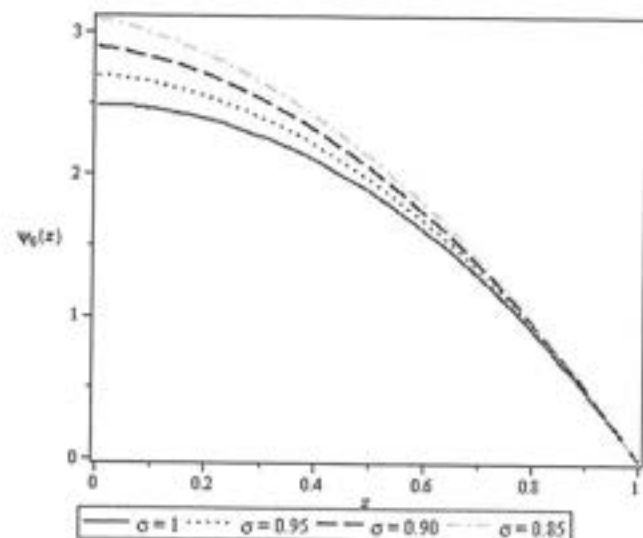
Fig. 4. Plots of temperature $\psi_0(z)$ with respect to z at $\alpha = 12$ and $\varepsilon^2 = 0.5$ for different order of AB fractional derivative.

Finally, the FLDM series solution of fractional model is expressed as

$$\psi_0(z) = \psi_{0.1}(z) + \psi_{0.2}(z) + \psi_{0.3}(z) + \cdots.$$

Fractional exothermic reactions model with Mittag-Leffler law and ...tion

In this section we suggest a Fractional exothermic reactions model by using AB fractional derivative. To develop the fractional exothermic reactions model having fixed heat source in the porous media with very strong memory effect, we replace ordinary deriva-

tive with respect to z by AB fractional operator of order σ, the Eq. (2) takes the following form:

$$_0^{AB}D_z^{\sigma+1}\psi_0 + \alpha\varepsilon^2\left(1 - \frac{\psi_0}{\alpha}\right) = 0. \tag{26}$$

with the BCs

$$\frac{d\psi_0}{dz} = 0, \qquad at\ z = 0$$
$$\psi_0 = 0, \qquad at\ z = 1. \tag{27}$$

In Eq. (26) $_0^{AB}D_z^{\sigma+1}\psi_0$ indicates the AB fractional operator [29] of the function $\psi_0(z)$ defined as:

$$_0^{ABC}D_t^{\sigma}(\psi_0(z)) = \frac{B(\sigma)}{1-\sigma}\int_0^z \psi_0'(s)E_\sigma\left[-\frac{\sigma}{1-\sigma}(z-s)^\sigma\right]ds, \tag{28}$$

In Eq. (28) $B(\sigma)$ stands for a normalization of the function holding the result $B(0) = 1 = B(1)$.

To solve the fractional exothermic reactions model (26), we use the FLDM.

Step I: Apply the Laplace transform on Eq. (26), it gives

$$L[\psi_0] = \frac{a}{p} - \alpha\varepsilon^2\left(\frac{p^\sigma + \sigma(1-p^\sigma)}{p^{\sigma+2}}\right) + \varepsilon^2\left(\frac{p^\sigma + \sigma(1-p^\sigma)}{p^{\sigma+1}}\right)L[\psi_0], \tag{29}$$

where $a = \psi_0(0)$.

Step II: On applying the inversion of Laplace transform on Eq. (29), we get

$$\psi_0(z) = a - \alpha\varepsilon^2\left((1-\sigma)z + \frac{\sigma z^{\sigma+1}}{\Gamma(\sigma+2)}\right)$$
$$+ \varepsilon^2 L^{-1}\left[\left(\frac{p^\sigma + \sigma(1-p^\sigma)}{p^{\sigma-1}}\right)L[\psi_0]\right]. \tag{30}$$

Step-III: We express the solution as an infinite series in the following form

$$\psi_0(z) = \sum_{m=0}^{\infty} \psi_{0,m}(z). \tag{31}$$

Step-IV: On using Eq. (31) in Eq. (30), we have

$$\sum_{m=0}^{\infty}\psi_{0,m}(z) = a - \alpha\varepsilon^2\left((1-\sigma)z + \frac{\sigma z^{\sigma+1}}{\Gamma(\sigma+2)}\right)$$
$$+ \varepsilon^2 L^{-1}\left[\left(\frac{p^\sigma + \sigma(1-p^\sigma)}{p^{\sigma+1}}\right)L\left[\sum_{m=0}^{\infty}\psi_{0,m}(z)\right]\right]. \tag{32}$$

Step-IV: On using the FLDM process, we get

$$\psi_{0,0}(z) = a - \alpha\varepsilon^2\left((1-\sigma)z + \frac{\sigma z^{\sigma+1}}{\Gamma(\sigma+2)}\right). \tag{33}$$

$$\psi_{0,1}(z) = \varepsilon^2 L^{-1}\left[\left(\frac{p^\sigma + \sigma(1-p^\sigma)}{p^{\sigma+1}}(L(\psi_{0,0}))\right)\right]. \tag{34}$$

$$\vdots$$

$$\psi_{0,m}(z) = \varepsilon^2 L^{-1}\left[\left(\frac{p^\sigma + \sigma(1-p^\sigma)}{p^{\sigma+1}}(L(\psi_{0,m-1}))\right)\right]. \tag{35}$$

Finally, the FLDM series solution of fractional model expressed as

$$\psi_0(z) = \psi_{0,1}(z) + \psi_{0,2}(z) + \psi_{0,3}(z) + \cdots.$$

3. Results and discussion

The numerical results for the ER model having fixed source of heat in the porous media involving Caputo, CF and AB fractional

derivative are obtained by using FLDM for distinct values of variables and parameters are presented in Tables 1–2 and Figs. 1–4. In view of Table 1, it can be noticed that the results computed with the aid of FLDM are in a great compatibility with the solutions derived with the aid of FDM [5] and HATM [15]. The Table 2 presents the comparison of integer order, Caputo, CF and AB fractional derivatives. In Fig. 1, the influence of ε at $\alpha = 12$ and $\mu = 1$ on the temperature profile is shown. It can be noticed from Fig. 1, if we increase the value of ε, then it leads the enhancement in temperature profile. In Fig. 2, the influence of order of Caputo fractional operator at $\alpha = 12$ and $\varepsilon^2 = 0.5$ on the temperature profile is shown. It can be seen from Fig. 2 that, if we decrease the order of Caputo fractional derivative, then it leads the enhancement in temperature profile. In Fig. 3, the impact of order of CF fractional operator at $\alpha = 12$ and $\varepsilon^2 = 0.5$ on the temperature profile is presented. It can be seen from Fig. 3 that, if we decrease the order of CF fractional operator, then it leads the enhancement in temperature profile. In Fig. 4, the effect of order of AB fractional operator at $\alpha = 12$ and $\varepsilon^2 = 0.5$ on the temperature profile is demonstrated. It can be observed from Fig. 4 that, if we decrease the order of AB fractional operator, then it leads the enhancement in temperature profile.

4. Concluding remarks and observations

In this article, a comparative analysis has been carried out for the ER model having fixed source of heat in the porous media via Caputo, CF and AB theories. The FLDM and symbolic computation have been utilized to simulate the numerical solution of the FEBE. The results derived with the aid of the present scheme are in a great compatibility with the other available results obtained by using analytical and numerical schemes. The order of Caputo, CF and AB derivative put significant influence on temperature profile. The results reveal that the suggested mathematical models by using Caputo, CF and AB fractional derivatives gives interesting and useful consequences and FLDM is a very efficient and computationally attractive scheme to examine such type of problems.

Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijheatmasstransfer.2019.04.094.

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STUDY OF MIXING BEHAVIOR OF Cu-Sn-Se PRECURSORS USING ANNEALING PROCESS TO PREPARE Cu_2SnSe_3 THIN FILMS

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Cu_2SnSe_3, a ternary semiconductor has emerged as a suitable material for photovoltaic application and can be used as a precursor for $Cu_2ZnSnSe_4$ thin films. This paper reports the study of mixing behavior of Cu-Sn-Se precursor thin films. These thin films were grown by employing RF sputtering and thermal evaporation methods by maintaining substrate temperature at 100°C. These were further annealed in Vacuum for 30 minutes at 200°C and 500°C. The structure of as-deposited and annealed stacked layer of constituents Cu, Sn and Se is analyzed by X-ray diffraction technique which revealed that the as-deposited and annealed sample possess secondary phases along with formation of Cu_2SnSe_3. AFM results confirmed that sample annealed at 500°C revealed better surface having higher smoothness. The variation in electrical properties of the various thin films has been reported.

1. Introduction

Ternary compounds $A_2^IB_{IV}C_{3VI}$ are of significant interest because of low band-gap, having low melting points 1). A lot of studies on the thin films of ternary semiconductor compound Cu_2SnSe_3 (CTSe) have been reported by various workers. This is due to the wide applicability of this compound in the fields like photovoltaic solar cells, opto-electronic devices etc.2). Important factors which have been investigated are optical band gap, radiation tolerance, absorption coefficient (from solar cell point of view) and price of large-scale production 1). A study of crystal structure refinement of this compound by Delgado et al shows that CTSe has unit cell parameters of a=6.9670Å, b=12.0493 Å, c=6.9453 Å crystallizing in the monoclinic space group Cc (C_s^4, No. 9) having Z=4 4). CTSe exhibits diamond structure with low thermal conductivity and high specific heat 5). Thin films of CTSe have been developed by using various deposition techniques like RF-DC sputtering method 6, 7), thermal evaporation method 8) etc. Marcano et al studied the crystal growth and structure of CTSe prepared by vertical Bridgman–Stockbarger technique and obtained the chemical composition in 2:1:3 ratios having the monoclinic structure with Cc space group. They have observed a secondary phase of $SnSe_2$ due to a eutectic reaction 9). Kang et al studied the effect of growth temperature on the CTSe thin films prepared by using thermal evaporation method and observed that at 400°C single phase CTSe structure was attained. Growth temperature was varied between 325°–425°C for which the band gap was varying from 0.84 to 2.1 eV.10).

Zeguo et al studied the formation of secondary phases like $Cu_{2-x}Se$ and SnSe in CTSe thin films. It was concluded that the increment in Cu/Sn ratio caused increment in $Cu_{2-x}Se$ phase. Higher carrier concentration was attributed to the formation of $Cu_{3-x}Se$ phase 11). Naji et al studied the influence of annealing temperature and thickness on the physical properties of CTSe thin films. Grain size was found to be increased with increasing the thickness, which decreased on increasing the annealing temperature 12). This work presents the preparation of Cu-Sn-Se precursor in the form of CTSe thin films employing RF sputtering and thermal evaporation method. During deposition ratio of elemental precursors was controlled to obtain the desired stoichiometry at a constant temperature of 100°C.

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2. Experimental

Stacked layers containing Cu-Sn-Se were grown on Si-wafer and Soda lime glass substrates by means of RF sputtering and thermal evaporation methods. The substrates were immersed firstly in acetone and ultrasonically cleaned for 10 minutes. Afterward the substrates were kept in hot bath for 10 minutes and then were cleaned by using DI water. Thin films of Cu of thickness 127.4 nm was fabricated by RF sputtering method with maintaining the base pressure of the chamber 1.73×10^{-5} mbar using Argon as sputtering gas with flow rate of 15.0 sccm. The sputtering power was 70 watt during the deposition of Cu and deposition rate was 1.2 Å/sec at substrate temperature of 100°C. Then the samples were cooled to room temperature in vacuum and shifted to thermal evaporation set- up where Sn and Se were deposited by employing the thermal-evaporation method (Model BC-300 HHV). The chamber was evacuated to the pressure of 1.5×10^{-5} mbar. The deposition rate for Sn (109.6 nm) was 0.9 Å/sec while for Se (236.9 nm) it was 9.2 Å/sec while the substrate temperature was again maintained at 100°C. To obtain the uniform deposition the substrate plate was rotated at constant rate of 10 rpm throughout the deposition process. These as-deposited stacked layer of thin films were annealed in vacuum (Cast n' Vac 1000 (Buehler)) at two different temperatures of 200°C and 500°C with holding time of 30 minutes and heating rate of 10°C/min.

3. Results

3.1. XRD data analysis

X-ray diffraction data analysis was carried out using X'pert Pro X-ray Diffractometer model XPERT-PRO, with CuK$_{\alpha}$ radiation (1.540598Å) in the range of 2Θ degree from 20.0150° to 89.9750° in the steps of 0.03° with a counting time of 0.7s. Working voltage and acceleration current were 45kV and 40mA, respectively.

XRD pattern of as-deposited stack of elemental precursor of Cu, Sn and Se is presented in Fig. 1. Five main peaks at 2Θ=27.15°, 37.12°, 40.16°, 43.79° and 55.99° corresponding to d-spacing values of 3.2819Å, 2.4198Å, 2.2438Å, 2.0657Å and 1.6412Å were observed and attributed to the (20-2), (025), (31-2), (224)and (40-4) planes belonging to Cu$_2$SnSe$_3$.13) However, appearance of peak at (110) is due to Se with d- spacing of 1.9107 Å.14).
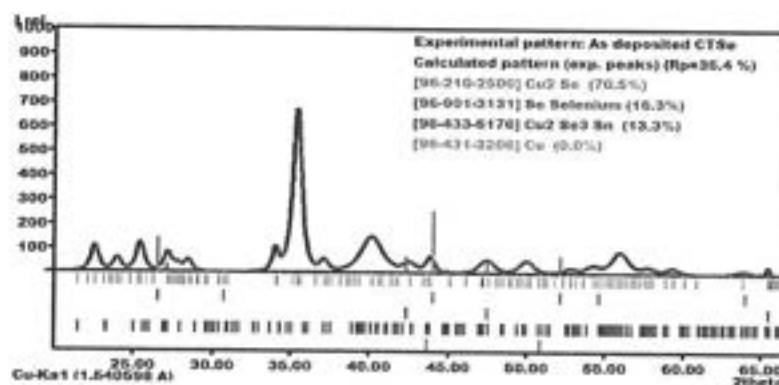
Fig.1. XRD pattern of as –deposited stacked layers of Cu-Sn-Se.

Cu$_2$SnSe$_3$ is formed of 13.3% in the as deposited stacked layers containing Cu-Sn-Se. Some other phases like Cu$_2$Se, Cu and Se are also formed during the deposition of stacked layers. Se is founded in the as- deposited sample in 16.3%. Cu$_2$SnSe$_3$ is found in monoclinic structure in the as-deposited sample while Cu$_2$Se is found in cubic structure. It is observed from the XRD analysis that Cu$_2$Se phase is found in maximum percentage of 70.5 % in the as- deposited sample.

Table 1 lists the unit cell dimensions and other structural information studied from the XRD curve plotted above.

Table1. Structural parameters of as-deposited stacked layers of Cu-Sn-Se.

Empirical formula	Crystal system	Space Group	Unit Cell dimension (Å)	I/I_c	$c/2a$	Density gm/cm³	Wyckoff positions			
								X	Y	Z
Cu	Cubic	F m -3 m	a= 3.591	11.88	0.5	9.112	Cu	0.00	0.000	0.000
Se	Trigonal	R-3 m	a= 3.829 c= 2.790	10.29	0.36	11.100	Se	0.000	0.000	0.000
Cu_2Se	Cubic	F 2 3	a= 5.816	9.25	0.5	7.084	Cu	0.33	0.33	0.33
							Cu	0.67	0.67	0.67
							Se	0.00	0.00	0.00
Cu_2SnSe_3	Monoclinic	C1 c 1	a= 6.971 b= 12.078 c= 13.393 (β=99.96°)	6.563	0.96	5.770	Cu	0.23	0.082	0.006
							Cu	0.74	0.086	0.005
							Sn	0.25	0.250	0.00
							Se	0.05	0.425	-0.051
							Se	0.04	0.082	0.058
							Se	0.30	0.2540	0.190

XRD pattern of annealed stacked layers of Cu-Sn-Se at 200°C has been shown in fig. 2. It can be profound from the study of XRD pattern that the sample annealed at 200° C exhibited various phases like Cu_2SnSe_3, SnSe, Se, Cu_3Se_2, Cu_2Se and $Cu_5Sn_2Se_7$. Peaks at 26.37° and 43.31° belongs to $Cu_{2.0}Se$ with hkl parameters (111) and (200) and d- spacing of 3.3771Å and 2.0874Å respectively. 15) A minor peak at 21.51° corresponds to SnSe with hkl plane of (021) 16). The most intense peak found at 35.59° belongs to $Cu_5Sn_2Se_7$ phase with d- spacing of 2.5208Å.17)

It could be shown that annealing of the as deposited stacked layers at 200° C reduced the amount of the phase of Cu_2SnSe_3 as comparing to the as deposited precurors. The dominating phase in the annealed stacked layer at 200° C is SnSe with 24.2 %.

Structural properties including the wyckoff positions of atoms of the phases present in annealed sample at 200°C have been presented in Table 2.
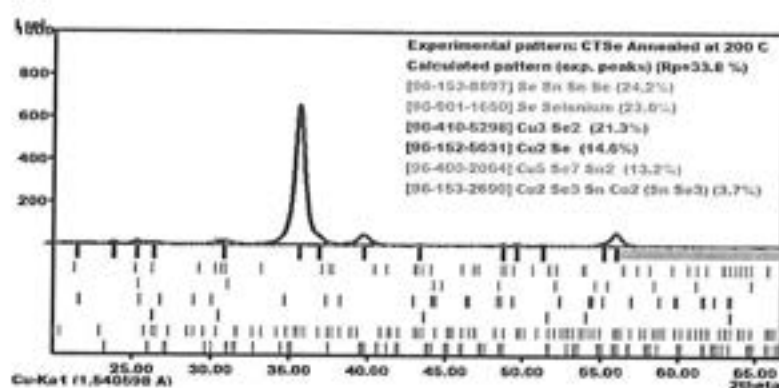
Fig. 2. XRD pattern of stacked layer of Cu-Sn-Se annealed at 200° C.

Table 2. Structural parameters of stacked layers of Cu-Sn-Se annealed at 200° C.

Empirical formula	Crystal system	Space Group	Unit Cell dimension (Å)	I/Ic	c/2a	Density gm/cm³		Wyckoff positions		
								X	Y	Z
SnSe	Orthorhombic	P n m a	a=11.570 b= 4.190 c = 4.460	9.35	0.192	6.072	Sn Se	0.855 0.118	0.250 0.250	0.479 0.103
Se	Trigonal	P 3121 (152)	a= 4.052 c= 5.038	9.90	0.624	5.491	Se Cu	0.237 0.370	0.000 0.418	0.333 0.116
Cu₂SnSe₃	Monoclinic	C 1 c 1	a= 6.967 b= 12.049 c= 6.945 β= 109.19°	6.45	0.498	5.822	Cu Sn Se Se Se	0.371 0.363 0.503 -0.026 0.000	0.257 0.091 0.259 0.078 0.409	0.616 0.107 -0.014 -0.015 0.00
Cu₃Se₂	Tetragonal	P- 4 2 1 m	a= 6.60 c= 4.102	3.96	0.310	6.362	Cu Cu Se	0.00 0.353 0.199	0.00 0.853 0.699	0.00 0.250 0.676
Cu₂Se	Cubic	F m- 3 m	a= 5.8707	6.49	0.5	6.764	Cu Se	0.30 0.00	0.30 0.00	0.308 0.00
Cu₅Sn₂Se₇	Monoclinic	C 1 2 1	a= 12.65 b= 5.664 c= 8.931 β= 98.125°	6.59	0.3530	5.807	Cu Cu Cu Sn Se Se	0.00 0.144 0.712 0.925 0.777 0.077	0.264 0.256 0.268 0.776 0.027 0.027	0.500 0.268 0.642 0.776 0.860 0.860
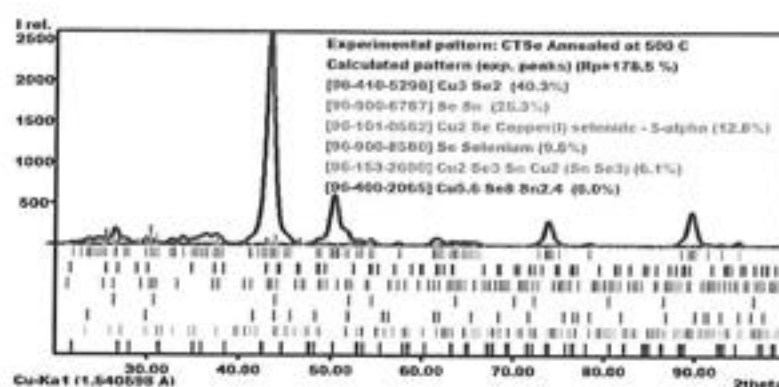
Fig.3. XRD pattern of stacked layer of Cu-Sn-Se annealed at 500° C.
Table. 3. Structural parameters of stacked layer of Cu-Sn-Se annealed at 500° C.

Empirical formula	Crystal system	Space Group	Unit Cell dimension(Å)	I/Ic	c/2a	Density gm/cm³		Wyckoff positions		
								X	Y	Z
SnSe	Orthorhombic	P b n m	a = 4.460 b= 11.570 c = 4.190	8.08	0.500	6.073	Sn Se	0.103 0.479	0.118 -0.145	0.250 0.250
Se	Trigonal	P 32 2 1	a= 4.355 c= 4.949	8.67	0.567	4.832	Se	0.217	0.000	0.167
Cu₂SnSe₃	Monoclinic	C 1 c 1	a = 6.967 b= 12.049 c= 6.945 β= 109.19°	6.45	0.498	5.822	Cu Cu Sn Se Se Se	0.370 0.371 0.363 0.503 -0.026 0.000	0.418 0.257 0.091 0.259 0.078 0.409	0.116 0.616 0.107 -0.014 -0.015 0.000
Cu₃Se₂	Tetragonal	P- 4 2 1 m	a= 6.60 c= 4.102	3.96	0.310	6.362	Cu Cu Se	0.000 0.353 0.199	0.000 0.853 0.699	0.000 0.250 0.676
Cu₂Se	Cubic	F 2 3	a= 5.840	8.48	0.5	6.872	Cu Cu Se	0.33 0.667 0.00	0.33 0.667 0.000	0.33 0.667 0.00
Cu₅.₆Sn₂.₄Se₈	Tetragonal	I – 4 2 m	a= 5.747 c= 11.455	11.28	0.996	5.583	Cu Cu Cu Sn Sn Se	0.000 0.000 0.000 0.000 0.000 0.257	0.000 0.000 0.500 0.000 0.500 0.257	0.000 0.500 0.250 0.500 0.250 0.372

Fig. 3 represents the X-ray diffraction pattern of stacked layers annealed at 500° C. Sample annealed at 500°C exhibited the phases of Cu_3Se_2, SnSe, Se, Cu_2Se, Cu_2SnSe_3 and $Cu_{5.6}Se_8Sn_{2.4}$. Main peaks at $2\Theta= 35.88°$ and $42.49°$ belongs to $Cu_{5.6}Se_8Sn_{2.4}$ 17). $Cu_{5.6}Sn_{2.4}Se_8$ is found in tetragonal structure of space group of I-42 m. Wyckoff positions of atoms are shown in table 3. However appearance of peaks at 43.45° confirmed the formation of SnSe exhibiting d-spacing of 2.0810 Å of (hkl) planes (002) 18). Table 3 accounts the unit cell dimensions and Wyckoff positions of atoms of different phases present in the sample annealed at 500°C. It can be concluded

that stacked layers of Cu-Sn-Se annealed at 500° C consist of a mixture of amorphous and crystalline phases. The stacked layer annealed at 500° C exhibited Cu_2SnSe_3 in monoclinic structure with C 1 c 1 space group and it is formed in 6.1%. 19)The dominating phase found after annealing at 500° C is Cu_3Se_2.

3.2. Analysis of AFM results

Surface features have been analyzed using the atomic force microscopy (AFM) images shown in Figs.4 (a-c). These show that the surface of the film annealed at 500°C is exhibiting the smoother surface than others (represented by average roughness R_a values). This is because with increment in annealing temperature particles achieve enough energy to consolidate and distribute homogenously in all directions. Table 4 shows various parameters obtained from AFM results, which are as (i) Stress fracture: described by kurtosis parameter (R_{ku}) which represents the distribution of spikes about the mean line. Roughness kurtosis R_{ku} is more than 3 for spiky surfaces while it is less than 3 for bumpy surfaces; it is exactly equal to 3 for perfectly smooth surfaces. R_{ku} is found to be more than three for CTSe films annealed at 200° C and 500°C which shows that the sample exhibited the spiky surface as the distribution has relatively higher numbers of highest peaks and lowest valleys 20, 21). (ii) Average Roughness R_a which shows the mean height with respect to reference plane is found minimum for sample annealed at 500°C revealing it a better surface than the other samples.

(a)   As-deposited stacked layers

(b)   Stacked layers annealed at 200° C

(c)   Stacked layers annealed at 500° C
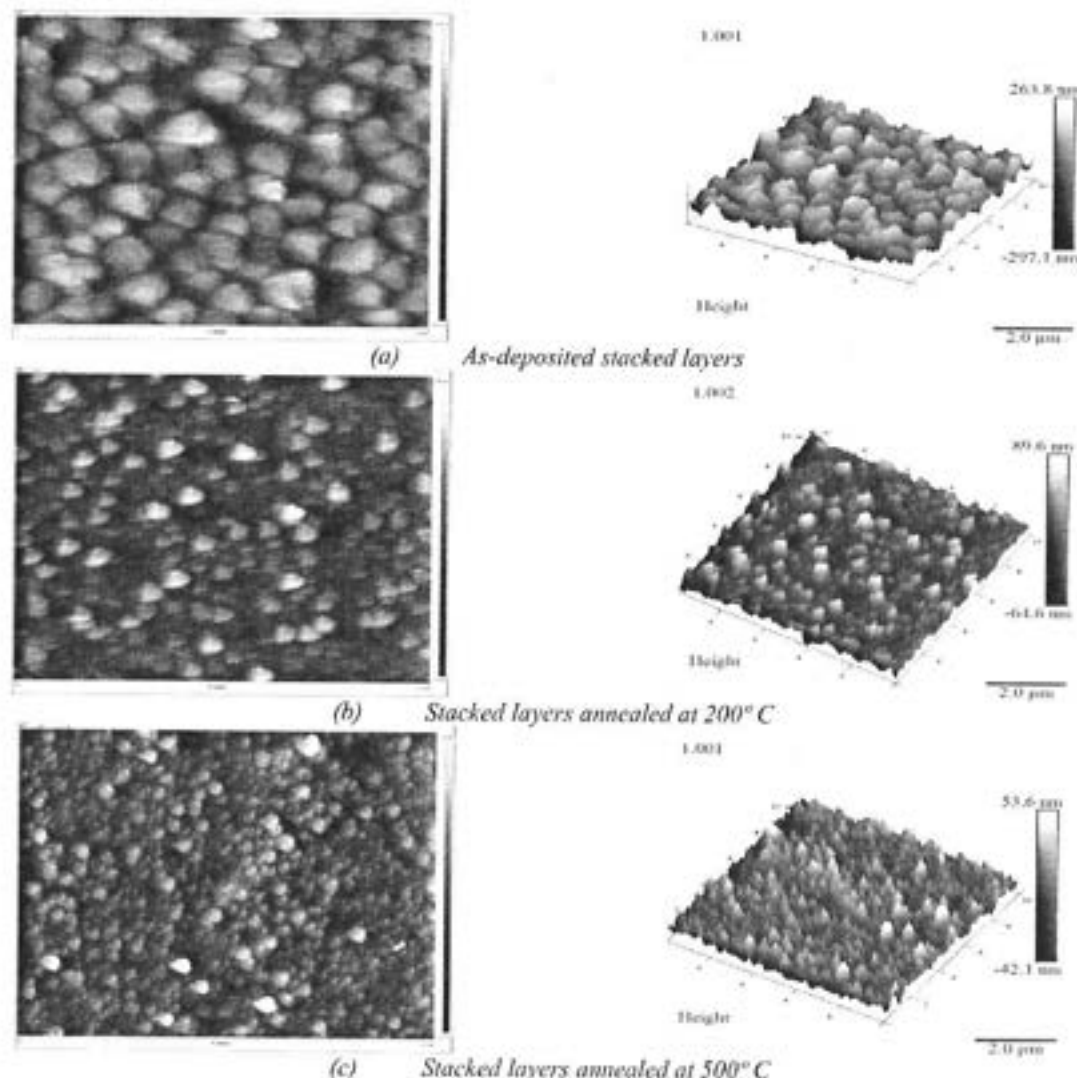
Fig.4. 2-D and 3-D AFM images of stacked layers containing Cu-Sn-Se.

(iii)The skewness is enumerated by R_q (root mean square roughness) which outlines the square root of the distribution of surface height and the finish of optical surface. As deposited sample exhibited the value of R_q as 80.5 nm which reduced with the increment in annealing temperature.(iv) The difference between five highest peaks and lowest peaks in surface profile is symbolized by R_z (Ten- points mean height roughness). The value of R_z for the as-deposited sample is found 583 nm and a decrement in this parameter has been observed with the increment in annealing temperature. (v) R_{sk} (Roughness skewness) represents symmetry of surface about the mean line plane, found maximum for the sample annealed at 200°C which is the measurement of porosity and load carrying capacity 1, 2).

Table 4. Comparative analysis of AFM parameters of stacked layers with respect to annealing temperature.

	R_a (nm)	R_q (nm)	R_z (nm)	R_q/R_a	R_{ku}	R_{sk}
As deposited	64.3	80.5	583	1.251	2.93	-0.275
Annealed at 200° C	16.8	21.7	198	1.2916	3.81	0.850
Annealed at 500° C	10	13	190	1.3	4.34	0.694

3.3. Hall Effect analysis

Electrical properties of the stacked layers containing Cu, Sn and Se were investigated at room temperature by Hall Effect measurements. In a four probe technique current is applied across two probes while potential difference is measured across two another probes, as shown in Fig.5.
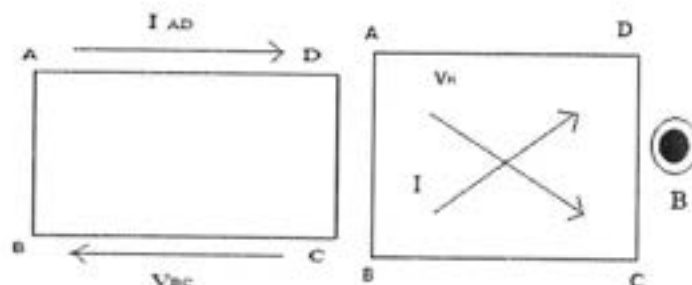
Fig. 5. Current node arrangement for Hall measurement 20).

A constant magnetic field is applied perpendicular to the direction of flow of current in the sample and variation in hall voltage is measured between the contacts 22).Hall measurements were performed by applying magnetic field of 0.5T strength. These measurements shows that n- type Cu_2SnSe_3 has been obtained having, resistivity and mobility of $3.1263 \times 10^{-3}\Omega$-cm and 1.4841 $cm^2/(V.s)$, respectively.

Table 5. Comparison of electrical parameters with respect to annealing temperature

Sample	Resistivity (Ω.cm)	Mobility ($cm^2/(V.s)$)	Carrier Concentration (cm^{-3})
As deposited	3.1263×10^{-3}	1.4841	5.3230×10^{21}
Annealed at 200 C	3.457×10^{-3}	3.8745	5.3258×10^{21}
Annealed at 500 C	2.9295×10^{-3}	4.1187	6.1820×10^{22}

The resistivity varied from 2.93×10^{-3} to 3.457×10^{-3} Ω.cm showing minimum for the sample annealed at 500° C. Mobility varied in the range from 1.4 to $4.1 cm^2/(V.s)$. Carrier concentration has been found $5.3230 \times 10^{21} cm^{-3}$ for as deposited which increased upto 6.1820×10^{22} cm^{-3} for the sample annealed at 500° C. These parameters have been shown in table 5.

From the results shown in aforementioned table 5, it could be revealed that the sample annealed at 500°C exhibited the lowest value of electrical resistivity, this drastical change and decrement in the value of electrical resistivity shows the presence of some other phases which could be said as impurity making it a extrinsic semiconductor 23).

4. Conclusion

The effect of annealing temperature on structural and electrical properties of multilayer structure Cu-Sn-Se has been studied in this work. The XRD results revealed that with the annealing of the multilayer structure at two different temperatures, some secondary phases have been developed, along with the Cu_2SnSe_3 phase. Cu_2SnSe_3 phase is formed in monoclinic structure with the space group of C 1 c 1.While the AFM results revealed that roughness is minimum for stacked layers annealed at 500° C having spiky surface. Hall measurements showed that the carrier concentration increased with the increment in the annealing temperature.

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STUDY OF Cu$_2$ZnSnSe$_4$ THIN FILMS PREPARED BY E- BEAM EVAPORATION OF SOLID-STATE REACTED COMPOUND

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A quaternary semiconductor Cu$_2$ZnSnSe$_4$ (CZTSe) has been emerged as a paramount candidate in form of absorber layer in thin film solar cell. CZTSe holds additional advantages like non- toxic constituents, abundant in earth crust and low cost over other chalcogenides like CIGS, CdTe etc. In this paper we have reported the growth of CZTSe thin films using pre synthesized bulk CZTSe solid state reacted compound as a source in e- beam evaporation deposition technique. Firstly bulk CZTSe compound in five different ratios were prepared using elemental constituents of Cu, Zn, Sn and Se. These five solid state reacted compounds were used as a target for thin film deposition. The Cu/(Zn+Sn) ratio in these films vary nearly to stoichiometry. The structural result analysis carried out using XRD data of thin films confirmed that phase content was noticeably affected during the film deposition process with respect to Cu/(Zn+Sn) ratios variation. Some amount of secondary phases were also found in the samples. Compositional variation in elemental constituents was studied by SEM-EDX and mapping spectra.

1. Introduction

A serious consideration is increased towards the renewable energy resources due to increasing energy demand over to fossil fuel sources. Photovoltaic technology has been extensively emerged with latest innovations in recent years to develop and increase the efficiency of thin film solar cell. Kesterite semiconductors like Cu$_2$ZnSnSe$_4$ and Cu$_2$ZnSnS$_4$ are commercially developed as an absorber layer in thin film solar cell based on some special properties like earth abundant material and non-toxicity. The earlier investigations shows that CZTSe have been deposited by spray pyrolysis method and corresponding solar cell showed conversion efficiency of 2.39%.[1] Lots of deposition techniques have been employed by many researchers to fabricate CZTSe thin films like spray pyrolysis, thermal evaporation etc.[1] XRD studies reveals that thermally evaporated CZTSe thin films exhibited the Kesterite structure with unit cell dimension a= 0.569nm and c= 1.139 nm with band gap lying within the range of 1.0 eV and 1.4 eV.[2]

A deep investigations have been done using in situ laser light scattering and ex situ characterization techniques for CZTSe as some other detrimental phases like ZnSe and Cu$_{2-x}$Se developed during the deposition process highly influences the solar cell device performance.[3] Septina et al. in their study showed that annealing of electrodeposited CZTSe under Ar gas flow caused losses of Sn and Se precursors due to evaporation of SnSe and device showed the conversion efficiency of 1.1%.[4] Khalil et al. successfully fabricated CZTSe solar cell approaching the electrochemical method for the synthesis of CZTSe with conversion efficiency of 0.1%.[5] Lex et al reported the controlled selenization of thermally evaporated CZT structure to fabricate CZTSe from industrialization point of view at 450° C and concluded that the value of absorption coefficient of 104 cm^{-1} with resistivity of 30 Ω.cm was exhibited by CZTSe in conjuction with the band gap of 1.52 eV.[6] To investigate the influence of stoichiometry variations in CZTSe, Chinnaiyah and his coworkers successfully prepared

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$Cu_2Zn_{1.5}Sn_{1.2}Se_{4+x}$ alloys and presented an overview that pure CZTSe phase was obtained for the value of x= 0.8 with p-type conduction.[7]

Characterizaton of polycrystalline CZTSe thin films discloses that selenization process of CZTSe between the temperature range of 480°C-540°C showed Kesterite structure having orientation along (112) direction with optical band gap ranging from 0.88 to 0.93 eV due to loss of $SnSe_x$ phase and solar cell designed from CZTSe selenized at 500°C showed the fill factor and conversion efficiency of 44 % and 7.18% respectively.[8]Furthermore photoluminescence study of selenised sputtered CZTSe reveals that intense and narrow band was resolved by high quality films showing two photon replica.[9] The results confirms that the annealing temperature is a dominating reason for the formation of detrimental phases during the annealing process. It also desirable to control the formation of phases as selenization of CZT layers at 250°C lead to formation of phase Cu_6Sn_5 .[10]

2. Experimental

CZTSe thin films have been grown by employing two stage process: (i) In first step bulk CZTSe has been synthesized using Cu, Zn, Sn and Se powders (99.99% pure) by solid state reaction method. CZTSe is prepared with varying the Cu/(Zn+Sn) ratio in number of five samples. The elemental precursors were weighed in the five different molar ratios with chemical composition as presented in table 1. These weighed elements were sealed in quartz ampoule at a pressure of 1×10^{-6} Torr and were allowed to heat up in furnace for 3 hours. After the cooling process chunks were separated from the ampoules and were grinded into square shape.

(ii) Prior to the film deposition from pre-synthesized bulk CZTSe, substrates (Soda lime glass) were ultrasonically cleaned in acetone and hot bath were given at the temperature of 70° C with 60 rpm. Cleaned and dried substrates were mounted on the substrate holder to place in the E-Beam deposition unit. Substrates were rotated at constant rate for uniform deposition and were put up in the line of sight of the crucible. The supply voltage of 5.20KV with current of 1 mA was applied for deposition and the deposition chamber was evacuated to the vacuum of 1.5×10^{-5} mbar.

Five samples of CZTSe thin films were prepared with variation in Cu/(Zn+Sn) ratio with different stoichiometry as mentioned in table1 below. XRD measurements have been performed to study the structural features of synthesized and deposited thin films. SEM-EDX of the thin films was done to confirm the stoichiometry variation.

Table 1. Stoichiometry variations in ratio of solid state reacted CZTSe compound.

Sample	Stoichiometry	Cu/Zn	Cu/Sn	Se/(Cu+Zn+Sn)	Cu/(Zn+Sn)
Sample 1	$Cu_2ZnSnSe_4$	2.0	2.0	1.0	1.0
Sample 2	$Cu_2ZnSnSe_{5.6}$	2.0	2.0	1.4	1.0
Sample 3	$Cu_2ZnSnSe_{5.2}$	2.0	2.0	1.3	1.0
Sample 4	$Cu_{1.8}ZnSnSe_{5.2}$	1.8	1.8	1.36	0.9
Sample 5	$Cu_2Zn_{1.1}SnSe_{5.2}$	1.818	2.0	1.26	0.95

3. Results

3.1 CZTSe bulk

3.1.1. Structure and phase analysis

Study of Structural features of synthesized bulk CZTSe material is done by XRD. Figure 1 shows the XRD spectra recorded for CZTSe (bulk) prepared by employing the conventional method of solid state reaction method. Analytical report of CZTSe bulk confirms the formation of CZTSe phase with some secondary phases. It could be easily seen from the pattern that the dominating peak located at 38.82° corresponds to $Cu_2ZnSnSe_4$.[11] An additional peak at the value of 2Θ= 23.21° attributes to Cu_2SnSe_3 phase.[12]
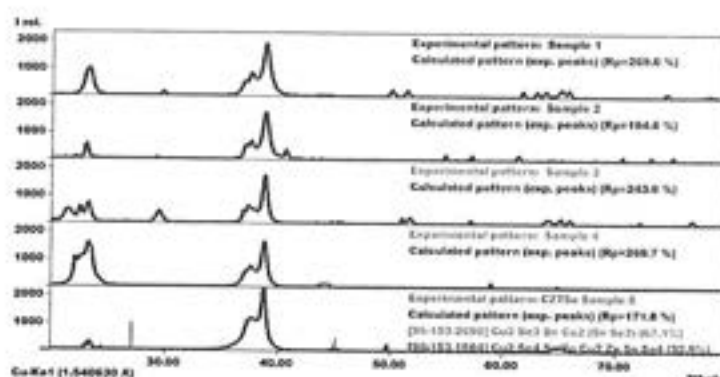
Fig. 1. XRD pattern for bulk CZTSe compound synthesized by solid state reaction.

The crystallite size is calculated by using Scherrer's formula given below

$$D = \frac{0.9\lambda}{\beta Cos\Theta}$$

where λ is the wavelength of the radiation used in XRD characterization, D is crystallite size and β is FWHM in radians for the most intense peak. The crystallite size is found 21.6 nm for bulk CZTSe samples.

CZTSe with space group I-42 m (121) is exhibiting tetragonal crystal structure with unit cell parameters a= 5.68820 Å c= 11.33780 Å with Wyckoff parameters listed in table 2 below:

Table 2.Structural parameters of Sample 1.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/I_c	c/2a	Density (calculated) gm/cm³	Wyckoff position		X	Y	Z
Cu$_2$ZnSnSe$_4$	Tetragonal	I -4 2 m (121)	a= 5.68820 c=11.33780	13.17	0.9959	5.6760	Sn		0.000	0.000	0.500
							Se		0.259	0.259	0.371
							Cu		0.000	0.500	0.250
							Zn		0.000	0.000	0.000
Cu$_2$SnSe$_3$	Monoclinic	C 1 c 1 (9)	a =6.96700 b=12.04930 c= 6.94530 β=109.190 °	6.450	0.4989	5.82200	Cu		0.370	0.418	0.116
							Cu		0.371	0.257	0.616
							Sn		0.363	0.091	0.107
							Se		0.503	0.259	-0.014
							Se		-0.026	0.078	-0.015
							Se		0.00	0.409	0.000

3.2. CZTSe thin films
3.2.1. Structural and phase analysis
Thin films prepared in five different elemental ratios from the e-beam evaporation of CZTSe compound synthesized by solid state reaction method is investigated from XRD characterization to get a view about the structural parameters. Figure 2 represents the typical XRD pattern of CZTSe sample 1 and reveals the formation of some phases like Se, Sn$_{0.9816}$Se, Sn, Cu, Zn and CZTSe. Most intense peak belonging to 2Θ value at 38.79° corresponds to CZTSe phase

with hkl parameters of (114) with d-spacing of 2.319 Å.[2] Another intense peak found at 23.56° belongs to Se with d-spacing of 3.7736Å.[4] Structural parameters are tabulated in the table 3 below.
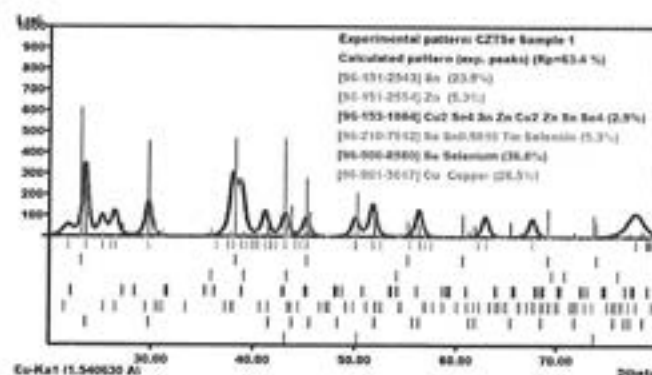
Fig. 2. XRD pattern of CZTSe Sample 1.

Table 3. CZTSe thin film formed by solid state reacted compound Sample 1.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/I$_c$	c/2a	Density (calculated) gm/cm^3	Wyckoff positions			
								X	Y	Z
Se	Trigonal (hexagonal axes)	P 32 2 1 (154)	a= 4.35517 c= 4.94945	8.670 000	0.5682	4.83800	Se	0.127	0.00	0.167
Cu	cubic	F m -3 m (225)	a= 3.63600	11.99 0000	0.5	5.34800	Cu	0.00	0.00	0.000
Sn	Cubic	F d -3 m (227)	a= 6.65596	17.58 00	0.5	6.12700	Sn	0.00	0.00	0.00
Sn$_{0.9816}$Se	Orthorhombic	P n m a (62)	a= 11.49417 b= 4.15096 c= 4.44175	8.080 000	0.1932	7.07300	Sn Se	0.118 0.855	0.250 0.250	0.103 0.482
Zn	Hexagonal	P 63/m m c (194)	a= 2.66169 c= 5.00397	10.90 0	0.9399	5.67600	Zn	0.33	0.667	0.750
Cu$_2$ZnSnSe$_4$	Tetragonal	I -4 2 m (121)	a= 5.68820 c= 11.33780	13.17 0000	0.9966	0.9959	Cu Zn Sn Se	0.000 0.00 0.00 0.259	0.50 0.00 0.00 0.259	0.250 0.00 0.50 0.371

It can be inferred from the spectra that a very little amount of CZTSe (2.9%) was formed in thin films formed by E-beam evaporation of bulk CZTSe compound. Major amount of Se is found and it could be related to the fact that melting point of Se is lowest among all elemental precursors.

Another peak is found denoting the $Sn_{0.9816}Se$ phase at 26.45° and 67.62° belonging to hkl value of (210) and (113) respectively with orthorhombic crystal structure.[3] Cu in cubic structure belongs to F m -3 m (225) with I/I_c value of 11.99.[5]
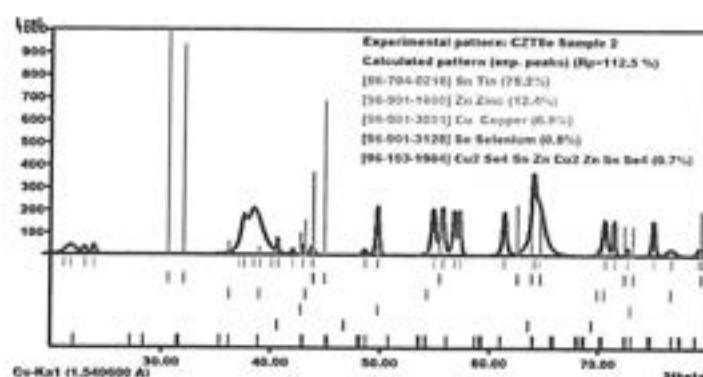
Fig. 3. XRD pattern for CZTSe Sample 2.

Parameters delineated from the study of XRD pattern of CZTSe sample 2 are presented in Table 4. There is clear evidence of the formation of CZTSe as a peak located at 63.96° with hkl value of (305) belongs to CZTSe phase.[14] Some secondary phases other than CZTSe is also observed in this sample like Se, Cu, Zn and Sn.[17-20].

Table 4. CZTSe thin film formed by solid state reacted compound Sample 2.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/I_c	c/2a	Density (calculated) gm/cm³	Wyckoff positions			
								X	Y	Z
Sn	Tetragonal	I 41/a m d (141)	a= 5.83230 c= 3.18230	11.460	0.2728	7.28400	Sn	0.00	0.250	0.875
Zn	Hexagonal	P 63/m m c (194)	a= 2.67000 c= 4.96600	10.9600	0.9288	7.08300	Zn	0.33	0.66250	0.250
Cu	Cubic	F m -3 m (225)	a= 3.66700	12.030000	0.5	8.56000	Cu	0.00	0.00	0.00
Se	Trigonal (hexagonal axes)	R -3 m (166)	a= 3.89200 c= 2.95720	10.70	0.3799	10.14000	Se	0.00	0.00	0.000
$Cu_2ZnSnSe_4$	Tetragonal	I -4 2 m (121)	a= 5.68820 c= 11.33780	13.170000	0.9966	5.67600	Cu	0.00	0.50	0.250
							Zn	0.00	0.00	0.000
							Sn	0.00	0.00	0.50
							Se	0.259	0.259	0.371

Some amount of elemental precursors could be seen as the melting point of these precursors are different from each other so it could be related from the fact that each precursor was evaporated as they achieved their melting point during the deposition process. Peak at 2Θ value of $40.61°$ and $49.60°$ belongs to Se and Cu elemental precursors respectively.
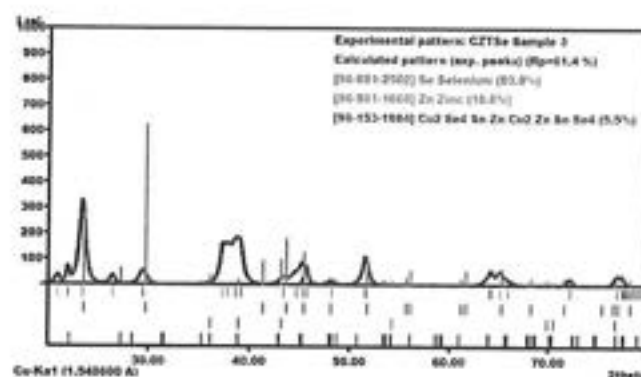
Fig. 4. XRD pattern of CZTSe sample 3.

XRD pattern of CZTSe sample 3 thin films reveals that this sample exhibited the three different phases like Zn, Se and CZTSe. CZTSe is belonging to space group of I -4 2 m (121).[2] Major amount of Se is detected in the sample 3.[21] It could be easily seen from analysis of compositional aspects that CZTSe is formed in very little quantity from bulk CZTSe compound in thin films. Highest amount of Se is detected in this sample.

Table 5. CZTSe thin film formed by solid state reacted compound Sample 3.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/I_c	c/2a	Density (calculated) gm/cm³		Wyckoff positions		
								X	Y	Z
$Cu_2ZnSnSe_4$	Tetragonal	I -4 2 m (121)	a= 5.68820 c= 11.33780	13.17 0000	0.9966	5.67600	Cu Zn Sn Se	0.00 0.00 0.00 0.259	0.50 0.00 0.00 0.259 0.250	0.250 0.00 0.50 0.371
Zn	Hexagonal	P 63/m m c (194)	a= 2.67000 c= 4.96600	10.960 000	0.9299	7.08300	Zn	0.33	0.667	0.250
Se	Trigonal (hexagonal axes)	P 31 2 1 (152)	a= 4.36620 Å c= 4.95360	13.17 0000	0.56726	4.81000	Se	0.225	0.00	0.333
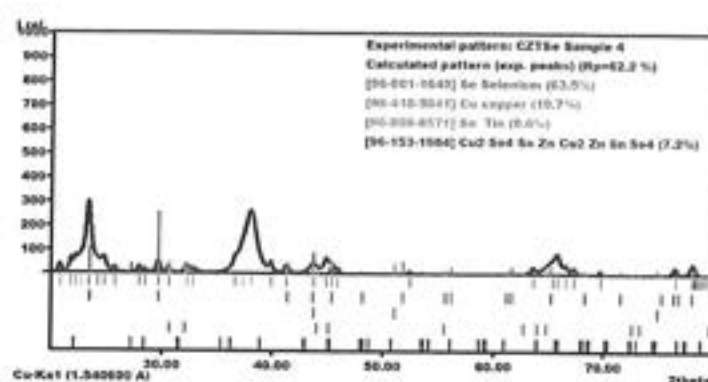
Fig. 5. XRD pattern of CZTSe sample 4 thin films.

Table 4. CZTSe thin film formed by solid state reacted compound Sample 4.

Empirical formula	Crystal system	Space Group	Unit Cell dimension (Å)	I/I_c	$c/2a$	Density (calculated) gm/cm^3	Wyckoff positions			
								X	Y	Z
Se	Trigonal (hexagonal axes)	P 31 2 1 (152)	a= 4.36800 Å c= 4.95800	9.150 000	0.5675	4.80100	Se	0.225	0.00	0.33
Cu	Cubic	F m -3 m (225)	a= 3.58191	10.640 000	0.5	9.18400	Cu	0.00	0.050	0.000
Sn	Tetragonal	I 41/a m d (141)	a= 5.81970 c= 3.17488	11.46 0000	0.2727	7.33300	Sn	0.00	0.00	0.00
Cu$_2$ZnSn Se$_4$	Tetragonal	I -4 2 m (121)	a= 5.68820 c= 11.33780	13.17 0000	0.9966	5.67600	Cu	0.000	0.50	0.250
							Zn	0.00	0.00	0.00
							Sn	0.00	0.00	0.50
							Se	0.259	0.259	0.371

Thin films synthesized from solid state reacted compound sample 4 were composed of phases like Se, Sn, Cu and CZTSe from study of XRD pattern. Major peak belongs to CZTSe phase at 2Θ value of 65.81° with hkl value of (008). Another peaks found at 2Θ value of 23.43°, 30.64° and 43.71° are relating to Se, Sn and Cu with d-spacing of 3.7936Å, 2.9157Å and 2.0693Å respectively.[16,22,23]

XRD result analysis of Sample 5 confirms that it exhibited the phase of Cu, Sn, Se and Cu$_2$ZnSnSe$_4$. Most intense peak at 38.74° belongs to Cu$_2$ZnSnSe$_4$ phase.[2] Peak located at the 2Θ value of 23.55° , 64.74° and 49.68° attribute the phase of Se, Sn and Cu with d- spacing of 3.7745Å, 1.4387Å and 1.8337Å respectively.[16,17] Figure 6 represents the XRD spectra of CZTSe sample 5. An increment in the quantity of CZTSe is seen in this thin film as it increased upto 18.7%.
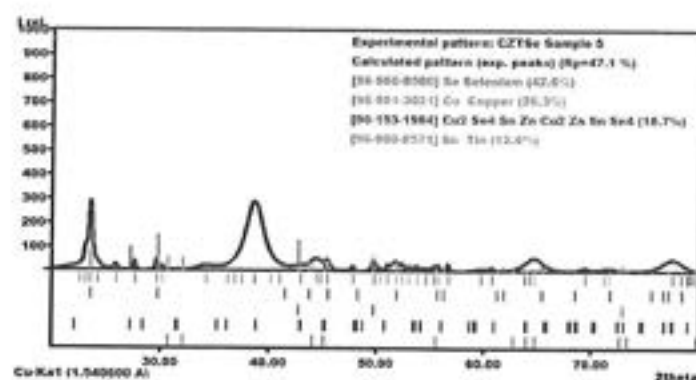
Fig. 6. XRD pattern of CZTSe Sample 5.

Table 7. CZTSe thin film formed by solid state reacted compound Sample 5.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/I_c	c/2a	Density (calculated) gm/cm³		Wyckoff positions		
								X	Y	Z
Se	Trigonal (hexagonal axes)	P 32 2 1 (154)	a= 4.35517 c= 4.94945	8.670	0.5682	4.83800	Se	0.217	0.00	0.167
Cu	Cubic	F m -3 m (225)	a= 3.66700	12.03 0000	0.5	8.56000	Cu	0.00	0.00	0.00
Cu₂ZnSnSe₄	Tetragonal	I -4 2 m (121)	a= 5.68820 c= 11.33780	13.17 0000	0.9966	5.67600	Cu	0.00	0.50	0.250
							Zn	0.00	0.00	0.00
							Sn	0.000	0.00	0.500
							Se	0.259	0.259	0.371
Sn	Tetragonal	I 41/a m d (141)	a= 5.81970 c= 3.17488	11.46	0.2727	7.3330	Sn	0.00	0.00	0.00
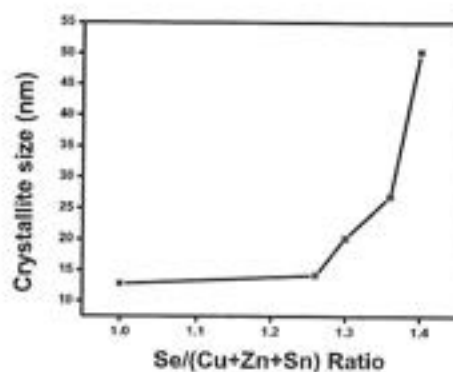
Fig. 7. Variation in crystallite size with respect to Se/(Cu+Zn+Sn) ratio.

Fig. 7 shows variation in crystallite size relative to Se/(Cu+Zn+Sn) ratio. Crystallite size presented an increasing trend towards the increment in the value of Se/(Cu+Zn+Sn) ratio.

3.3. SEM EDX result analysis

Fig. 8 shows the SEM images of CZTSe thin films from sample 1 to sample 5 with respect to compositional variation deposited on Soda Lime glass substrate. Formation of rod arrays connecting to each other at the center was observed in SEM images for the thin films of $Cu_2ZnSnSe_4$ thin films. Sample 1 showed inter-particle distance and area of 0.075 µm and 0.006000 μm^2 respectively. Inter-particle distance is found to be increased with respect to Se/(Cu+Zn+Sn) ratio and its variation is tabulated in Table 8.

Table 8. Inter-particle distance variation in CZTSe thin films.

Sample	Inter particle distance (µm)	Area (μm^2)
1	0.075	0.0060
2	0.170	0.0175
3	0.250	0.0150
4	0.175	0.0175
5	0.275	0.0450
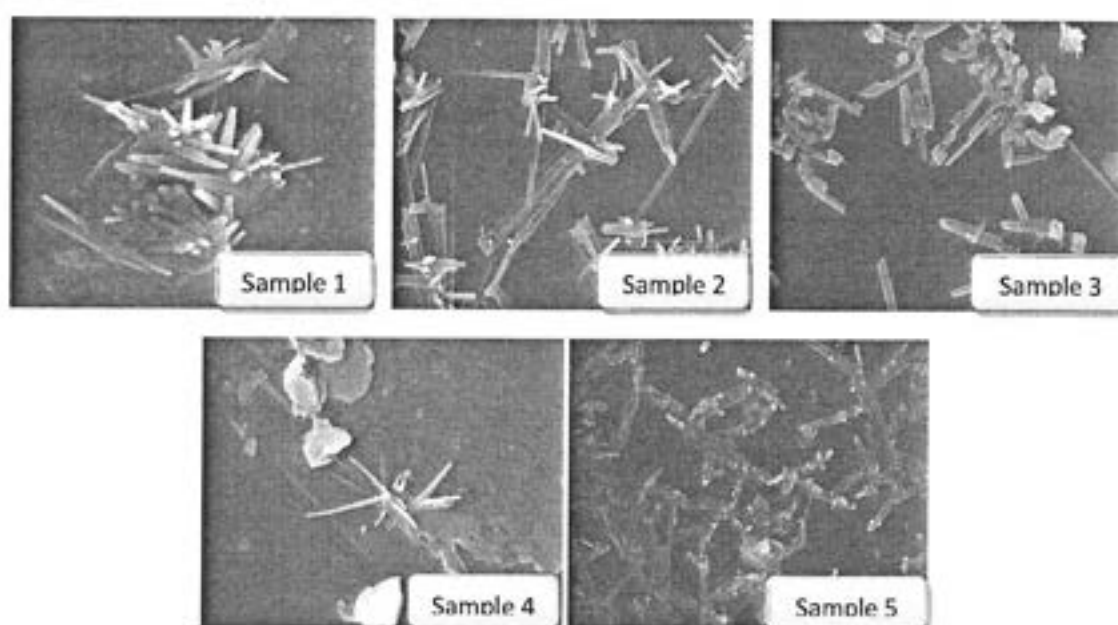
Fig.8. FESEM images of CZTSe samples

Various atomic ratios obtained from EDS results for CZTSe thin films grown with different sedimentary sequences, are shown in Table 9. FESEM mapping spectra of all CZTSe thin films is shown in figure 9. As expected, the elemental ratio of constituents during the deposition of thin films from bulk changes after deposition. The Cu/(Zn+Sn) ratio for all CZTSe thin films ranges from 0.80-0.90. The content of Se is observed more in thin films which may be due to lowest melting point of Se amongst all constituents. Furthermore the ratio of Cu/Sn is found relatively unchanged for all samples. But it could be inferred from the analysis that all CZTSe thin films samples retained their stoichiometry almost nearly to stoichiometry of bulk CZTSe material.
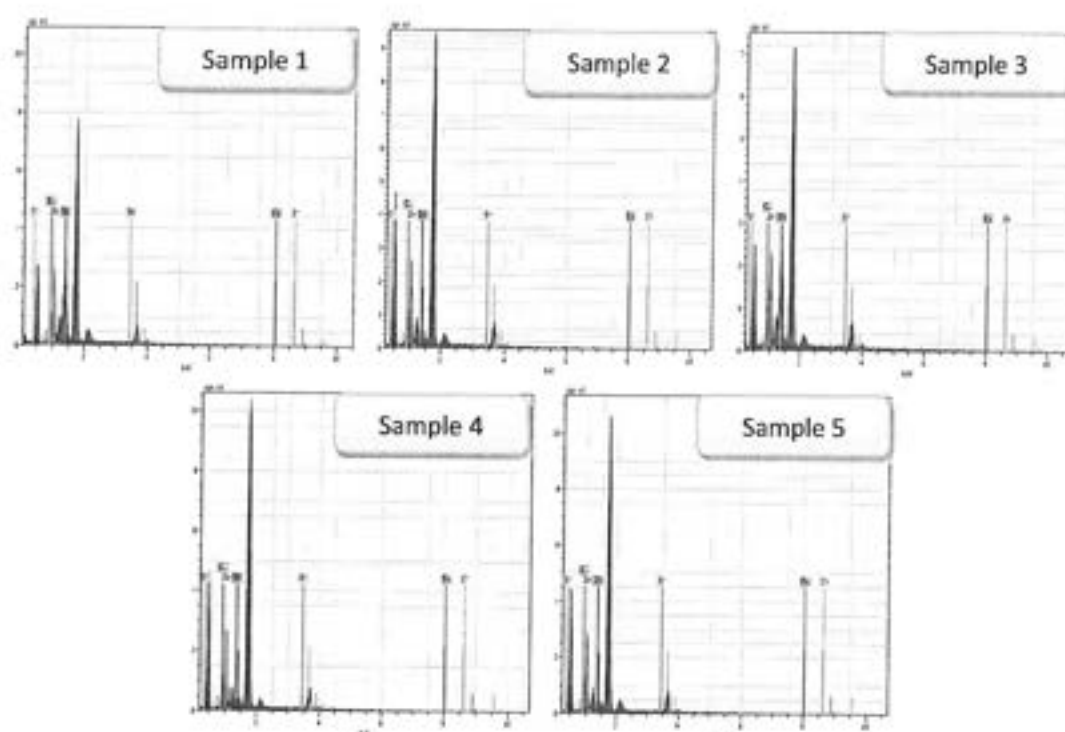
Fig. 9.FE-SEM mapping spectra recorded for CZTSe compound.

Table 9.The composition of the CZTSe thin films determined by EDX analysis.

Sample ID	Elemental composition at (%)			
	Cu/Zn	Cu/Sn	Se/(Cu+Zn+Sn)	Cu/(Zn+Sn)
Sample 1	1.90	1.94	0.98	0.80
Sample 2	1.88	1.95	1.32	0.89
Sample 3	1.95	1.94	1.26	0.87
Sample 4	1.74	1.75	1.30	0.85
Sample 5	1.65	1.98	1.20	0.90

4. Conclusion

A study of CZTSe thin films fabricated from the pre-synthesized solid state reacted CZTSe compound using e- beam method shows that variation in Cu/(Zn+Sn) ratio highly affects the formation of secondary phases like $Sn_{0.9816}Se$, Se, Cu, Zn and Sn along with formation of CZTSe as single phase Se is found in almost samples (1-5) and it could be due to lowest melting point of Se in among all elemental constituents in CZTSe solid state reacted compound. An analysis of FESEM results of CZTSe thin films confirms that the stoichiometry retained during the deposition of CZTSe thin films and are almost matching with CZTSe solid state reacted compound. An increment in crystallite size is observed with the increment in Cu/(Zn+Sn) ratio.

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PAPER

Study of mixing behaviour of Cu, Zn, Sn and Se multilayer structure by annealing

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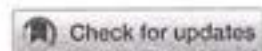
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Abstract

Solar energy is abundantly available using which electricity can be produced, without any formulation of greenhouse gases. For the production of solar cells, Copper Zinc Tin Selenide (CZTSe) thin films have attracted much attraction in recent times due to high natural abundance of constituents and their non-toxicity, large absorption coefficient and tunable band gap. In this work stack of four layers of films of precursors namely Cu, Zn, Sn and Se have been deposited and their mixing behavior has been studied. These films have been grown employing RF and DC sputtering method and thermal evaporation method on soda lime glass and Si- wafer substrates while maintaining the substrate temperature at 100 °C. Deposited four layer film structure has been annealed at 200 °C and 500 °C in vacuum. X-ray diffraction technique has been employed to determine the structure of resulting material. Atomic force microscopy (AFM) technique has been employed to study the surface morphology of material which confirms that sample annealed at 500 °C revealed better surface than the other samples. The electrical properties were investigated by Hall Effect measurements.

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Surface statistical properties of solid state reacted CZTSe compounds prepared in five different ratios

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Abstract

Copper Zinc Tin Selenide (CZTSe) has attracted much attention in recent times, for an absorber layer in thin film solar cells, due to high natural abundance of its constituents and their non-toxicity. In this work preparation of CZTSe compounds through solid state reaction of elemental precursors, namely Cu, Zn, Sn and Se and study of surface roughness, using the atomic force microscopy (AFM) has been presented. In order to study the influence of compositional variation on surface morphology, quantitative roughness and surface characteristics have been evaluated from AFM characterization. Surface roughness and grain size along with parameters like surface kurtosis, skewness and root mean square (RMS) roughness have been discussed. A significant difference has been observed in roughness parameters and grain size with respect to Cu/Zn variations. It has been concluded that deficiency of Cu and excess of Zn, caused decrement in mean grain size of the material with respect to perfect stoichiometric sample. These observations have also been verified using SEM-EDAX and FTIR studies.

Introduction

Quaternary CZTSe crystallizes in stannite structure at room temperature and show p-type behavior having the absorption coefficient in the range of $104-105$ cm^{-1}. In thin film solar cells, CZTSe is used as an absorber layer but its open circuit voltage and band gap is highly influenced by composition and formation of various phases [1]. There are variety of methods available for the fabrication of CZTSe like RF-DC sputtering method [2], thermal co-evaporation [3], electro deposition method [4], solid state reaction [5] etc Deviation in the ratio of elemental precursors of the CZTSe from ideal stoichiometry causes the formation of secondary phases like CuSe, ZnSe and SnSe which highly influence the performance of the solar cell devices [5]. Farva and Park used solid state reaction by taking Cu, ZnO, SnO and Se powders as precursors, the reaction was performed at 500 °C [6]. The compound exhibited non uniform size particles with aggregation of nano powder which were crystallized in stannite phase. Bishop et al prepared CZTSe crystals by employing solid state reaction of elements in different ratio [7]. Cu poor and near stoichiometry prepared crystals were correlated with carrier concentration in the range from 10 16 to 10 19 cm^{-3}. Formation of some binary phases during the reaction at different temperatures was discussed by Wibowo et al [8]. It was observed that at low temperature, CuSe and CuSe2 phases were formed due to reaction between Cu and Se, but with further increase in temperature (at or above 320 °C) all constituents reacted and formed binary phases of CuSe, ZnSe and SnSe. It was also observed that Se loss necessarily happens during the whole process of reaction. For the preparation of CZTSe compound, the milled elemental powders of Cu, Zn, Sn and Se using Zirconia balls were allowed to react in a quartz tube with Argon gas flow in the work by Wibowo et al [9]. The reaction process was done at 500 °C for 6 h which resulted into synthesis of stannite phase along with α-CuSe phase, which was attributed to the mechanical alloying effect. Gremenok et al prepared CZTSe films via two stage process i.e. electro deposition of CZT and selenization at a particular temperature which contained phases of ZnSe and CuSe [10]. These densely packed films exhibited faceted grain structure with no voids. When these films were annealed at 450°C, they had homogeneous particle distribution [11]. A study of CZTSe thin films fabricated by employing co-evaporation method on Mo substrate showed that at the interface CZTSe/Mo, ZnSe phase was
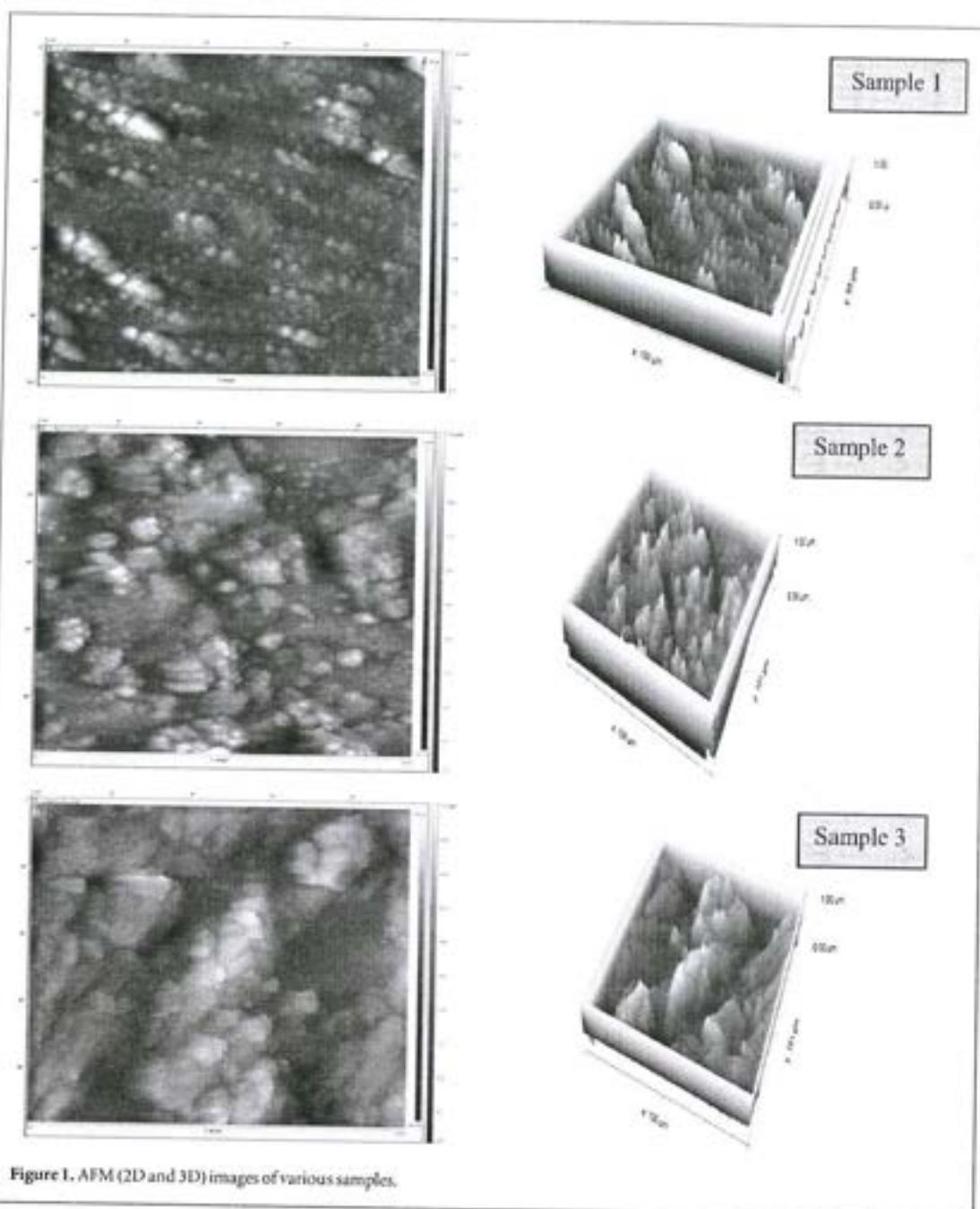
Figure 1. AFM (2D and 3D) images of various samples.

formed [12]. CZTSe thin films fabricated by sputtering of single CZTSe target showed that phase formation is highly influenced by annealing temperature as annealing caused an increment in grain size of films [13]. The authors of this paper have reported study of mixing behaviour of Cu, Zn, Sn and Se multilayer structure in earlier work [14]. It was concluded that annealing at 500°C smoothen the surface of the films. Study of surface morphology of a compound is important in device fabrication as the performance characteristics of the sample strongly depends upon the surface features in terms of grain size distribution, long-range roughness, the average grain size, roughness kurtosis and roughness skewness [15, 16]. These are parameters that allow insight into the surface properties and quality. Present work reports study of the surface morphology, topography and texture of CZTSe materials developed by solid state reaction at 850 °C by atomic force microscopy.

As efficiency of solar cell depends upon the stoichiometry and the phases formed along with CZTSe absorber layer. Purity of CZTSe highly affects the performance of the solar cells, hence it is vital to explore synthesis of CZTSe bulk material under different conditions and by various methods. This work reports synthesis of CZTSe bulk materials by solid state reaction of four elemental constituents at 850°C in a rocking furnace. These are analysed for formation of CZTSe alongwith various phases by AFM and XRD techniques. SEM-EDAX has been used for verification of the compositional character of the reported materials. FTIR analysis has also been done for examining the purity of the materials.
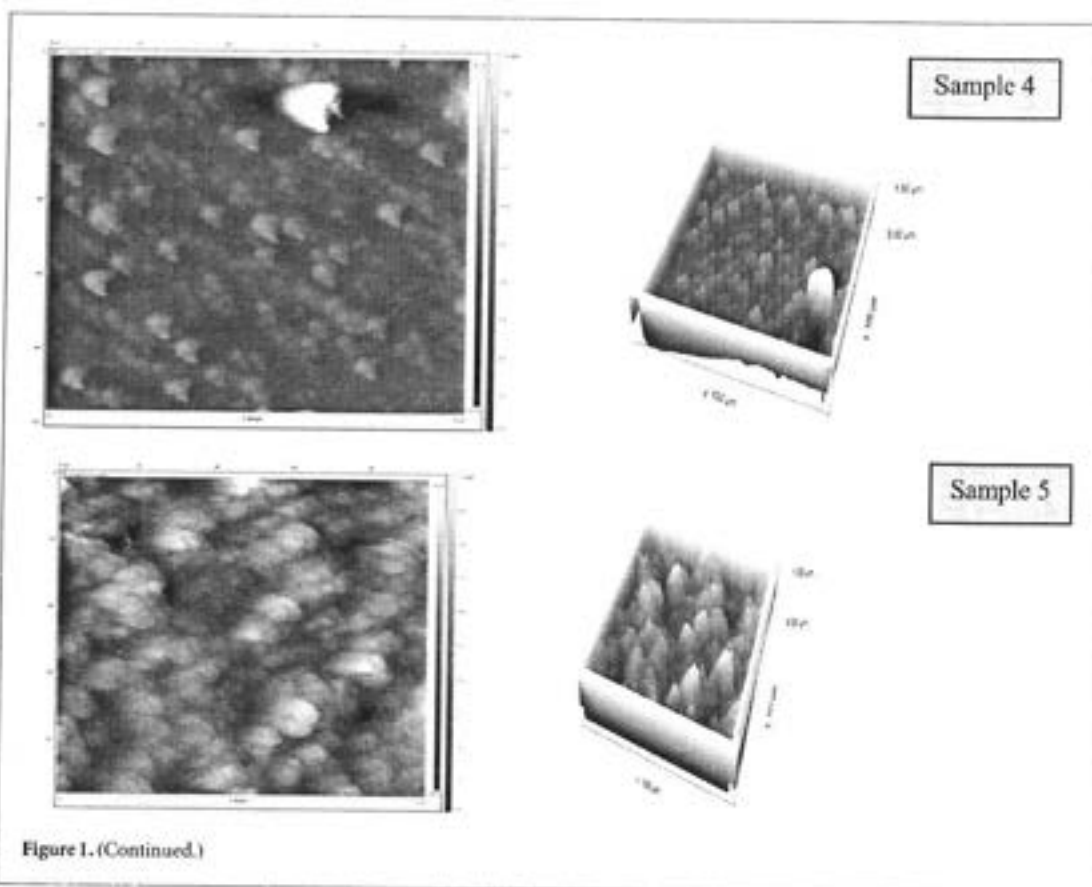
Figure 1. (Continued.)

Experimental details

Firstly, high purity Cu, Zn, Sn and Se (99.9%) were weighed in desired stoichiometry and were loaded in cleaned quartz ampoules which were etched in acetone to remove impurities. The ampoules were sealed under dynamical pumping at a base pressure $\sim 1 \times 10^{-6}$ Torr and the ampoules were placed in a vertical rocking furnace and heated at temperature of 850 °C and hold for 4 h. After this process, these ampoules were cooled down to room temperature (30 °C). After cooling process, the quartz ampoules were broken to extract the solid polycrystalline samples. Chunks separated from ampoules were grinded into square shape and were polished. Stoichiometry of five different samples prepared with exhibiting different ratio of Se/(Cu+Zn+Sn) are given in table 1.

Results and discussion

AFM analysis

Atomic force microscopic (AFM) technique is an established tool to characterize the surface features for quantitative analysis of surface roughness and other parameters of the materials. AFM images (2D and 3D) of CZTSe materials prepared in five different stoichiometric variation in Se/(Cu + Zn + Sn) ratio has been shown in figures 1(a)–(e). Roughness of the absorber surface is the key feature in the application of photovoltaic technology as physical and chemical properties are directly affected by it. Roughness of the surface is defined as the surface height with respect to mean height. Rough surface is mainly classified into two parts: Deterministic and random rough surfaces [17].

In terms of equation, random rough surfaces can be represented by:

$$h = h(r) \tag{1}$$

where 'h' denotes the surface height of rough surface measured with respect to smooth reference surface. It could be seen that some height is exhibited by rough surface which is single valued function of height and these height fluctuations are random with respect to positions [12]. Height distribution function p(h) is one of the most important property of Random rough surfaces. The probability of surface height between surface height h and h + dh is given by p(h)dh where height distribution function p(h) is the Gaussian height distribution given by:

Table 1. Stoichiometry variations in the elemental constituents of various samples.

Sample	Stoichiometry	Cu/Zn	Cu/Sn	Se/(Cu + Zn + Sn)	Cu/(Zn + Sn)
Sample 1	$Cu_2ZnSnSe_4$	2.0	2.0	1.0	1.0
Sample 2	$Cu_2ZnSnSe_{5.6}$	2.0	2.0	1.4	1.0
Sample 3	$Cu_2ZnSnSe_{5.2}$	2.0	2.0	1.3	1.0
Sample 4	$Cu_{1.8}ZnSnSe_{5.2}$	1.8	1.8	1.36	0.9
Sample 5	$Cu_2Zn_{1.1}SnSe_{5.2}$	1.818	2.0	1.26	0.95

$$p(h) = \frac{1}{\omega\sqrt{2\pi}}\exp\left(\frac{-h^2}{2\omega^2}\right) \tag{2}$$

here 'w' is interface width [17].

Figure 2 represents a comparative analysis of the height distribution function of each sample carried out on program GWYDDION. The statistical distributions of $p(h)$ of all samples show a Gaussian distribution along the surface. A small deviation in Gaussian distribution is observed for sample 3 exhibiting stoichiometry of $Cu_2ZnSnSe_{5.2}$ with Se/(Cu + Zn + Sn) ratio of 1.3 while sample 4 with stoichiometry $Cu_{1.8}ZnSnSe_{5.2}$ having Cu/Zn ratio 1.8 showed almost perfect Gaussian distribution.

Figure 2 represents a comparative analysis of the height distribution function of each sample carried out on program GWYDDION to perform various data analysis. This statistical distribution $p(h)$ of all CZTSe sample shows a Gaussian distribution along the surface. A small deviation in Gaussian distribution is observed for sample 3 exhibiting stoichiometry of $Cu_2ZnSnSe_{5.2}$ with Se/(Cu + Zn + Sn) ratio of 1.3 while sample 4 with stoichiometry $Cu_{1.8}ZnSnSe_{5.2}$ having Cu/Zn ratio 1.8 showed almost perfect Gaussian distribution.

Roughness parameters have been calculated by analyzing the topographical scan of various sample surfaces. Surface profile parameters includes average roughness(R_a), root mean square roughness(R_q), skewness of the line (R_{sk}), kurtosis of the line (R_{ku}). Average roughness 'R_a' denotes the deviation in height and mathematically is represented by

$$R_a = \frac{1}{l}\int_0^l |y(x)|\, dx \tag{3}$$

A small variation in value of average roughness of five different sample of CZTSe is observed with respect to their stoichiometry change. Sample 2 with ratio Se/(Cu + Zn + Sn) = 1.4 i.e. $Cu_2ZnSnSe_{5.6}$ with 40% excess of Se exhibits the lowest value of average roughness 49.4 nm while sample 1 with perfect stoichiometry $Cu_2ZnSnSe_4$ and sample 3 with 30% excess of Se, $Cu_2ZnSnSe_{5.2}$ exhibited same value of roughness 51.8 nm. RMS Roughness represents the standard deviation of surface height and in terms of h_i is defined as [17]:

$$\langle R_q \rangle_N = \left\{\frac{1}{N}\sum_{i=1}^N (h_i - \langle h\rangle_N)^2\right\}^{1/2} \tag{4}$$

RMS roughness is found maximum for sample 1 exhibiting perfect stoichiometry $Cu_2ZnSnSe_4$ with value of 65.4 nm. Symmetry of distribution about a mean surface level is denoted by Roughness Skewness (R_{sk}). R_{sk} can exhibit positive or negative values. The location of farther points above the mean surface level is described by the positive value of R_{sk} with asymmetric tail extending out toward more positive height with respect to mean surface level. The negative value of skewness describes the points located below the mean surface level and is distributed with tail extended out toward more negative height with respect to mean surface level [17]. Skewness also presents a picture about the bumps and holes on surface as positive skewness gives a distribution of bumps on surface while negative skewness represents distribution of holes [17]. Positive value of skewness is exhibited by all five samples showing that the peaks are dominant on the surface irrespective of variation in elemental composition ratio in CZTSe samples as skewness is defined as:

$$R_{sk} = \frac{1}{w^3}\int_{-\infty}^{+\infty} h^3 p(h)\, dh \tag{5}$$

Sharpness of the height distribution function is measured by kurtosis which is dimensionless quantity and defined as:

$$R_{ku} = \frac{1}{w^4}\int_{-\infty}^{+\infty} h^4 p(h)\, dh \tag{6}$$

Randomness of the surface profile is specified taking a reference of a perfectly random surface which exhibits the kurtosis value of 3.0 [17]. Further 'R_{ku}' provides an idea about the distribution of spikes above and below the mean surface [12]. Surface can be classified into three categories depending on the value of kurtosis (i) Surface

Figure 2. Height distribution of various samples.
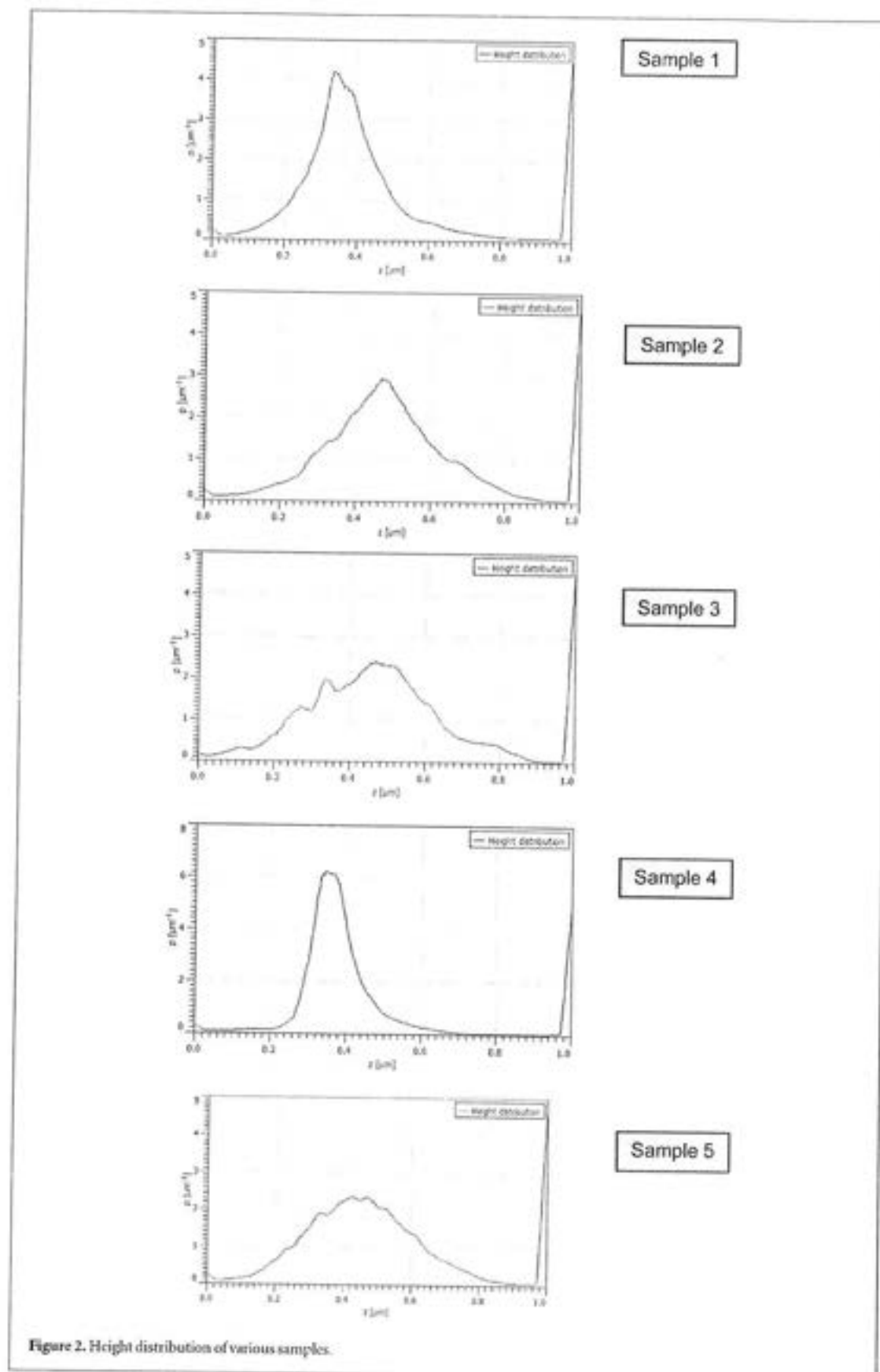
exhibiting the value of 'R$_{ku}$' equal to 3 is known as Mesokurtic (ii) A Surface will be flat with kurtosis smaller than three and called platykurtica (iii) The surface more than three value exhibits more peaks rather than valleys. Table 2 shows that R$_{ku}$ value is found more than 3 for the samples with Cu/(Zn + Sn) ratio of 1.0 and 0.95 which

Table 2. Roughness Parameters of various samples.

Sample	R_a (nm)	R_q (nm)	R_z (nm)	R_q/R_a	R_{ku}	R_{sk}
Sample 1	51.8	65.24	650	1.259	6.02	0.932
Sample 2	49.4	63.8	636	1.2914	3.41	0.105
Sample 3	51.8	65.1	427	1.2561	2.88	0.0750
Sample 4	51.1	64.8	521	1.2681	3.01	0.0542
Sample 5	50.9	64.2	590	1.2612	3.17	0.0458

Table 3. Statistical information obtained from AFM images of various samples.

Sample	Length $(\times 10^2) \mu m$	Diameter $(\times 10^2) \mu m$	Perimeter $(\times 10^3) \mu m$
Sample 1	407.45	198.43	198.435
Sample 2	634.99	185.20	132.290
Sample 3	500.015	264.58	661.451
Sample 4	701.13	259.28	185.206
Sample 5	465.26	256.64	119.061

Table 4. Grain size distribution among various samples.

Sample	Mean grain size (nm)	Mean grain area (μm^2)	Total grain volume (μm^3)
Sample 1	250.4	0.1605	5.294
Sample 2	226.9	0.1576	5.570
Sample 3	185.0	0.1213	3.715
Sample 4	237.4	0.4499	4.140
Sample 5	213.5	0.1502	6.130

shows the presence of high peaks and deep valleys in the sample [1]. Sample 3 with 30% excess of Se, $Cu_2ZnSnSe_{5.2}$ exhibited the value of R_{ku} less than three while sample 4 with 10% Cu deficient exhibited R_{ku} almost equal to three showing it a random surface.

Table 2 illustrates that the variations in RMS roughness 'R_q' values observed for all the samples which have the same trend as exhibited by average roughness values 'R_a' and ten point mean height 'R_z' values. 'R_z' is defined by two definitions as per ISO and German DIN. According to ISO it is the difference in height between the average of five highest peaks and lowest valleys along the reference length of the profile while German DIN system specifies it as the average over the summation [18].

$$R_z = \frac{1}{2n} \left(\sum_{i=1}^{n} P_i + \sum_{i=1}^{n} V \right)_i \tag{7}$$

where P_i = height of ith peak, V_i = depth of ith valley with respect to line profile and n = number of sampling points. A study of statistical theory of surface parameters reveals that the ratio of R_q to R_a should be almost 1.25. The values of R_q/R_a presented in table are very close to the value of 1.25 indicating the Gaussian height distribution of these surfaces independent of compositional variation [19]. A close relation between the R_{ku} and R_z can be observed from the data due to the fact that R_{ku} is mathematically directly related to the peak heights and valleys depths as per following formula:

$$R_{ku} = \frac{1}{NR_q{}^4} \left(\sum_{i=1}^{N} Y_i{}^4 \right) \tag{8}$$

where R_{ku} is the RMS roughness parameter and Y is the height of the profile at point 'i' [12].

Software based image processing of AFM images generate quantitative information like particle size distribution, length, perimeter, diameter, shown in figure 3. Table 3 gives data on surface area studied from aforementioned histograms. Sample 4 with 10% Cu deficiency exhibited highest value of length of grains i.e. 701.13 μm while lowest value 407.45 μm was exhibited by sample 1. Sample 3 containing 30% excess of Se showed highest perimeter of grains. It can be concluded that samples with perfect stoichiometry and excess of Se caused an increment in perimeter of grains while Cu deficiency and excess of Zn caused a decrement in perimeter. The similar observation could be noted in the case of diameter of grains in various samples.

Figure 3. Quantitative analysis of nanoscale parameters of various samples.
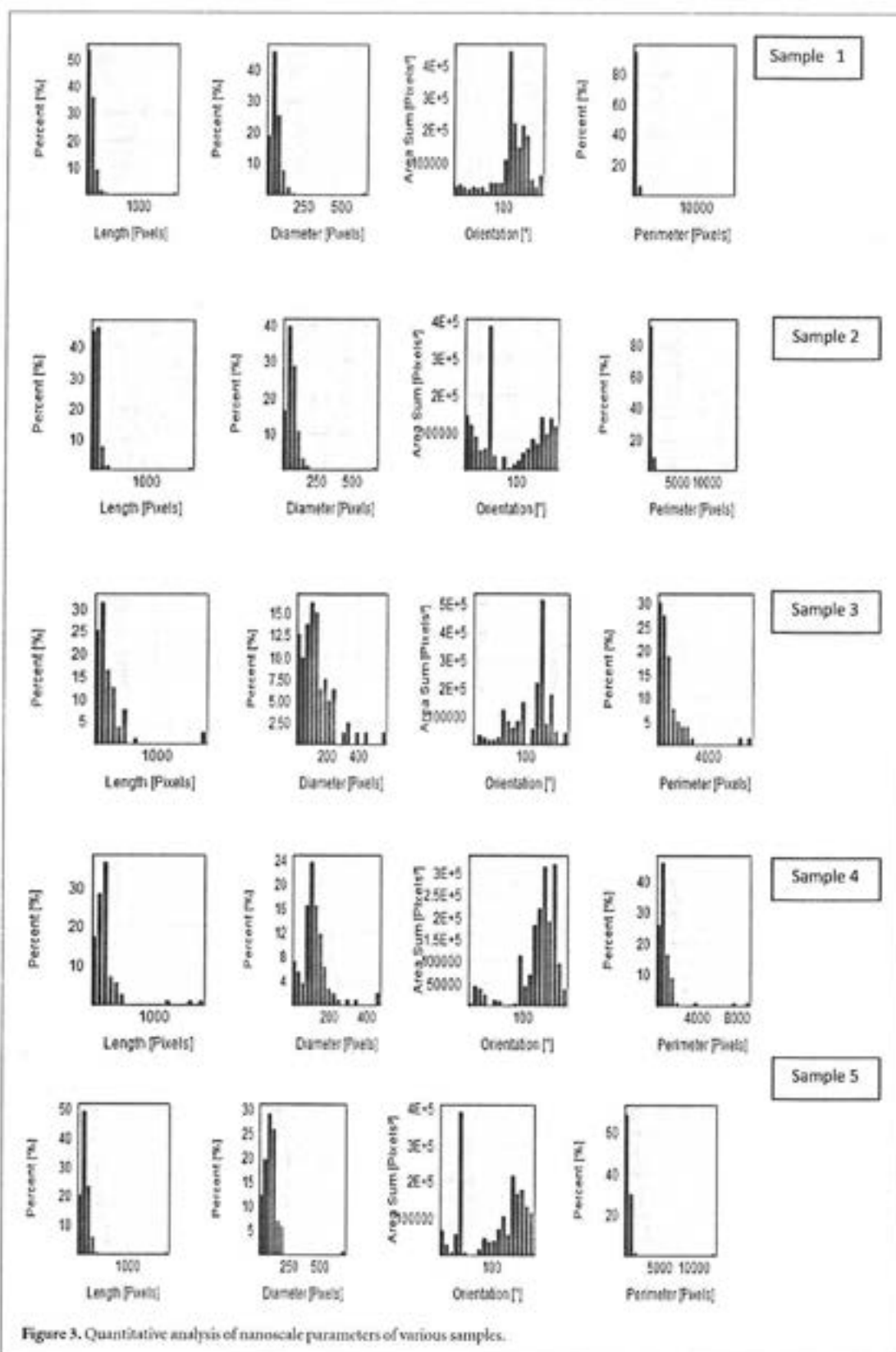
To present an analytical comparison between grain size and stoichiometry variation, grain size distribution images of all prepared CZTSe compounds have been presented in figure 4. In case of all the samples, grain size varied with its stoichiometry variation and its distribution with sample wise has been shown in table 4. It can be observed that sample 1 with perfect stoichiometry of $Cu_2ZnSnSe_4$ exhibited the highest mean grain size 250.4 nm while the sample 3 with 30% excess of Se had lowest mean grain size of 185.0 nm. Highest grain volume of
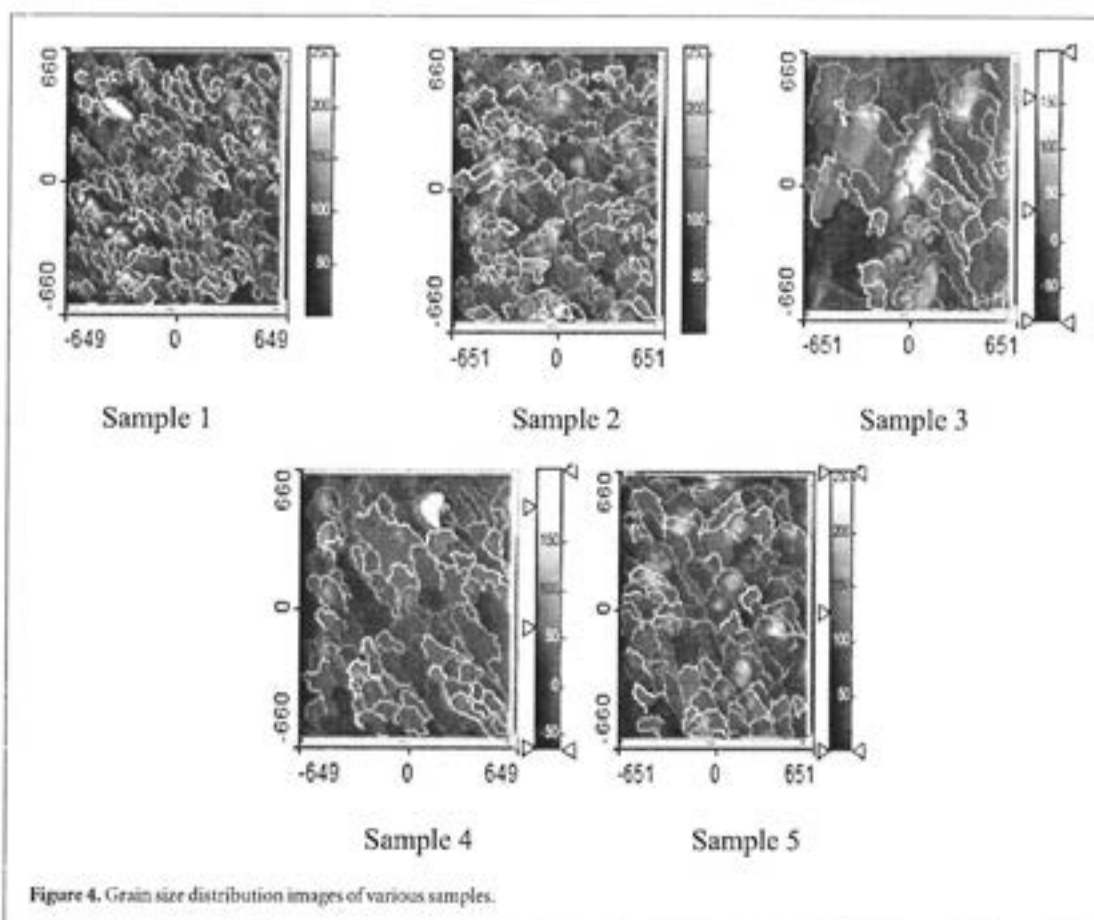
Figure 4. Grain size distribution images of various samples.
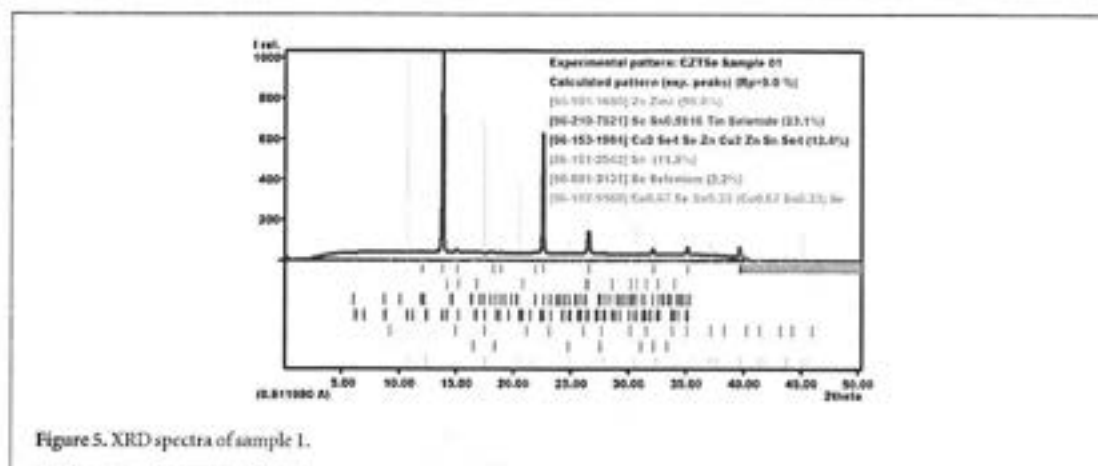
Figure 5. XRD spectra of sample 1.

6.130 μm^3 was shown by sample 5 with 10% Cu deficiency. Excess of Se in 30% with formation of $Cu_2ZnSnSe_{5.2}$ shows minimum of total grain volume of 3.715 μm^3.

XRD analysis

To get a view about the structural features of various samples XRD characterization has been performed. Figure 5 shows the XRD pattern recorded for sample 1. The solid state reaction of precursors in this sample led to the formation of orthorhombic binary phase of $Sn_{0.9816}Se$ and a ternary phase of cubic $Cu_{0.67}Sn_{0.33}Se$. The space groups exhibited by these binary and ternary phases were C m c m (63) and d F -4 3 m (216), respectively [20, 21].

The most intense peak was found for the value of 2θ at 13.80° corresponding to $Cu_2ZnSnSe_4$ phase with tetragonal structure of space group of I -4 2 m exhibiting d- spacing 2.5466Å with hkl parameters of (202) [22]. Some metallic elemental constituents like Zn, Sn and Se have been found unreacted in the sample 1 as presented

Table 5. Structural parameters of sample 1.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/I$_c$	c/2a	Density (calculated) gm/cm^3		X	Y	Z
Zn	Hexagonal	P 63/m m c (194)	a = 2.67000 c = 4.96600	10.960000	0.9299	7.08300	Zn	0.333	0.667	0.250
SeSn$_{0.965}$	Orthorhombic	C m c m (63)	a = 4.29978 b = 11.71878 c = 4.31479	8.760000	0.5016	5.97300	Sn	0.00 0.50	0.124	0.250
							Se		0.857	0.250
Cu2 Zn Sn Se4	tetragonal	I -4 2 m (121)	a = 5.68820 c = 11.33780	13.170000	0.9966	5.67600	Cu	0.000	0.50	0.250
							Zn	0.000	0.000	0.000
							Sn	0.000	0.000	0.500
							Se	0.259	0.259	0.371
Sn	cubic	F d -3 m (227)	a = 6.65596	17.580000	0.5	5.34800	Sn	0.00	0.00	0.000
Se	trigonal	R -3 m (166)	a = 3.82900 c = 2.79100	10.290000	0.3644	11.10000	Se	0.00	0.000	0.000
Cu$_{0.67}$SeSn$_{0.33}$	cubic	F -4 3 m (216)	a = 5.69600	13.4500	0.5	5.77600	Cu	0.250	0.250	0.250
							Sn	0.250	0.250	0.250
							Se	0.00	0.00	0.00

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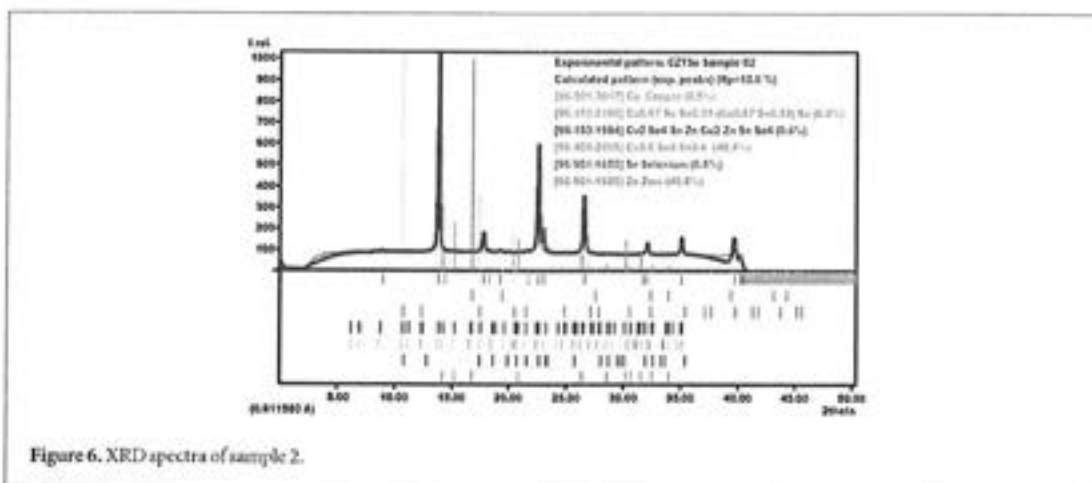
Figure 6. XRD spectra of sample 2.
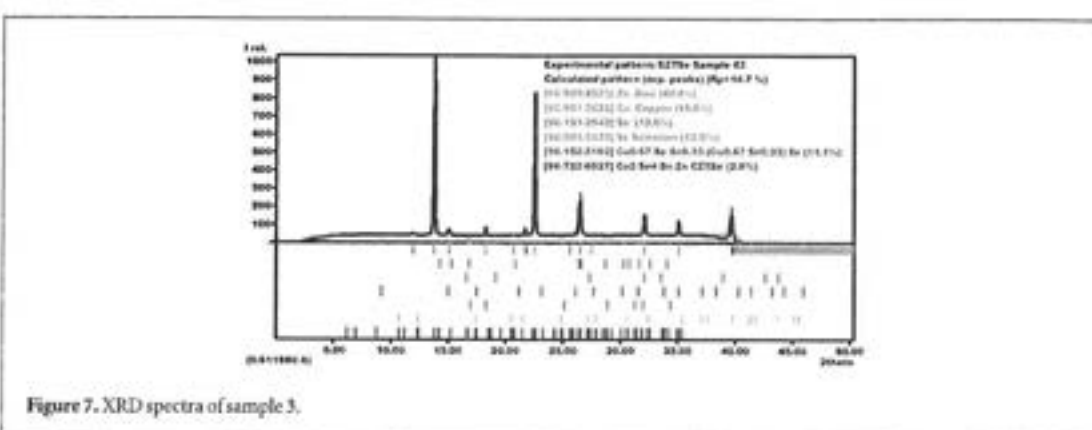
Figure 7. XRD spectra of sample 3.

in table 1 [23–25]. The peak at 2θ value of $32.12°$ with d-spacing of 1.1060 Å corresponds to trigonal Se with space group of R-3 m (166) [25]. Having a sight on percentage of formation of different phases it can be concluded that CZTSe formed is 1.9% while most of the Zn is found unreacted.

The XRD spectra of sample 2 presented in figure 6 illustrates the presence of ternary compounds $Cu_{5.6}Sn_{2.4}Se_8$ and $Cu_{0.67}Sn_{0.33}Se$. Peak located at 2θ value of $23.02°$ belongs to tetragonal $Cu_{5.6}Sn_{2.4}Se_8$ structure with space group of I-4 2 m (121) and unit cell dimensions are a = 5.74738 Å, c = 11.45583 Å [26] while the peak at $39.67°$ corresponds to $Cu_{0.67}Sn_{0.33}Se$ with d-spacing of 0.9018Å and hkl of (602). Phase $Cu_{0.67}Sn_{0.33}Se$ is found in cubic structure with space group of F-4 3 m (216) [27]. Wyckoff parameters for sample 1 have been shown in table 5.

Wyckoff parameters of atoms have been shown in table 6. The most intense peak at $13.77°$ corresponds to tetragonal $Cu_2ZnSnSe_4$ phase with d-spacing of 2.5517Å. The dominant peak found at $22.57°$ also belongs to $Cu_2ZnSnSe_4$ [22]. Metallic constituents like Cu, Se and Zn have been found unreacted in the sample. CZTSe formed is 0.4% while $Cu_{5.6}Sn_{2.4}Se_8$ is 48.4%.

The XRD pattern of sample 3 shown in figure 7 confirms the formation of ternary and quaternary phase of $Cu_{0.67}Sn_{0.33}Se$ and $Cu_2ZnSnSe_4$. The Wyckoff parameters for sample 3 have been shown in table 7. This table shows that the most intense peak corresponds to tetragonal $Cu_2ZnSnSe_4$ at 2θ value of $13.74°$ attributing hkl value of (202). The other intense peak located at $22.55°$ with d-spacing of 1.5650Å also belongs to CZTSe phase [28]. $Cu_{0.67}Sn_{0.33}Se$ formed is 11.1% while CZTSe is 2.9%. Peak at $32.10°$ confirms the presence of cubic Cu with space group of F m -3 m (225) while peak located at $35.09°$ belongs to cubic Sn with d-spacing of 1.0151Å [24, 29]. This analysis shows that as the melting point of Cu is 1085 °C and the solid state reaction is conducted at 850 °C Cu has not reacted completely with other constituents to form CZTSe compound.

Figure 8 presents the XRD of sample 4 which reveals that it comprises of elemental phases of Cu, Zn, Sn and Se. The most intense peak at $13.98°$ belongs to tetragonal CZTSe with d-spacing of 2.5195Å with hkl values of (121) [22]. The peak located at $26.87°$ represents Se with d-spacing of 1.3172Å exhibiting hkl values of (316) [30]. Lattice parameters of different phases formed in sample 4 are presented in table 8.

XRD pattern of sample 5 (figure 9) confirms the formation of ternary and quaternary phases along with residual metallic elemental constituents. Peak at 2θ value of $13.83°$ belongs to CZTSe with d-spacing of 1.8634Å with hkl values of (202) while second peak at $22.60°$ belongs to d-spacing of 1.5619Å with hkl values of (107)

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Table 6. Structural parameters of sample 2.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/Ic	c/2a	Density(calculated)(gm/cm³)		Wyckoff positions		
								X	Y	Z
Se	trigonal	P 31 21 (152)	a = 3.81000	10.470000	0.3706	6.12300	Se	0.249	0.00	0.333
			c = 5.11000							
Zinc	hexagonal	P 63 /m s m c (194)	a = 2.67000	10.960000	0.9299	7.08300	Zn	0.333	0.667	0.250
			c = 4.96600							
$Cu_{5.6}Se_{7}Sn_{2.4}$	tetragonal	I -4 2 m (121)	a = 5.74738	11.280000	0.9966	5.58300	Cu	0.000	0.000	0.000
			c = 11.45583							
							Cu	0.000	0.000	0.500
							Cu	0.000	0.500	0.250
							Sn	0.000	0.000	0.500
							Sn	0.000	0.500	0.250
							Se	0.257	0.257	0.372
$Cu_2ZnSn\,Se_4$	tetragonal	I -4 2 m (121)	a = 5.68820	13.170000	0.9966	5.67600	Cu	0.000	0.500	0.250
			c = 11.33780							
							Zn	0.000	0.000	0.000
							Sn	0.000	0.000	0.500
							Se	0.259	0.259	0.371
Cu	cubic	F m -3 m (225)	a = 3.67200	12.040000		8.52500	Cu	0.000	0.000	0.00
$Cu_{0.67}SeSn_{0.33}$	cubic	F -4 3 m (216)	a = 5.69600 Å	13.4500		5.77600	Cu	0.250	0.250	0.250
							Sn	0.250	0.250	0.250
							Se	0.00	0.00	0.00

Table 7. Structural parameters of sample 3.

Empirical formula	Crystal system	Space Group	Unit Cell dimension	I/Ic	c/2a	Density(calculated)gm/cm³		Wyckoff positions		
								Y	X	X
Cu	cubic	Fm-3m (225)	a = 3.67200	12.040000	0.5	8.5250	Cu	0.00	0.00	0.00
Se	trigonal	R-3m (166)	a = 3.85000 c = 2.64500	9.730000	0.3435	11.58500	Se	0.00	0.000	0.00
Sn	Cubic	Fd-3m (227)	a = 6.65596 Å	17.580000	0.5	5.34800	Sn	0.000	0.000	0.000
Cu_2Se_4SnZn	tetragonal	I-42m (121)	a = 5.69647	13.130000	0.9953	5.65700	Cu	0.000	0.000	0.000
							Cu	0.000	0.500	0.250
							Zn	0.000	0.500	0.250
							Sn	0.000	0.000	0.500
							Se	0.759	0.241	0.129
Zn	hexagonal	P63/mmc (194)	c = 11.3394 a = 2.66480 c = 4.96670	10.960	0.9281	7.13900	Zn	0.333	0.667	0.250
$Cu_{0.67}Sn_{0.33}Se$	cubic	F-43m (216)	a = 5.69600 Å	13.450	0.5	5.77600	Cu	0.250	0.250	0.250
							Sn	0.250	0.250	0.250
							Se	0.00	0.00	0.00
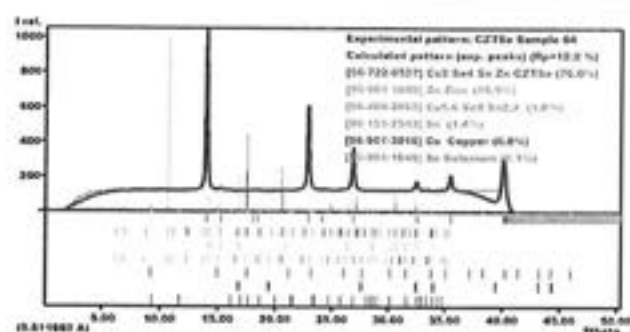
Figure 8. XRD spectra of sample 4.
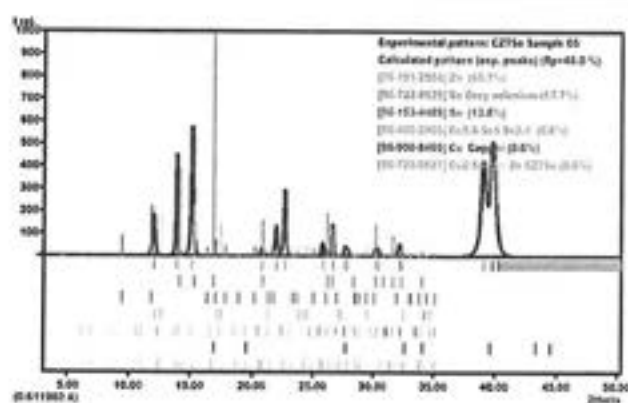
Figure 9. XRD spectra of sample 5.
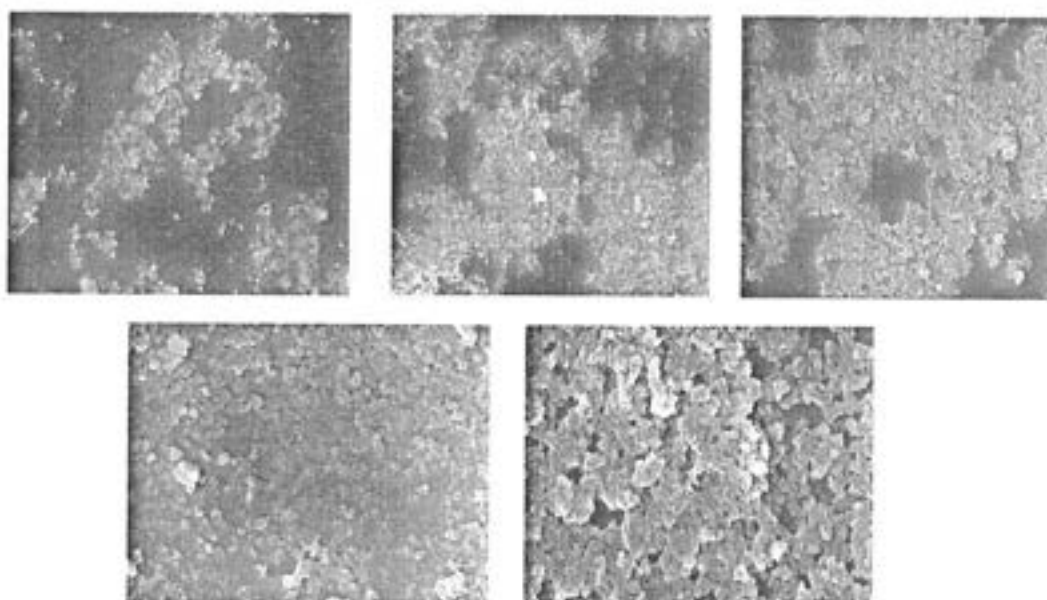
Figure 10. SEM images of various samples.

[22]. Peak at 20.80° belongs to elemental metallic phase of Zn [1] Peak at 27.64° shows the formation of ternary phase of $Cu_{5.6}Se_8Sn_{2.4}$ with hkl values of (208) with d- spacing of 1.2791Å [26]. Metallic elements like Sn, Se and Cu were also detected in this sample [21, 24, 31–33]. The lattice parameters were determined from XRD peaks which have been presented in table 9. CZTSe is formed in a very small quantity.

Table 8. Structural parameters of sample 4.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/Ic	c/2a	Density (calculated) gm/cm³		Wyckoff positions X	Y	Z
Zn	hexagonal	P 63/m m c (194)	a = 2.6700	10.960000		7.08300	Zn	0.333	0.667	0.250
			c = 4.96600		0.9299					
Sn	cubic	F d -3 m (227)	a = 6.65596	17.580000	0.5	5.34800	Sn	0.000	0.000	0.000
Cu	cubic	F m -3 m (225)	a = 3.63000 Å	11.990000	0.5	8.82400	Cu	0.00	0.00	0.00
							Cu	0.00	0.500	0.250
Cu₂Se₄SnZn	tetragonal	I -4 2 m (121)	a = 5.68820	13.17000	0.9966	5.67600	Zn	0.00	0.000	0.000
			c = 11.3378	0			Sn	0.00	0.00	0.500
				9.150000			Se	0.259	0.259	0.371
Se		P 31 2 1 (152)	a = 4.36800		0.5675	4.80100	Se	0.225	0.000	0.333
	trigonal		c = 4.95800							
				11.280000						
Cu₃.₆Sn₁.₄ Se₈		I -4 2 m (121)	a = 5.74738				Cu	0.00	0.00	0.00
	tetragonal		c = 11.45583		0.9966	5.58300	Cu	0.00	0.00	0.25
							Cu	0.00	0.50	0.50
							Sn	0.00	0.00	0.25
							Sn	0.00	0.50	0.372
							Se	0.257	0.257	0.345

Table 9. Structural parameters of sample 5.

Empirical formula	Crystal system	Space group	Unit Cell dimension (Å)	I/Ic	c/2a	Density (calculated) gm/cm³		X	Y	Z
Cu₁.₆Se₈Sn₂.₄	tetragonal	I-4 2 m (121)	a = 5.74738	11.280000	0.9966	5.58300	Cu	0.000	0.00	0.000
			c = 11.45583				Cu	0.000	0.000	0.500
							Cu	0.000	0.500	0.250
							Sn	0.000	0.000	0.500
							Sn	0.000	0.500	0.250
							Se	0.257	0.257	0.372
Zn	hexagonal	P 63 /m m c (194)	a = 2.66169	10.900000	0.9399	7.07300	Zn	0.333	0.667	0.750
			c = 5.06397							
Sn	tetragonal	I 41/a m d (141)	a = 5.83170 c = 3.18130	11.460000	0.2727	7.28700	Sn	0.00	0.00	0.000
Se	trigonal	P 31 2 1 (152).	a = 4.31250	9.240000	0.5763	4.91300	Se	1.000	0.229	0.667
Cu	cubic	F m -3 m (225)	c = 4.97110	0.5		8.93500	Cu	0.000	0.00	0.00
Cu2 Zn Sn 5e4	tetragonal		a = 3.61496	11.970000	0.9966	5.67600	Cu	0.000	0.500	0.250
		I-4 2 m (121)	a = 5.68820	13.170000			Zn	0.000	0.000	0.000
			c = 11.3378				Sn	0.000	0.000	0.500
			a = 5.68820				Se	0.259	0.259	0.371
			c = 11.3378							
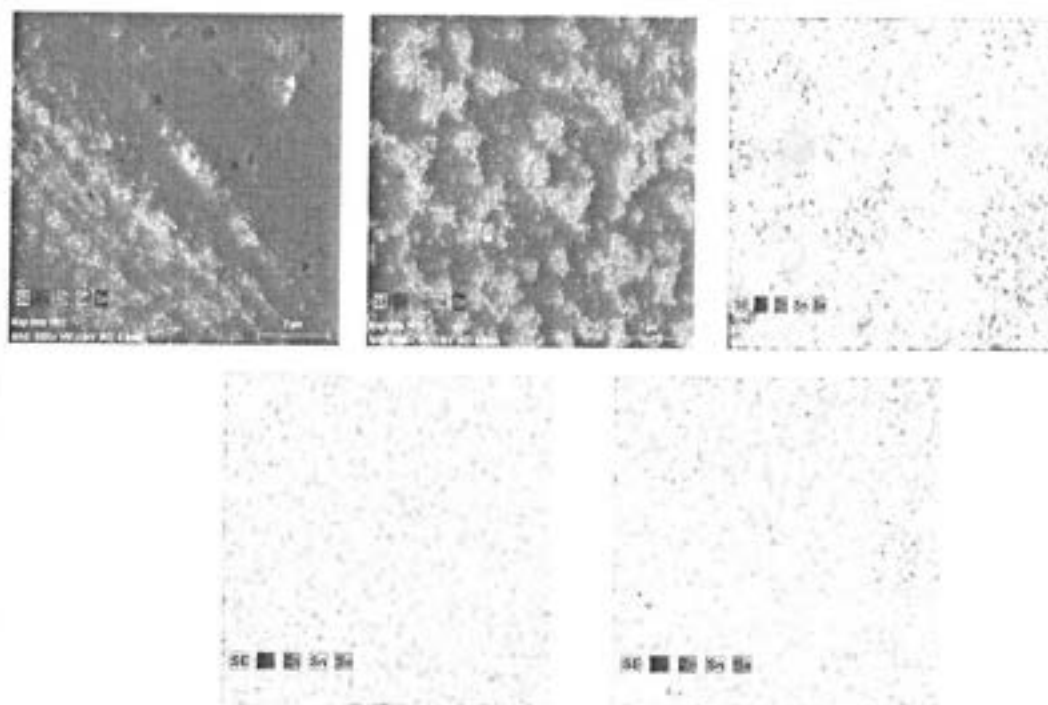
Figure 11. Elemental mapping images for various samples.
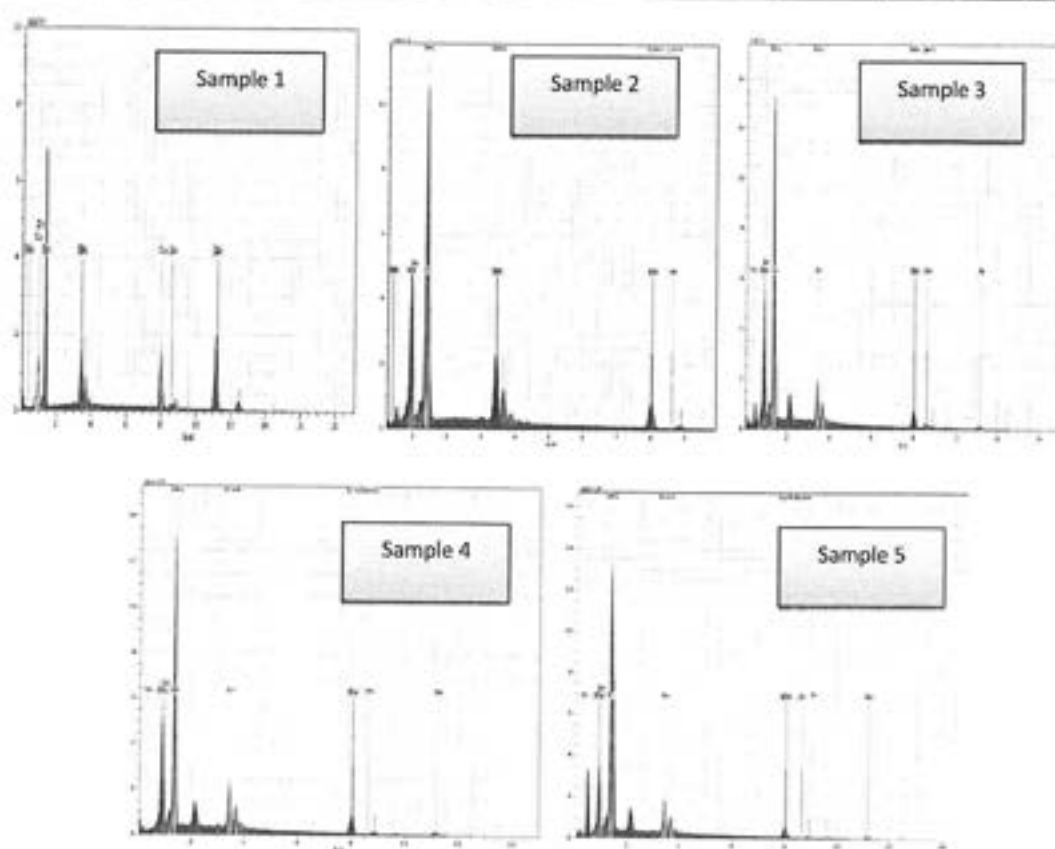
Figure 12. EDAX spectra of various samples.
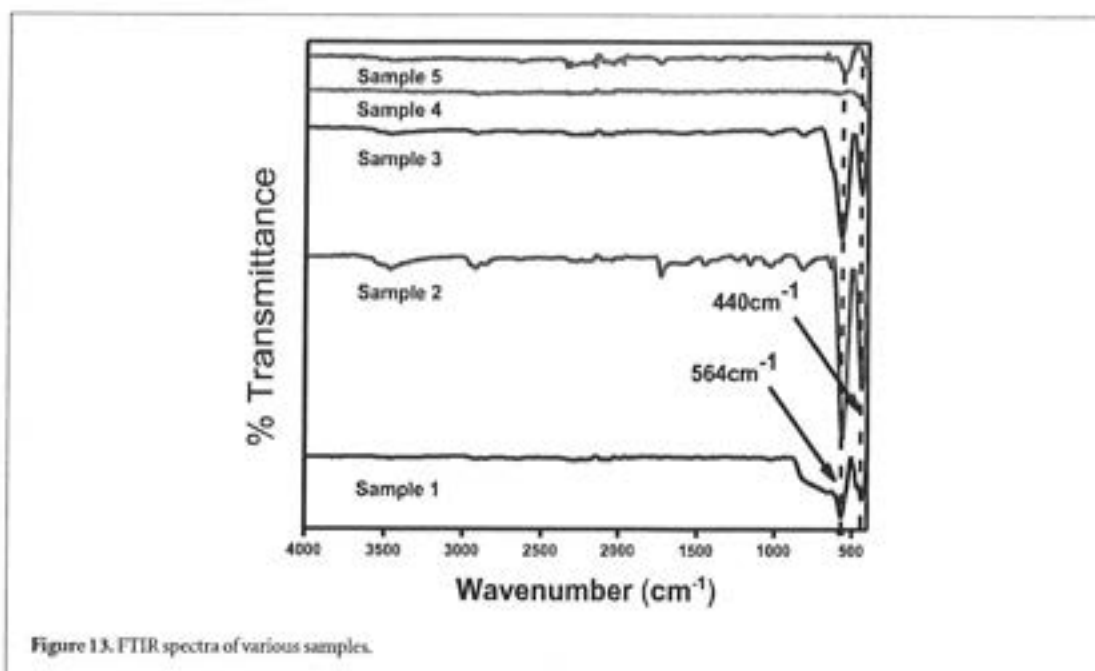
Figure 13. FTIR spectra of various samples.

Table 10. Elemental composition variation studied from EDX.

Sample	Elemental composition at (%)			
	Cu/Zn	Cu/Sn	Se/(Cu +Zn+Sn)	Cu/ (Zn+Sn)
Sample 1	2.77	2.04	1.088	1.180
Sample 2	2.08	1.99	1.038	1.701
Sample 3	2.11	2.27	1.099	1.094
Sample 4	2.44	2.13	1.085	1.92
Sample 5	2.16	1.87	1.078	1.85

SEM and EDAX analysis

Figure 10 shows the FESEM micrographs recorded for different samples of CZTSe compound. Dispersed nano particles in CZTSe compounds could be observed through these images. From the EDX spectra, the compositions are estimated and are presented in table 10. The distribution of elements in all five samples are observed by using EDX based mapping which are underlying uniform stoichiometry distribution in the samples and are presented in figures 11 and 12.

FTIR analysis

Fourier transform infrared (FTIR) spectroscopy has been employed in order to rule out the presence of either organic or inorganic impurities in various samples. The presence of various functional groups can be clearly seen for the various samples in figure 13. The group frequency identified in all sample is 564 cm^{-1} and 440 cm^{-1}. Wavenumber 564 cm^{-1} has been attributed to the presence of C-Br (alkyl halide) functional group with bond stretching.

Conclusions

Topographical scan of AFM images of solid state reacted CZTSe compounds has been evaluated. The analysis revealed that all samples exhibited peaks and valley structure independent of compositional variations. A significant difference has been observed in roughness parameters and grain size with respect to Cu/Zn variations and it can be concluded that Cu deficiency and excess of Zn in the samples caused a decrement in mean grain size with respect to perfect stoichiometric sample of CZTSe. These observations have been analysed and verified in terms of XRD and SEM-EDAX studies. The FTIR studies show that all the samples have presence of C-Br (alkyl halide) functional group which shows that their elemental purity remains same despite variation in the

stoichiometry in different samples. This quantitative study of surface features provides an extensive understanding about the effect of compositional variations on surface morphology which is very useful for device applications.

Acknowledgments

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Morphological characterization and microstructural study of Cu$_2$ZnSnSe$_4$ thin films with compositional variation

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Keywords: CZTSe thin films, AFM, SEM-EDX, XRD

Abstract

In second generation thin film solar cell, Cu$_2$ZnSnSe$_4$ (CZTSe) is used as an absorber layer due to some remarkable properties like non-toxicity and earth abundancy. In this paper we have presented the preparation of Cu$_2$ZnSnSe$_4$ thin films in five different elemental ratios employing the RF-DC sputtering and E-beam deposition technique. In order to study the effects of elemental compositional variation on structural and morphological properties, thin films were characterized using SEM-EDX, XRD and AFM technique. Elemental compositional variation is studied using EDX technique. Numerical analysis of the surface parameters affected by compositional variations are presented against the data processed by AFM images. Watershed based segmentation algorithm is employed to present a quantitative grain size distribution. Variation in growth exponent (β) and roughness critical exponent (α) due to compositional variation in CZTSe thin films is studied using height-height correlation function. Auto correlation length varied from 3.65 nm to 4.44 nm while R$_{ku}$ is found greater than three for all thin films. A critical analysis of fractal dimension and auto correlation length with surface parameters like amplitude parameters, spacing parameters and hybrid parameters is also presented. Optoelectronic properties are studied with respect to compositional variation. Sample with lowest Cu/(Zn+Sn) ratio showed the lowest value of band gap of 0.909 eV. EDX results confirmed that the atomic ratio of Cu-Zn-Sn-Se in thin films of all CZTSe samples remained controlled. Films showed tetragonal kesterite crystal structure with the space group of I$-$4 2 m with preferential orientation along the (105) plane.

1. Introduction

CZTS and CZTSe, quaternary semiconductors have recently emerged as a suitable absorber layer for thin film solar cell due to some inescapable properties like non-toxicity and earth abundant over other chalcogenides. CZTSe is reported in Kesterite and stannite structure. Both structures differ in the arrangement of atoms. The earlier investigations of XRD studies of CZTSe reveals that Kesterite CZTSe possesses optical band gap within the range of 1.42 and 1.57 eV with lattice parameters of $a = 0.569$ nm, $c = 1.141$ nm [1]. There is a good indication of interest towards CZTSe thin films as many vacuum and non-vacuum techniques have been employed for the fabrication of CZTSe thin films like thermal evaporation [1–5], sputtering [4] etc. Substrate temperature is an important factor which can control the formation of some secondary phases. It was reported by Sunghun et al that thickness decreases and grain size increases with increment in substrate temperature. At the substrate temperature of 773°K decomposition of CZTSe occurred into the phases of Cu$_2$Se and ZnSe while pure CZTSe were grown at the substrate temperature of 593° K and solar cell of these absorber layer showed 2.88% conversion efficiency [2]. Excess of Sn constituents in Stannite CZTSe semiconductor lead to formation of secondary phase of SnSe$_2$ while excess of Cu in stannite CZTSe generates CuSe phase [3]. Single phase p-type CZTSe structure fabricated by sputtering of CZT target and selenization process between the temperature of 400°C to 500°C showed resistivity within the range of 0.20 Ω.cm to 1.95 Ω.cm [4]. Dependence of hole concentration on Cu/(Zn+Sn) ratio is explained by Tanaka et al as it is measured in order of 10^{17} cm^{-3} for ratio
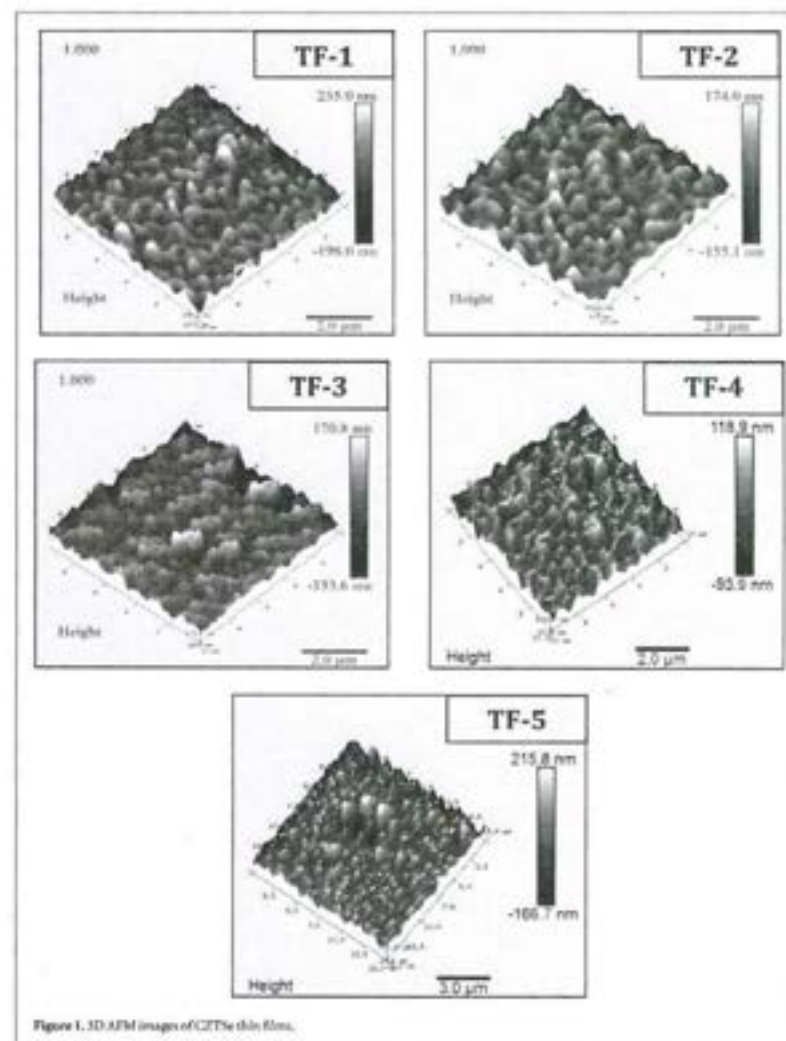
Figure 1. 3D AFM images of CZTSe thin films.

of 0.7 and increases to over 10^{20} cm^{-3} with ratio exceeding to 0.9. Existence of Cu$_2$Se phase was confirmed with increasing the Cu/(Zn+Sn) ratio upto 0.9 [5]. Solar cell prepared by the annealing process of bilayer structure Cu$_2$SnSe$_3$ and ZnSe at 500 °C showed conversion efficiency of 7% [6]. XRD results of electrodeposited CZTSe i.e. CZT + Se showed that CZT stacked layers contained some other phases like η-Cu$_{6.26}$Sn$_5$, Sn and γ-CuZn$_5$ phases and annealing at higher temperature lead to the formation of pure CZTSe phase [7].

The study of Compositional analysis of Cu$_2$ZnSnSe$_4$ (x = 1.4 to 2.2) pellets prepared by liquid phase sintering reveals that Cu, Zn, Sn and Se settled at 1$^+$, 2$^+$, 4$^+$ and 2$^-$ valance states respectively. P-type CZTSe for x = 1.8 and 2.0 exhibited highest value of mobility while for x = 1.6 showed lowest mobility and hole concentration [8]. Atom probe topography study of CZTSe thin films can be used as an important tool to get the information about the composition at the interface. Topographical study of CTSe detects the presence of

Table 1. Stoichiometry variations in elemental composition in CZTSe thin films.

Sample ID	Stoichiometry	Cu/Zn	Cu/Sn	Se/(Cu + Zn + Sn)	Cu/(Zn + Sn)
TF-1	$Cu_2ZnSnSe_4$	2.0	2.0	1.0	1.0
TF-2	$Cu_2ZnSnSe_{5.6}$	2.0	2.0	1.4	1.0
TF-3	$Cu_2ZnSnSe_{5.2}$	2.0	2.0	1.3	1.0
TF-4	$Cu_{1.8}ZnSnSe_{5.2}$	1.8	1.8	1.36	0.9
TF-5	$Cu_2Zn_{1.1}SnSe_{5.5}$	1.8	2.0	1.26	0.91

Table 2. Comparative analysis of roughness of CZTSe thin films with respect to stoichiometry ratio.

Sample ID	R_a (nm)	R_q (nm)	R_z (nm)	R_q/R_a	R_{ku}	R_{sk}
TF-1	44.0	57.9	683	1.315	5.10	0.654
TF-2	35.7	45.7	515	1.280	3.88	0.374
TF-3	29.9	39.1	412	1.304	4.44	0.636
TF-4	21.7	29.6	371	1.364	7.56	0.959
TF-5	32.9	45.2	419	1.373	5.85	0.871

Nanometer sized ZnSe grains near grain boundaries and after annealing at 500 °C a variation in Composition near grain boundaries was observed [9].

Optical properties exhibited by CZTSe are suitable from solar cell point of view. The direct optical band gap values of CZTSe are around 1.0 eV with absorption coefficient of 10^4 cm^{-1}. Dielectric constant and carrier concentration is also affected by impurity present in the CZTSe [10]. Optical spectroscopy study of CZTSe thin films shows that Cu/(Zn+Sn) ratio highly causes a deviation in the value of energy band gap. Cu deficiency and Zn excess causes to increase the band gap [11]. An increment in transmittance of Kesterite CZTSe thin films are detected for annealing process within the temperature range of 300°C to 400°C and annealing beyond the temperature of 450°C caused decrement in transmittance and resistivity [12]. The maximum conversion efficiency delineated by high performance CZTSe solar cell with short circuit current density of 39.7 mA cm^{-2} is 10.4% under AM1.5 G [13].

2. Experimental

CZTSe thin films are deposited on soda lime glass substrate and Si- wafer employing RF-DC sputtering and e-beam method. Prior to deposition all substrates were given ultrasonic bath in acetone for 15 minutes and then were heated in acetone with maintaining the stirring rate of 100 rpm for 5 minutes on hot plate at 70°C to remove the contamination from the surface. In last substrates were cleaned by using deionized water and were dried. In order to fabricate CZTSe, firstly Cu deposition was accomplished by employing DC sputtering method. During Cu deposition, the camber was evacuated to the pressure of 9.0 mtoer with Ar gas flow at the rate of 15.1 sccm. The deposition rate was 1.0 Å s^{-1} and DC voltage of value 502 volt with 0.05 ampere current was applied. Zn was deposited by RF sputtering of 99.99% pure target of Zn. The deposition conditions maintained during Zn sputtering process were as: (i) Power: 49 watt (ii) Deposition rate: 0.6 Å s^{-1} (iii) Vacuum: 11.8 mtoer (iv) Rotation of substrate: 10 rpm. E- Beam vacuum deposition technique was used for Sn and Se deposition. In case of Sn deposition, deposition rate was maintained at 1.0 Å s^{-1} with the application of current and voltage of 1.2 milli ampere and 5.20 kV respectively. After the deposition of CZT stacked layers, Se was deposited at the top of CZT structure. In the process of Se deposition current and voltage was maintained at the value of 1 milli ampere and 5.20 kV respectively and deposition rate was 1.2 Å s^{-1}. Stoichiometry variations done in elemental compositions in $Cu_2ZnSnSe_4$ thin films are disclosed in table 1.

3. Results

3.1. Surface statistical study by AFM result analysis

Electrical, mechanical and optical properties are highly influenced by surface morphology. From the device point of view, there is a big need of present era to have a deep investigation of surface parameters of thin films. The most famous technique used for the surface imaging is an atomic force microscope (AFM). Figure 1 shows the AFM images (3D) of CZTSe thin films deposited on Si- wafer. There is clear evidence from these AFM images
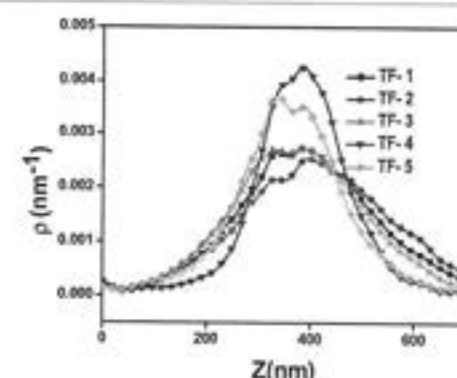
Figure 2. Height distribution function against AFM data for CZTSe thin films.

that surface parameters like average surface roughness and grain size are highly influenced by its constituent variation.

A comparative analysis of surface parameters of CZTSe thin films with respect to Cu/(Zn + Sn) ratio is shown in table 2. Average roughness R_a which represents the deviation in height is found maximum with value 44.0 nm for TF-1 with exhibiting the value of Se/(Cu + Zn + Sn) = 1 with perfect stoichiometry. TF-4 with 10% Cu deficiency and 30% excess of Se i.e. $Cu_{1.8}ZnSnSe_{5.2}$ showed minimum average roughness 21.7 nm. Similar type of tendency is observed in case of standard deviation of surface height i.e. root mean square roughness R_q as maximum value is exhibited by TF-1.

Surface parameter R_z (Ten point height) is defined by two standard definitions as per German DIO system and international ISO system. ISO system exemplify R_z with a difference between the five lowest valleys and five highest peaks. On the other hand DIN system defines it as an average taken over the summation of five highest peaks and lowest valleys as follows [14]:

$$R_z = \frac{1}{n}\left(\sum_{i=1}^{n} p_i - \sum_{i=1}^{n} v_i\right) \text{ As per ISO system}$$

$$R_z = \frac{1}{2n}\left(\sum_{i=1}^{n} p_i + \sum_{i=1}^{n} v_i\right) \text{ As per German system}$$

The value of R_z is found maximum (686 nm) for TF-1 ($Cu_2ZnSnSe_4$) and minimum (371 nm) for TF-4 with 10% Cu-deficiency and 30% excess of Se. Excess in the quantity of Se and Cu deficiency caused a decrement in ten point height relative to TF-1 ($Cu_2ZnSnSe_4$) while excess of 10% Zn lead towards the increment in the trend.

The fourth moment of profile amplitude function, Kurtosis parameter i.e. R_{ku} is the assessment of the surface sharpness. It can be classified into three categories depending upon the value as (i) $R_{ku} = 3$ indicates the Gaussian amplitude distribution (ii) $R_{ku} < 3$ shows the flat surface (iii) $R_{ku} > 3$ denotes a surface exhibiting more peaks rather than valleys [14]. The value of R_{ku} greater than 3 is shown by all samples which is clearly indicating the existence of more peaks on the surface rather than valleys. Surface skewness R_{sk} denoted by third moment of profile amplitude density function is the measurement of profile symmetry about mean line. It is also categorized into three levels to give the specification about the surface feature. (i) $R_{sk} = 0$ shows symmetrical height distribution (ii) $R_{sk} > 0$ (positive) shows the surface with asymmetrical distribution exhibiting more peaks than valleys (iii) $R_{sk} < 0$ (negative) denotes the dominancy of valleys on the surface [14].

All CZTSe samples irrespective of compositional variation are demonstrating the value of surface skewness more than zero which is witnessing the surface with asymmetrical distribution with more peaks.

Variation in the roughness parameters are desirable in thin films with thickness variation. Average surface roughness is the arithmetic average of surface heights. The differences in the roughness parameters like average roughness (R_a), RMS roughness (R_q), kurtosis (R_{ku}) and skewness (R_{sk}) arises due to the statistical variation in height of the individual points in each image. In case of multilayer structure, the atoms of first layer diffuse to the

Figure 3. Height-Height correlation function H as a function of t plotted on log-log scale for CZTSe films deposited for different Cu/(Zn + Sn) ratio.
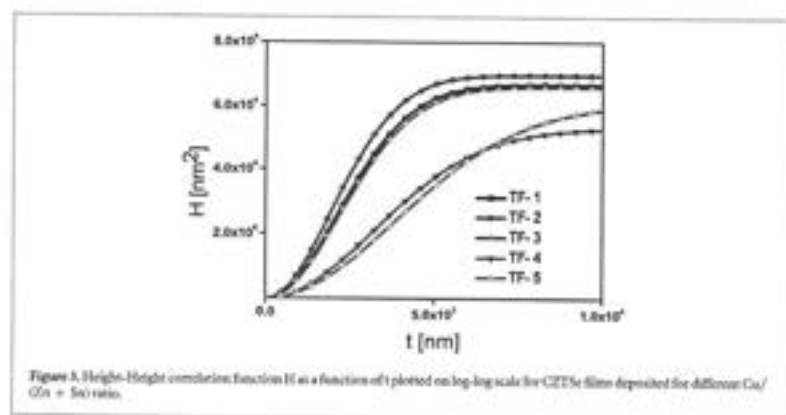
Table 3. Comparative analysis of roughness parameters.

Sample ID	D_f	T (nm)	Auto-correlation length S_a (nm)	σ (pm)	α (pm)	Growth exponent $\beta (\times 10^2)$	W (nm)
TF-1	2.35	3.06	3.65	182.8	15.37	14.83	73.413
TF-2	2.35	2.81	3.71	186.5	18.21	44.79	85.128
TF-3	2.35	3.14	3.58	181.8	20.57	69.79	72.146
TF-4	2.30	4.56	4.20	162.8	31.79	158.7	61.108
TF-5	2.29	5.47	4.44	174.6	24.00	48.48	76.560

surface of substrate meeting each other to form dimers. When another layer is deposited on the top of first layer, the atoms land at the top of existing island and diffuse with higher probability to hop down at the bottom layer.

This layer by layer growth plays essential role in determining the surface roughness parameters and this surface roughness will vary with multi-layer structure with compositional variation. Highest value of R_a, R_q and R_z is exhibited by TF-1 i.e. $Cu_2ZnSnSe_4$ as the introduction of Se in lower amount in comparison to other samples caused the etching process which generated a raise in the parameters while other samples exhibits Se in higher amount with lower roughness and this could be related to the surface diffusion. However skewness and kurtosis shows the shape of the surface height distribution in terms of the peaks and valley distribution [15].

One dimensional distribution function, an important parameter which is also known as height distribution function denoted by p(h) gives us the probability of a surface height between h and h+dh [15].

$$p(h) = \frac{1}{\sqrt{2\pi}\,\sigma} \exp\left(-\frac{h^2}{2\sigma^2}\right)$$

Figure 2 shows the plot of height distribution for all CZTSe samples. The curves represent the Gaussian distribution of height over the surface. Almost perfect Gaussian distribution is exhibited by TF-4. To show the reflection of compositional variation in CZTSe thin films on the surface morphology, statistical analysis is performed by height-height correlation function $H(\rho)$. It is mathematically represented as [15]

$$H(\rho) = E\{[h(r) - h(r + \rho)]^2\}$$

Where h(r) denotes the surface height at position vector (r) relative to mean surface height. In order to study the dynamic scaling behavior, height-height correlation function is plotted in figure 3 for a stimulated Gaussian surface. This curve is fitted by using the formula

$$F(x) = 2\sigma^2[1 - \exp(-(x/T)^2)]$$

In the above formula σ denotes the root mean square deviation of heights and T is auto correction length. Plot of HHCF for CZTSe thin films for five different compositional variations is shown in figure 3. The obtained value of hurst parameter (α), fractal dimension, auto correlation length (T), long roughness parameter/root mean square deviation of heights (σ), growth exponent (β) and roughness W(nm) are listed in table 3. Growth exponent (β) characterizes the time dependence of the roughness as follows.

Table 4. Variation in lateral parameters for CZTSe thin films with compositional variation.

Sample ID	Average wavelength of the profile $\lambda_a \times 10^{-6}$ m	Root mean square (RMS) wavelength of the profile $\lambda_q \times 10^{-6}$ m	Root mean square waviness $W_q \times 10^{-9}$ m	Waviness average $W_a \times 10^{-9}$ m	Waviness maximum height $W_{max} \times 10^{-9}$ m
TF-1	1.28443	1.13447	1.00287	1.23816	6.29421
TF-2	1.25593	1.07571	2.347	1.94487	4.41367
TF-3	1.07538	1.03064	1.71757	1.65734	7.8763
TF-4	1.15881	1.07060	1.9048	1.5221	7.24601
TF-5	1.28133	1.10986	1.80814	1.50846	7.74790

Figure 4. Elemental mapping images for CZTSe thin films.

Table 5. Variation in hybrid parameters in CZTSe thin films respective to compositional variation.

Sample ID	Maximum height of the profile (P_t) $\times 10^{-10}$ m	Mean spacing of profile irregularities (S_m) $\times 10^{-9}$ m	Average absolute slope (Δ_a)	Root mean square (RMS) slope (Δ_q)	Profile length ratio l_r
TF-1	6.03922	1.68137	0.0492822	0.0656444	1.00215
TF-2	6.80275	1.17978	0.0736875	0.105404	1.00508
TF-3	8.03922	1.64618	0.0777964	0.105905	1.00534
TF-4	7.29413	1.10456	0.0468909	0.0631492	1.00198
TF-5	1.09804	1.3719	0.0298213	0.0432205	1.00093

$$R_q(L, t) \propto t^{\beta}$$

Growth exponent $\beta (\times 10^{6})$ is found within the range of 14.0–158 ($\times 10^{6}$). TF-4 with 10% Cu deficiency showed the maximum value of growth exponent with 158.7 $\times 10^{6}$ while lower value was exhibited by TF-1. The roughness critical exponent (α) is given by [16]

$$R_q(L, t) \propto t^{\alpha}$$

The roughness parameter α is found to vary within the range of 15–32 pm. Fractal dimension, an important characteristics of surface feature is calculated by using cube counting method with linear interpolation method. Roughness critical exponent (α) tells about the texture of roughness which is connected to fractal dimension. Mathematically Fractal dimension is given by the formula $D_f = D - \alpha$.

The value of D_f is measured almost 2.3 for all samples. A very small variation in the value of fractal dimension is observed with respect to compositional variation in CZTSe thin films. The hybrid parameters are the consolidation of amplitude and spacing including the mean slope of the profile (Δ_a), RMS slope of the profile (Δ_q), average wavelength (λ_a), RMS wavelength (λ_q), waviness factor of the profile (W_t) etc. Average wavelength λ_a specifies spacing between local peaks and valleys analogous to their amplitudes and spatial frequencies.

$$\lambda_a = \frac{2\pi R_a}{\Delta_a}$$

Where R_a is average height and Δ_a is mean slope of profile. TF-3 with 30% excess of Se, Cu$_2$ZnSnSe$_{3.3}$ showed the maximum value of λ_a of 1.87936 nm. Spacing between local peaks and valley λ_a is found minimum for TF-4 with value of 1.15395 nm. RMS wavelength λ_q is the measure of root mean spacing between local valleys and peaks and mathematically given as follows:

Table 6. Analysis of grain parameters using AFM images.

Sample ID	Mean grain area (nm²)	Mean grain size (pm)	Total grain volume (nm³)	Total projected boundary length (µm)
TF-1	0.2059	203.5	245.9	1.388
TF-2	0.1843	190.9	233.5	1.478
TF-3	0.1774	195.3	166.3	1.449
TF-4	0.1468	156.2	116.8	0.9069
TF-5	0.1466	148.9	159.1	1.079

Table 7. Stoichiometry variations in elemental composition in CZTSe thin films.

Sample ID	Cu/Zn	Cu/Sn	Se/Cu + Zn + Sn)	Cu/(Zn + Sn)
TF-1	1.92	1.06	1.02	0.68
TF-2	1.91	1.66	1.428	0.68
TF-3	1.96	1.87	1.31	0.69
TF-4	1.80	0.98	1.38	0.63
TF-5	1.74	1.06	1.28	0.66

$$\lambda_q = \frac{2\pi R_q}{\Delta_q}$$

Root mean spacing between the peaks and valleys is found maximum for TF-3 (30% excess of Se) while lower value is shown by TF-4. Waviness factor of profile W_t is the ratio of arithmetic average height and the mean spacing of profile S_m [16]. Mean slope of the profile (Δ_a) express the mean absolute profile slope over the assessment length and is affected by some mechanical properties like reflectance, friction, elastic constant etc. Mathematically it can be calculated by taking the average of slope between two successive points of the profile.

$$(\Delta_a) = \frac{1}{L} \int_0^L \left| \frac{dy}{dx} \right| dx$$

An increment in Δ_a is observed upto the TF-3 with the increment in the amount of Se only in CZTSe thin films, after that a decrement could be seen in this parameter due to 10% Cu deficiency and 10% excess of Zn. Root mean square slope of the profile Δ_q is given by

$$(\Delta_q) = \sqrt{\frac{1}{L} \int_0^L [\theta(x) - \bar{\theta}]^2 dx}$$

Where $\bar{\theta} = \frac{1}{L} \int_0^L \theta(x) dx$ [16]

Table 4 summarizes the variation in hybrid parameters in CZTSe thin films against the compositional variations. A drastical drop in the value of maximum height of the profile P_t (vertical distance between the deepest valley and highest peak) is observed for TF-5 i.e. Cu$_2$Zn$_{1.3}$SnSe$_{3.3}$ [17]. Mean spacing between profile peaks is prescribed by mean spacing at mean line (S_m) and can be calculated by following equation.

$$S_m = \frac{1}{N} \sum_{i=1}^{N} S_i$$

Where number of profile peak at the mean line is denoted by N. From the data reported in table 5, it can be concluded that hybrid parameters are influenced by elemental composition variation in CZTSe thin films. The value of profile length ratio is found almost 1.00 for all samples having no influence of Cu/(Zn + Sn) ratio.

Nano particle statistical analysis using virtual data processing of AFM images is presented in table 5. In all CZTSe thin films respective to compositional variation, a change in the value of the mean grain area, mean grain size, and total volume could be seen from the data presented in the table 6. TF-1 with perfect stoichiometry exhibit the maximum value of grain size of 203.5 pm and TF-5, Cu$_2$Zn$_{1.3}$SnSe$_{3.3}$ with 30% excess of Se and 10% excess of Zn exhibited the minimum value of grain size i.e. 148.9 pm. Total grain volume is also influenced by compositional variation within the range of 116–245.9 nm³. Highest value of grain volume of 245.9 nm³ is occupied by TF-1 while lowest was by TF-4 Cu$_{1.8}$ZnSnSe$_{2.2}$.

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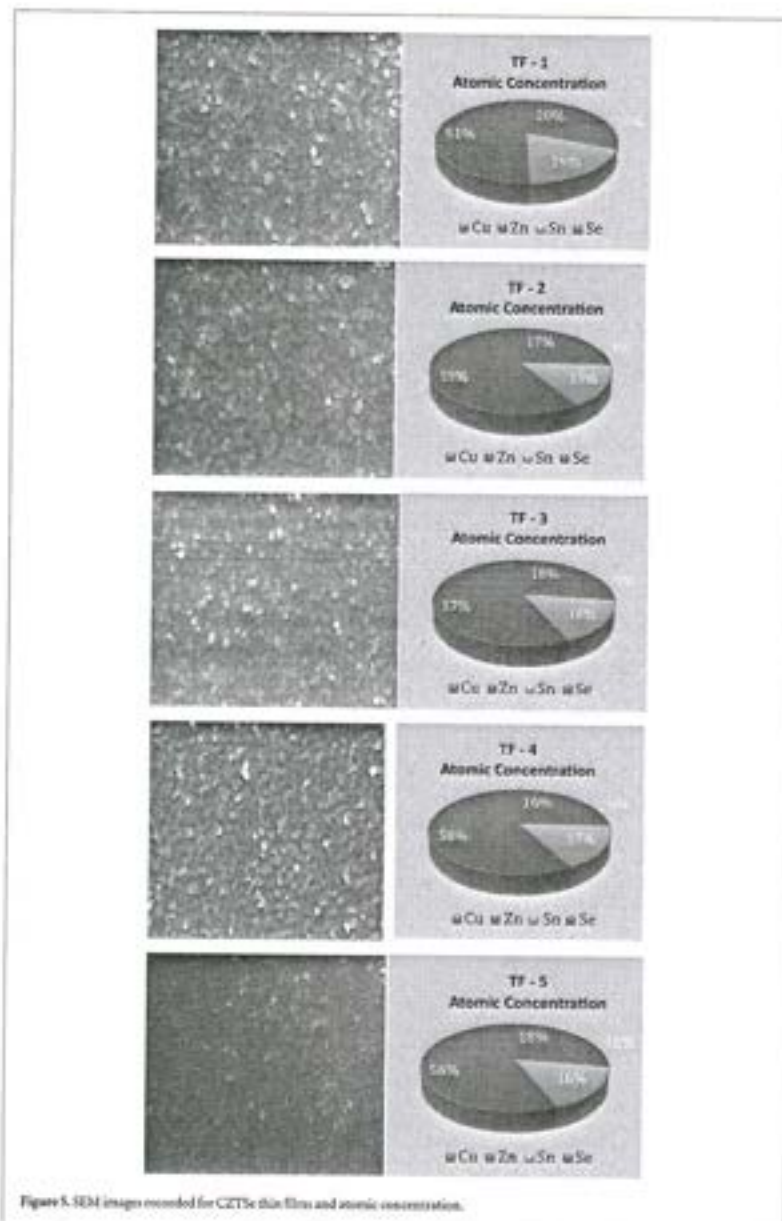
Figure 5. SEM images recorded for CZTSe thin films and atomic concentration.

3.2. Elemental distribution in CZTSe compounds by EDAX spectra and elemental mapping

Figure 4 represents the scanning electron microscope images of all CZTSe thin films. Variation in elemental constituents in CZTSe thin films is determined by EDX at an incidence of beam of 20 kV and are listed in table 7.
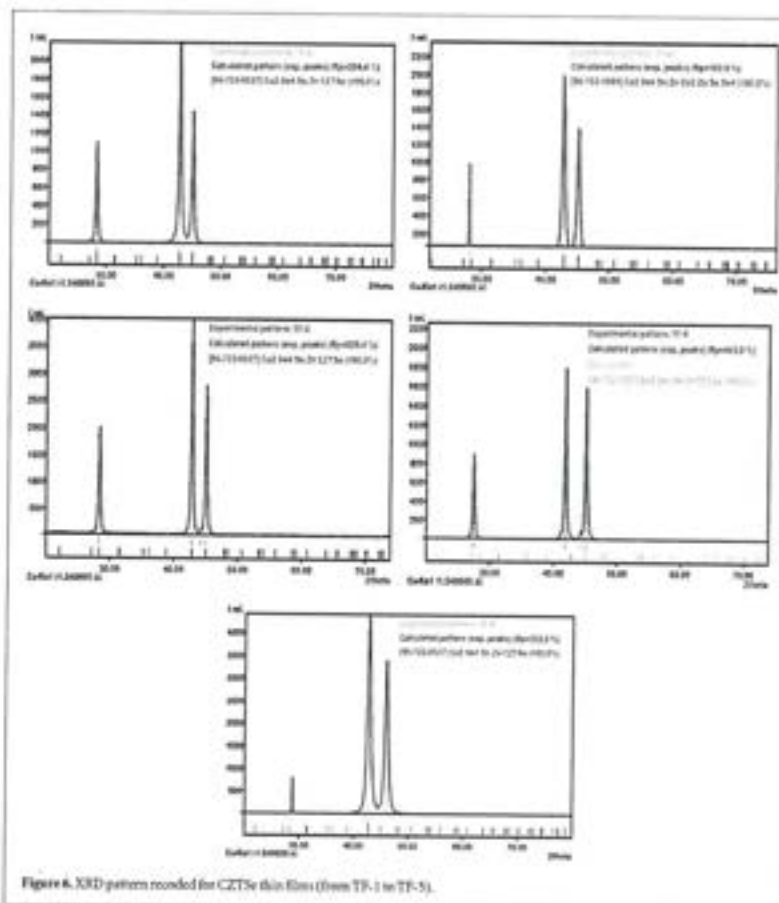
Figure 6. XRD pattern recorded for CZTSe thin films (from TF-1 to TF-5).

It can be concluded from the results presented in table 7 that all CZTSe thin films retained their composition very well. As can be seen from this table the sample TF-4 and TF-5 are showing deficiency of Cu with respect to other samples. A trend of increment in the ratio of Se/(Cu + Zn + Sn) after TF-1 could be seen in EDX results. The table 7 shows a good agreement between the ratios of precursors used in the fabrication process and composition estimated from EDX results on deposited thin films.

Figure 4 shows the FESEM images and figure 5 elaborates the atomic concentration of elemental constituents using EDX based mapping analysis.

3.3. XRD characterization

In order to study the structural features of all CZTSe thin films, XRD patterns are recorded. These patterns are recoded using the x-ray source Cu-K alpha of wavelength of 1.54060 Å within 2θ range of $20.010°$–$79.990°$ and are presented in below figure 6. These spectra confirms the formation of CZTSe in tetragonal crystal structure exhibiting the space group of I−4 2 m.

Three major peaks are identified in all CZTSe thin films confirming the formation of CZTSe phase. The main Bragg reflections at 2θ value of $28.34°$, $42.83°$ and $45.10°$ are clearly detected corresponding to the plane of (103), (105) and (204).
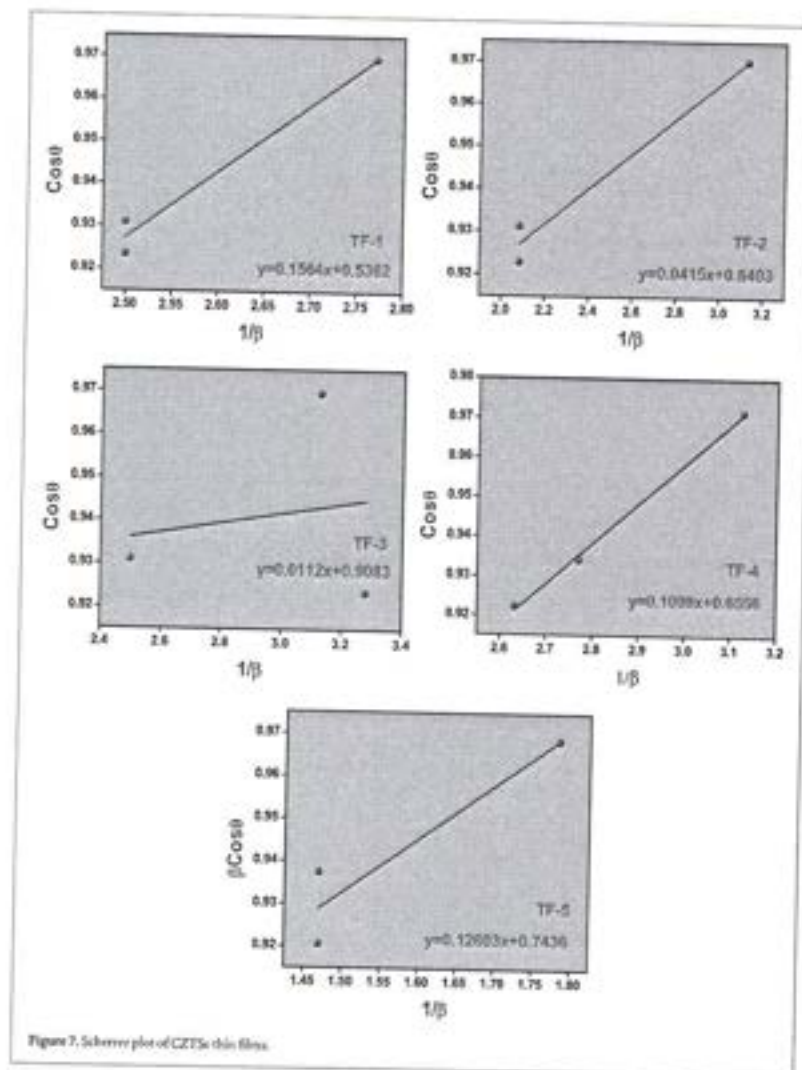
Figure 7. Scherrer plot of CZTSe thin films.

Table 8. Structural parameters of CZTSe thin films.

	TF-1	TF-2	TF-3	TF-4	TF-5
Lattice constants(Å)	a = 5.6965	a = 5.6882	a = 5.6965	a = 5.6965	a = 5.6965
	c = 11.3394	c = 11.3378	c = 11.3394	c = 11.3394	c = 11.3394
Crystallite size (nm) Scherrer's method	25.85	16.50	15.26	21.049	18.646
Crystallite size (nm) W-H (UDM plot)	25.67	26.36	26.210	33.728	20.78
Strain (milli Pascal)	0.71	4.32	0.241	1.1	2.87
Bond length (Å)	0.5341	0.5339	0.5341	0.5341	0.5341
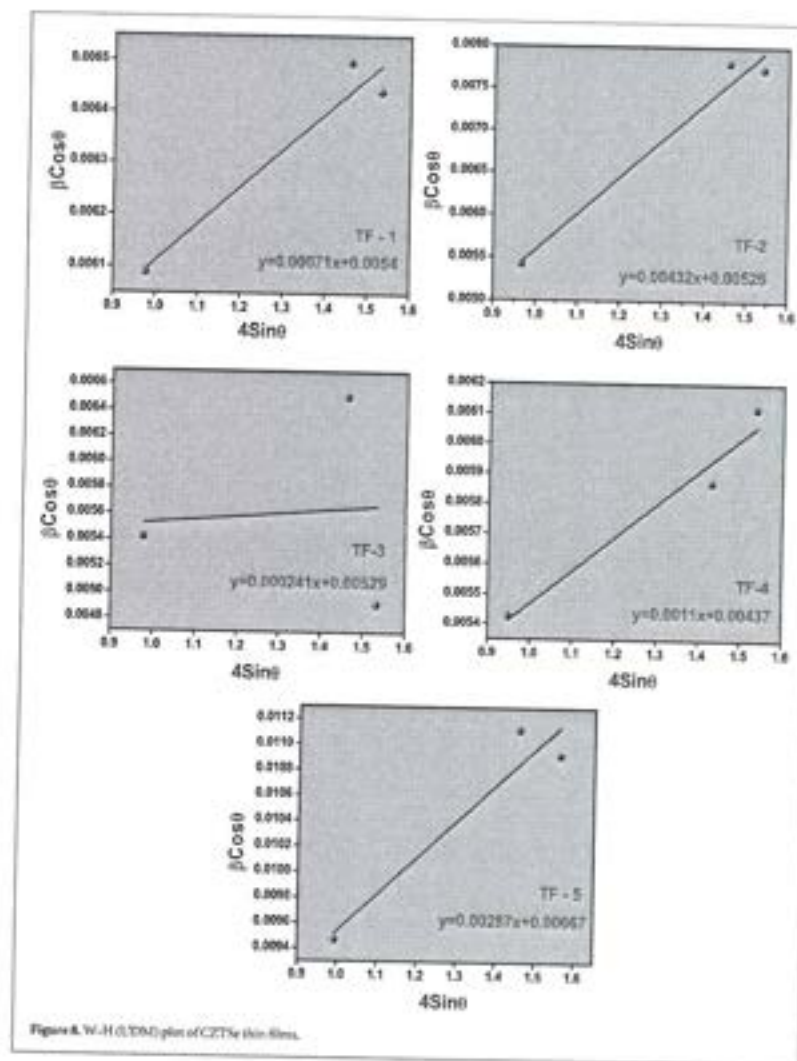
Figure 8. W-H (UDM) plot of CZTSe thin films.

3.4. Scherrer method

Scherrer's formula for the calculation of crystallite size is given as

$$D = \frac{K\lambda}{\beta_{hkl}\, Cos\, \theta_{hkl}}$$

Where D is crystallite size, λ is the wavelength of x-rays used, β_{hkl} is the full width half maxima in radian, K is shape factor (Usually taken as 0.9) and θ_{hkl} is Bragg's diffraction angle (degree). Figure 7 shows the plot between $1/\beta_{hkl}$ and $cos\theta$ for all CZTSe thin films which gives a straight line. By calculating the slope of fitted line, we can find out the crystallite size. Variation in crystallite size for all samples is presented in table 8 for these plots. The crystallite size varied from 16.50 nm to 25.85 nm with respect to variation in stoichiometry ratio. Highest crystallite size is exhibited by sample 1 i.e. Cu$_2$ZnSnSe$_4$ thin films. Sample exhibiting the lesser amount of Se i.e.

Figure 9. Graph of $(\alpha h\nu)^2$ versus photon energy (h\nu).
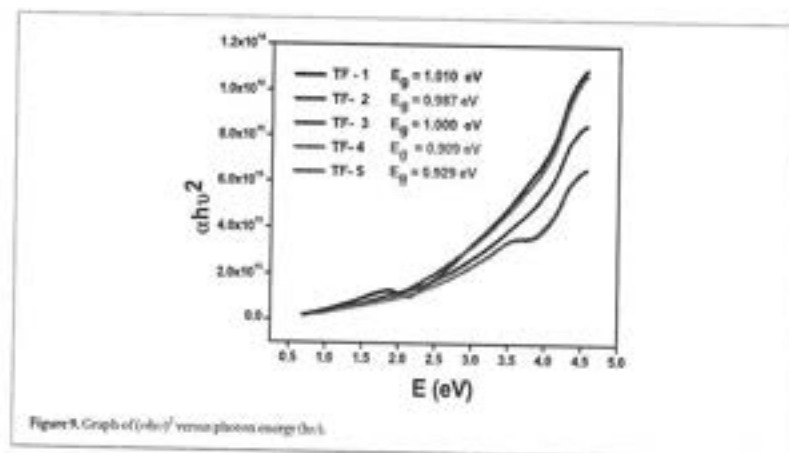
Table 9. Results of the hall measurements of all CZTSe thin films.

Sample ID	Bulk concentration (cm⁻³)	Sheet concentration (cm⁻²)	Sheet resistance (Ω)	Resistivity (Ω.cm)	Conductivity (Ω.hm.cm)	Mobility (cm²/(V. s))
TF-1	5.8218×10^{15}	1.9109×10^{11}	4.2606	2.1303×10^{-04}	4.6942×10^{3}	0.7665
TF-2	5.3452×10^{17}	1.6726×10^{11}	3.8981	1.4690×10^{-04}	5.1307×10^{3}	0.0925
TF-3	4.3377×10^{16}	2.9791×10^{10}	4.5665	3.1439×10^{-04}	5.1808×10^{3}	0.4795
TF-4	6.8514×10^{15}	4.8439×10^{10}	1.4322	1.0126×10^{-04}	9.8757×10^{3}	0.3994
TF-5	5.5849×10^{15}	4.9546×10^{10}	2.7909	2.0262×10^{-04}	4.9554×10^{3}	8.6106

Cu₂ZnSnSe₃.₂ sample showed the lowest value of crystallite size of 15.26 nm. Intermediate values of crystallite size is shown by other samples. It can be concluded that variation in the amount of Se in the samples with respect to the perfect stoichiometry causes a variation in the value of crystallite size.

Using the Scherrer formula, the crystallite size is calculated from the slope of the fitted line as

$$Crystallite\ size = \frac{K\lambda}{Slope}$$

3.5. Williamson-Hall method

Scherrer method cannot explain about the crystalline imperfection and some other mechanical parameters like strain, so Williamson hall method is employed to calculate the strain induced in the CZTSe samples. Isotropic nature of crystals are studied using UDM model explaining about the uniform lattice strain in all direction [18]. The strain broadening term arises due to the imperfections and distortions in the crystals. Scherrer and Williamson formula can be used for the calculation of size broadening term and strain broadening term respectively.

$$\beta_s = C\varepsilon \tan\theta$$

Where C is a constant and taken as 4 and ε is the compressive strain. After combining the Scherrer formula and aforementioned formula, Williamson-Hall equation was modified to as

$$\beta_{hkl} = \beta_s + \beta_L$$

$$\beta_{hkl} = \frac{K\lambda}{D\ Cos\ \theta_{hkl}} + 4\varepsilon \tan\theta$$

$$\beta_{hkl}\ Cos\ \theta_{hkl} = \frac{K\lambda}{D} + 4\varepsilon\ Sin\ \theta$$
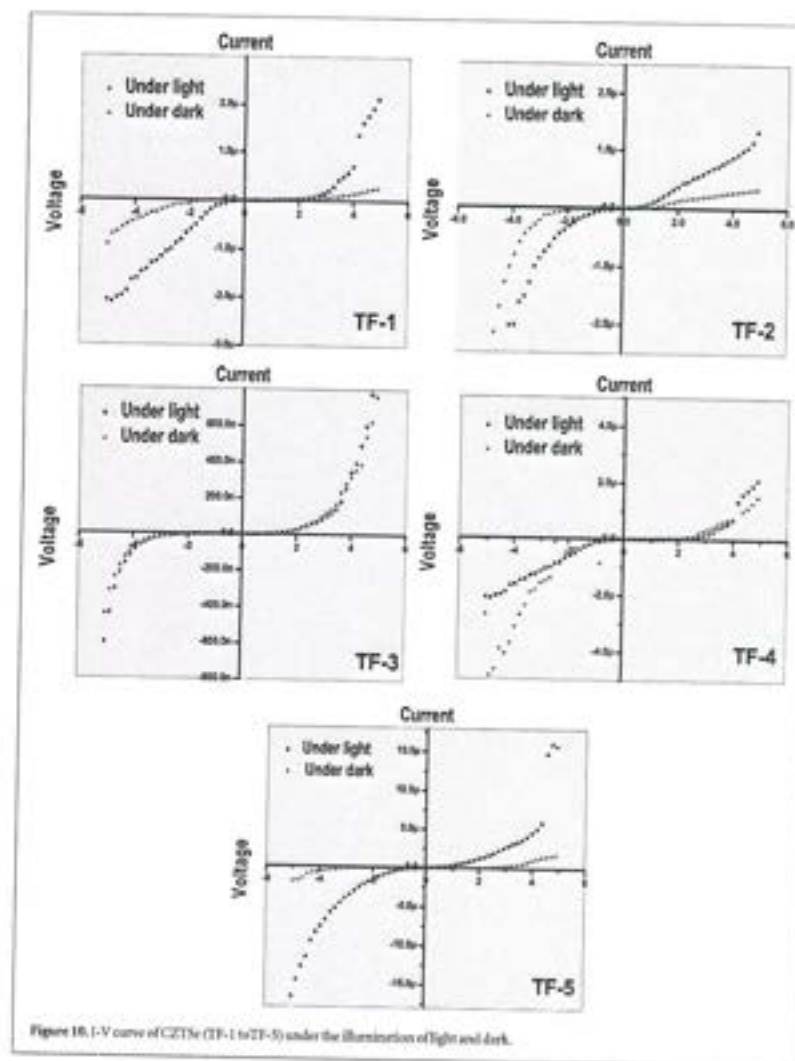
Figure 10. I-V curve of CZTSe (TF-1 to TF-5) under the illumination of light and dark.

This equation represents the uniform deformation model of Williamson-Hall method. Using this equation, we can plot a graph between $\beta_{hkl}\ Cos\ \theta_{hkl}$ and $4\ Sin\ \theta$ whose intercept will give us crystallite size and slope will give us lattice strain value in the crystal [19]. UDM plot for all CZTSe thin films are shown in figure X.

Comparison of crystallite size, stress and strain for compositional variation in CZTSe thin films is presented in table 8. The nearest bond length is calculated along c axis is given by following relation

$$b = \left[\left(\frac{1}{3}\right)\left(\frac{a^2}{c^2}\right) + \left(\frac{1}{4}\right)\right]$$

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4. Optical band gap

The optical band gap is extrapolated in figure 9 from the $\alpha h\nu^2$ versus $h\nu$ plot using the equation

$$\alpha h\nu = A(h\nu - E_g)^{1/2}$$

Where absorption coefficient is calculated using transmission measurements as $\alpha = 1/d(\ln(T))$ where d is the thickness of the film and T is the transmittance [20]. The optical band gap from the tauc's plot for all CZTSe thin films is measured within the range of 0.909 eV to 1.01 eV respective to compositional variations. An effect of Cu/(Zn + Sn) ratio could be seen on the value of band gap. The films with higher Cu/(Zn + Sn) ratio exhibited the higher value of band gap as compare to the films with lower Cu/(Zn + Sn) ratio. The lowest value of band is exhibited by Cu depleted thin films TF-4 i.e. $Cu_{1.6}ZnSnSe_{3.2}$.

It can be inferred that irrespective of variation in amount of Se in the films like $Cu_2ZnSnSe_4$, $Cu_2ZnSnSe_{3.8}$ and $Cu_2ZnSnSe_{3.2}$, the band gap is having the value nearly equal to 1.0 eV.

While Cu deficiency and Zn surplus caused a decrement in the band gap upto the 0.909 eV.

5. Electrical measurements

At room temperature, hall measurements are carried out at 0.5 Tesla magnetic field of all CZTSe thin films. Table 9 summarizes the variation obtained in the electrical parameters like resistivity, sheet resistance etc with respect to the variation in stoichiometry ratio. It is found that the resistivity of the perfect stoichiometry sample i.e. TF-1 is found 2.1303×10^{-04} Ω.cm.

A small deviation in Cu/(Zn + Sn) ratio caused a decrement in this value other than sample TF-3 $Cu_2ZnSnSe_{3.2}$. A direct relation between the resistivity and sheet resistance could be seen from the data presented in the table 9 as same type of behavior could be seen in this parameter with respect to compositional variation. Further poor mobility can be related to lower value of grain size leading to the recombination of the charge carriers at the grain boundaries. A linear increment in the value of carrier concentration is seen in the thin films from TF-1 to TF-5. Sample TF-4 showing the lowest value of resistivity and highest value of concentration could be due to formation of void free film on the substrate.

Current-voltage characteristic plot for all CZTSe thin films with different compositions under the illumination of light and dark are shown in figure 10. These curve show that the knee voltage is found in between 0.7 to 2.0 volt. Dark current is found much smaller as compare to the under the effect of illumination of light.

6. Conclusion

In order to study the surface topographical features of CZTSe thin films with respect to compositional variation, an analysis of height parameters, hybrid parameters and statistical parameters are presented. Fractal dimension analysis has been done using height-height correlation function. Due to very small variation in the thickness of CZTSe thin films respective to the compositional variation, a very small change in fractal dimension is observed. Compositional results obtained from SEM-EDX characterization are matching very well with the ratio of precursors used in deposition process. A gradual reduction in the value of band gap is observed with the decrement in Cu/(Zn + Sn) ratio in CZTSe thin films. A study of optoelectronic properties are presented against the compositional variation in CZTSe thin films. Scherrer method and Williamson- Hall method is opted for the crystallite size calculation. Strain induced in the thin films is found in between the range of 0.241 to 4.32 milli Pascal.

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Statistical Analysis of Comparison of Services of Public and Private Banks after and before Demonetization of 2016

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Abstract

The argument posited in favor of demonetization is that the cash that would be extinguished would be "black money" and hence, should be rightfully extinguished to set right the perverse incentive structure in the economy. While demonetization effects not only on the people of country but also on banks services, savings and most probably all the features banks provided. When complete cash come in banks than what are the impacts on services. Therefore, it is imperative to evaluate the short run and medium-term impacts that such a shock is expected to have on the economy. Further, the impact of such a move would vary depending on the extent to which the government decides to remonetize. This paper elucidates the impact of such a move on the availability of credit, spending, level of activity and transactions and services of banks. Moreover, complete economy going to cashless so all activities depends on banks so evaluation of effect on services is main aim of this paper.

Keywords: Public Bank, Private Bank, Demonetization, ATM, Credit Card, Debit Card, No of Transaction, Amount of Transaction.

Introduction

A bank is a financial institution that accepts deposits from the public and creates credit. Lending activities can be performed either directly or indirectly through capital markets. Due to their importance in the financial stability of a country, banks are highly regulated in most countries. Most nations have institutionalized a system known as fractional reserve banking under which banks hold liquid assets equal to only a portion of their current liabilities. For India, the apex bank is the Reserve Bank Of India. In addition to other regulations intended to ensure liquidity, banks are generally subject to minimum capital requirements based on an international set of capital standards. It is an establishment authorized by a government to accept deposits, pay interest, clear checks, make loans, act as an intermediary in financial transactions, and provide other financial services to its customers. It is licensed to deal with money and its substitutes by accepting time and demand deposits, making loans, and investing in securities. The bank generates profits from the difference in the interest rates charged and paid. Public Sector Banks are banks where majority stake is held by the Government of India. Examples of public sector banks are: SBI, Bank of India, Canara Bank, etc. Private Sector Banksare banks majority of share capital of the bank is held by private individuals. These banks are registered as companies with limited liability. Examples of private sector banks are: ICICI Bank, Axis bank, HDFC, etc.

Demonetization

Demonetization is an instrument to encounter price rises, Black Money, bribery and misdemeanor, dishearten a cash reliant economy and facilitate employment and trade as well. Its strategy of the government by outlawing Rs. 500 and Rs.1000 currency notes has predisposed more or less all the corner of the economy. Its upshot on Banking Sector is noteworthy as Bank is a core for directing the legal tender money to all requirements of the public. The principal recipients of demonetization are Banks. It made the banks to recognize the deposits with no any cost of endorsement and significantly augmented liquidity position of the banks. It exposes the consequence of demonetization on Banking Sector. It takes in the current resolution of the central government on Demonetization and its steady outcome on Indian banking sector. It is a method by which a sequence of currency will not be legal tender.The term demonetization is

Remarking An Analisation

not new to the Indian economy, the uppermost demonetization, done by the RBI was the Rs. 10000 note. According to RBI data, these notes were failed to recognize again in 1946 and again in January 1978. On 8 November, 2016 Indian Prime Minister acknowledged that offered INR 500 and 1000 bank notes would no longer be acknowledged as legal tender to put a checkup on the equivalent financial system. A new-fangled redesigned series of Rs 500 and Rs 2000 banknote is in exchange since 10th of November 2016.

Review of Literature

The sectors cover Micro Businesses, E-Wallet Businesses, and Online Retail Stores and So on and conclude that in long run it definitely will have positive impact in controlling black money and fake money. The decision taken will have far reaching impact on the economy was said by Abda(2017). Cashless transaction system is reaching to growth day by day. It is not only the requirement but also a need of today society. All the POS are using double as compare to earlier also UPI and IMPS are going high in uses analyzed by Manpreetkaur (2017) in her paper. Palanisamy and Sapariga E(2017) attempted to document the historical importance of demonetization and their impact on this export and import and it reveal that India will achieve a significant growth by adopting the demo strategy and it will great a huge positive impact on the entire economy. Demonetization is a step to dig out the people which are defaulter and had black money but instead of this common people like farmers took lots of pain for lack of facilities in rural areas said by Shan(2017) in his paper. Dhara K (2017)made some question regarding positive and negative impact of demonetization and effect of online banking by the employee of some bank and conclude that this demonetization has proven somehow more successful than previous two, people become more conscious a about online banking and may be total black money do not grabbed in this it made fear in black money hold people, so its correct decision for stop corruption, terrorism and black money.KumudhaandLakshmi (2016) studied about online Marketing and E-

commerce that is in form of trend. They resulted in the paving the way of new trend in online shopping and digital payment. The scope for digital marketing is to be seen in the days to come given the internet adoption level in the country, the ease of banking operations and the mindset of the people adopting the trend.

Objective of the Study

To find the effect of demonetization on Public and private banks by their services like on ATM, credit card, debit card and online transactions.

Research Methodology

Research Variables

The variables for the proposed research were selected and defined as follows.

Transaction from POS

POS stands for point of sale. A point-of-sale (POS) transaction is what takes place between a merchant and a customer when a product or service is purchased, commonly using a point of sale system to complete the transaction.

1. Transaction from ATM, credit card and debit card:The number of time any person uses their card for getting their payment complete.
2. Amount of transaction using ATM, credit card, and debit card: The total money people are paid or receive for their payment by using their card.

Data

Total 46 Banks were selected for analysis out of which 21 are public banks and 25 are private bank. The list of banks is attached in Annexure A1. The data were collected from October 2014 to December 2018 on monthly basis that is 17 monthsbefore and 19 monthsafter demonetization from the RBI website. Here all the data were corresponding to the research variables.

Statistical Methods

The data were tested for the Normality using Shapiro – Wilk test for Normality.The data were found Non Normal. Hence the non-parametric test Mann-Whitney U test for comparison of two groups was used.

Results and Discussion

Table -1: Results for Public Banks

Public Banks							
Research variables	Time	N	Mean	Std. Deviation	Std. Error Mean	Mann-Whitney U	P value
No. of Transactions (Actuals) ATM Credit	Before	17	175892.41	21541.82	5224.66	49.000	0.000
	After	19	222440.84	34195.84	7845.06		
No. of Transactions (Actuals) POS Credit	Before	17	11531685.47	1710173.13	414777.91	1.000	0.000
	After	19	21068090.68	3341422.01	766574.78		
Amount of transactions (Rs. Millions) ATM Credit	Before	17	829.8	100.33	24.33	76.000	0.006
	After	19	958.62	161.69	37.09		
Amount of transactions (Rs. Millions) POS Credit	Before	17	30601.16	5605.88	1359.63	1.000	0.000
	After	19	71780.87	13351.61	3063.07		
No. of Transactions (Actuals) ATM Debit	Before	17	558336766.4	43281642.32	10497340.17	89.000	0.021
	After	19	587635554	27317289.27	6267015.96		
No. of Transactions (Actuals) POS Debit	Before	17	56389985.24	10560380.02	2561268.37	0.000	0.000
	After	19	175909743.4	24978055.71	5730358.98		
Amount of transactions (Rs. Millions) ATM Debit	Before	17	1535005.76	90969.05	22063.24	39.000	0.000
	After	19	1771721.25	211058.25	48420.08		
Amount of transactions	Before	17	68130.73	14696.97	3564.54	0.000	0.000

| (Rs. Millions) POS Debit | After | 19 | 235796.61 | 31085.76 | 7131.56 | | |

Following table presents a comparative description for the selected research variables to understand the effect of demonetization of banking operations of both public and private sector banks .It is revealed from the above analysis that for the public banks, number of Transactions (Actuals) ATM Credit before demonetization was found 175892.4118 and after demonetization it was 222440.8421, so there is significant increment in number of transaction from atm. Number of Transactions (Actual) POS Credit before demonetization was found 11531685.4706 and after demonetization it was 21068090.6842.so there is significant increment in Number of Transactions POS(p value). Amount of transactions (Rs. Millions) ATM Credit before demonetization was found 829.8048259 and after demonetization it was 958.6156826 so there is significant increment in Amount of transactions ATM Credit. Amount of transactions (Rs. Millions) POS Credit before demonetization was found 30601.16412 and after

demonetization it was 71780.87142.so there is significant increment in Amount of transactions (Rs. Millions) POS Credit. Number of Transactions (Actual) ATM Debit before demonetization was found 558336766.3529 and after demonetization it was 587635554.0000.so there is significant increment inNumber of Transactions (Actual) ATM Debit. Number of Transactions (Actual) POS Debit before demonetization was found 56389985.2353 and after demonetization it was 175909743.4211. so there is significant increment in Number of Transactions POS Debit.Amount of transactions (Rs. Millions) ATM Debit before demonetization was found 1535005.7588 and after demonetization it was 1771721.2526.so there is significant increment in Amount of transactions ATM Debit. Amount of transactions (Rs. Millions) POS Debit before demonetization was found 68130.73076 and after demonetization it was 235796.61474.so there is significant increment in Amount of transactions POS Debit.

Table -2 : Results for Private banks

Private Banks							
Research Variables	Time	N	Mean	Std. Deviation	Std. Error Mean	Mann-Whitney U	P value
No. of Transactions (Actuals) ATM Credit	Before	17	356020.24	48896.2	11859.07	85.000	0.015
	After	19	422108.37	89207.37	20465.57		
No. of Transactions (Actuals) POS Credit	Before	17	58333160.24	6771727.18	1642385.08	0.000	0.000
	After	19	99405648.21	10542581.26	2418634.02		
Amount of transactions (Rs. Millions) ATM Credit	Before	17	1807.92	165.19	40.06	92.000	0.028
	After	19	2027.57	460.68	105.69		
Amount of transactions (Rs. Millions) POS Credit	Before	17	186005.45	26425.9	6409.22	1.000	0.000
	After	19	319583.16	45424.98	10421.21		
No. of Transactions (Actuals) ATM Debit	Before	17	138390421.3	8529654.95	2068745.2	154.000	0.827
	After	19	138117476.4	15824255.75	3630333.25		
No. of Transactions (Actuals) POS Debit	Before	17	50801403.71	7421980.41	1800094.66	0.000	0.000
	After	19	121209681.4	14299489.15	3280527.8		
Amount of transactions (Rs. Millions) ATM Debit	Before	17	628312.62	41551.89	10077.81	155.000	0.851
	After	19	620285.96	96531.4	22145.82		
Amount of transactions (Rs. Millions) POS Debit	Before	17	76395.72	11695.09	2836.48	0.000	0.000
	After	19	172743.72	21010.52	4820.14		

It is revealed from the above analysis that for the private banks, number of Transactions (Actual) ATM Credit before demonetization was found 356020.2353 and after demonetization it was 422108.3684. so there is significant increment in number of Transactions ATM Credit. Number of Transactions (Actual) POS Credit before demonetization was found 58333160.2353 and after demonetization it was 99405648.2105.so there is significant increment in Number of Transactions POS Credit. Amount of transactions (Rs. Millions) ATM Credit before demonetization was found 1807.9218647 and after demonetization it was 2027.5748789.so there is significant increment in Amount of transactions ATM Credit. Amount of transactions (Rs. Millions) POS Credit before demonetization was found 186005.44647 and after demonetization it was 319583.15579.so there is significant increment in Amount of transactions POS Credit. Number of Transactions (Actual) ATM Debit before demonetization was found 138390421.2941 and after demonetization it was 138117476.4211.so there is no significant difference in Number of Transactions

ATM Debit. Number of Transactions (Actual) POS Debit before demonetization was found 50801403.7059 and after demonetization it was 121209681.4211.so there is significant increment in Number of Transactions POS Debit. Amount of transactions (Rs. Millions) ATM Debit before demonetization was found 628312.6182 and after demonetization it was 620285.9637.so there is no significant increment in Amount of transactions ATM Debit. Amount of transactions POS Debit before demonetization was found 76395.72165 and after demonetization it was 172743.71789.so there is significant increment in Amount of transactions POS.

Conclusion

From all the above analysis and discussion we found that demonetization have significant effects on all the various factors regarding the bank services which significantly makes the conclusion that within only 19 months after demonetization, all the factor of public bank have significant increment and most of the factor of private bank have significant increment in the number of transaction by atm , credit card and debit card and

Statistical Analysis of Conventional Banking Services Comparison between Public and Private Sector Banks

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Abstract

Banking system which has also been stated as a system which reaches the customers offering services in cash management and updating them with the needed information on a regular basis with reference to the daily banking activities of their accounts maintained with the concerned financial institute. Every bank gives better services as well they can provide moreover bank services are same but the consumer whom using services is main effecting point for bank status. Best services attracted the consumer itself.

The purpose of this research article is to compare the conventional services by the primary method where sample unit is bank customer who are using services in both public as well as private banks . The study also focused on various factors that determine the , banking services, banking performance,infra- structure facility, loan oriented services and other value added services. Analysis was made by using t-test for comparison of services.

Keywords: Public Bank, Private Bank, Services Attributes, Loan, Insurance, Physical Amenities.

Introduction

Banking institutions are considered to be the subgroup of the financial service industry. Banking system which has also been stated as a system which reaches the customers offering services in cash management and updating them with the needed information on a regular basis with reference to the daily banking activities of their accounts maintained with the concerned financial institute. In India, the banking activities is free from difficulties and in addition to it should be able to meet the new defies postured by the technical know-how and any other macro and micro environment factors.

Importance of Banking Services

Businesses, regardless of size and type, would have to rely on or deal with banks and financial services companies one way or another. It's important to acknowledge and take advantage of the role these companies play. Banking and the federal insurance protects our money. Card services have enables us quick access to money. Money spent through bank can easily be traced and further be an important tool to check budget as well. Very few people have achieved long-term success in their personal finances without a budget. And few things make a budget work like the tools banks give us.Debt is a double-edged sword. Many tales abound of folks who used other people's money to increase their net worth, but far more traumatic are the stories of people whose finances were ruined by debt. Whichever way it slices, the fact that bank credit is available as an option has enhanced our lives in more ways than we might realize.

Public Sector Bank

These are banks where majority stake is held by the Government of India. Examples of public sector banks are: SBI, Bank of India, Canara Bank, etc..

Private Sector Banks:

These are banks majority of share capital of the bank is held by private individuals. These banks are registered as companies with limited liability. Examples of private sector banks are: ICICI Bank, Axis bank, HDFC, etc..

Review of Literature

Jitendra K. Sharma (2017) in his paper "A Study on Innovation in Banking and its Impact on Customer Satisfaction" he analyzed that private

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bank has been performing better than public sector bank. Customer trust is major ingredient of success for commercial bank. Private sector banks try to work in professional way since they have direct focus on revenues. Though public sector banks are also focusing more on creating better marketing mix, but there is more to achieve. The policy-makers in public sector banks must take proactive steps towards improving upon promptness and empathy towards customers.

Gurme and Meshram (2017) said that Mobile banking is big platform of new technology which promotes banking functions in India through mobile technology and also helps increasing their customers. This paper explores the awareness of mobile banking is the new era of technology which helps the banking industry grow at higher speed and also most important use is development of economic in India in his paper "A Study on Mobile Banking Awareness of Customers Perspective with Reference to Kothrud, Pune Area"

Gupta and Dev (2012) studied the factors impacting customer satisfaction in Indian banks and their effects on customer satisfaction. A questionnaire was given to 400 customers of 13 retail banks in India. Five factors were suggested driving customer satisfaction in banks namely: service quality, ambience, client participation, accessibility and financials.

Research Methodology

This study is based on primary data. The primary data were obtained through well structured questionnaires which is tested for reliability and validity and were completed with sending the mails , threw Google drive and oral interviews of customers who have account in both public sector bank as well as private sector bank involved in the study.the sample size is 248.

Objective of the study

1. To analyze the conventional services(service attributes, loan, insurance, physical amenities) of public and private sector banks
2. To compare the conventional services of public and private sector banks.

3. To evaluate which bank provide better conventional services.

Research Variables

For this study we considered some conventional services which is our research variable and these are following:

Service Attributes

Which contain some co variables which are:

1. Service Quality
2. Technology Base
3. Trust on Bank
4. Location of the Branch
5. Management/Staff

Loan

A thing that is borrowed, especially a sum of money that is expected to be paid back with interest. There are so many loans that we have considered in our study.

Insurance

A thing providing protection against a possible eventuality. Number of insurance are included in this article

Physical Amenities

Some amenities at the bank which help accentuate the customer experience. These amenities can include stationary, drinking water, guard(s), air conditioning

Analytical Tools

For the purpose of analysis of data, a number of statistical techniques have been used in this study.The date was tested for normality by Shapiro wilk test and found non normal. But by the central limit theorem every data is normal if data is large so in this paper we use independent t test for mean of two groups

Research hypothesis

H0: There is no significant difference in opinion of customers for providing conventional services by public and private sector banks

H1: there is significant difference in opinion of customers for providing conventional services by public and private sector banks

Result and Discussion

	Bank		Statistic	Bootstrapa			
				Bias	Std. Error	95% Confidence Interval	
						Lower	Upper
Service attributes	Public	N	248				
		Mean	2.3290	-.0013	.0330	2.2612	2.3920
		Std. Deviation	.49627	-.00114	.02535	.44356	.54621
		Std. Error Mean	.03151				
	Private	N	248				
		Mean	2.4161	.0006	.0342	2.3476	2.4833
		Std. Deviation	.53906	-.00296	.02994	.47699	.59605
		Std. Error Mean	.03423				
Loans	Public	N	248				
		Mean	1.5697	-.0006	.0233	1.5234	1.6155
		Std. Deviation	.35318	-.00086	.00981	.33296	.37054
		Std. Error Mean	.02243				
	Private	N	248				
		Mean	1.4303	.0002	.0227	1.3842	1.4722

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		Std. Deviation	.35318	-.00134	.01016	.33172	.37076	
		Std. Error Mean	.02243					
Insurance	Public	N	248					
		Mean	1.6097	-.0006	.0242	1.5592	1.6562	
		Std. Deviation	.36958	-.00095	.00958	.34796	.38706	
		Std. Error Mean	.02347					
	Private	N	248					
		Mean	1.3903	.0003	.0238	1.3445	1.4356	
		Std. Deviation	.36958	-.00157	.00964	.34752	.38607	
		Std. Error Mean	.02347					
Physical amenities at bank	Public	N	248					
		Mean	2.1124	-.0001	.0515	2.0090	2.2118	
		Std. Deviation	.79865	-.00227	.02806	.74067	.85448	
		Std. Error Mean	.05071					
	Private	N	248					
		Mean	2.0640	-.0002	.0448	1.9728	2.1486	
		Std. Deviation	.69992	-.00166	.02204	.65334	.73884	
		Std. Error Mean	.04444					

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
										95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		Lower	Upper
Service attributes	Equal variances assumed	1.604	.206	-1.872	494	.062	-.08710	.04653		-.17851	.00432
	Equal variances not assumed			-1.872	490.658	.062	-.08710	.04653		-.17851	.00432
Loans	Equal variances assumed	.000	1.000	4.394	494	.000	.13935	.03172		.07704	.20167
	Equal variances not assumed			4.394	494.000	.000	.13935	.03172		.07704	.20167
Insurance	Equal variances assumed	.000	1.000	6.609	494	.000	.21935	.03319		.15415	.28456
	Equal variances not assumed			6.609	494.000	.000	.21935	.03319		.15415	.28456
Physical amenities at bank	Equal variances assumed	6.067	.014	.718	494	.473	.04839	.06743		-.08410	.18088
	Equal variances not assumed			.718	485.641	.473	.04839	.06743		-.08411	.18088

From the table, group statistics has been done where responses were taken from 248 respondents who have account both public and private sector banks

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So by this table, "Service attribute" comprises of Service Quality, Technology base, Trust on bank, Location of the branch and Management/staff of the bank. Majority of the respondents from both Public and Private Banks were found satisfied with 'Service attribute'.

For variable "Loan" which comprises of 'Home loan', 'Car loan', 'Credit card loan', 'Education loan', 'Personal loan', 'Two wheeler loan'respondents from Public Banks were found satisfied whereas respondents from Private Banks were found extremely satisfied.

For variable "Insurance" which comprises of 'Life insurance', 'Car and Two wheeler insurance', 'Health insurance', 'Home insurance',respondents from Public Banks were found satisfied whereas respondents from Private Banks were found extremely satisfied.

For variable"Physical amenities at bank" which comprises of 'Pen and paper', ' Water', 'Guard', 'Cash deposit machine', 'Kiosks', 'Parking', 'Proper and comfortable fixtures for seating' , respondents from both Public Banks and Private Banks were found satisfied.

Conclusion

Since, after applying independent t- test we conclude that for service attributes and physical amenities the p value is greater than 0.05 so we accept our null hypothesis that is there is no significant difference in opinion of consumer for public and private sector bank that mean both bank provide equal services and perform equally. And by the group statistics we can also say that consumers are equally satisfied with both banks.

And, in providing loans and insurance the p value is less than 0.05 so we reject our null hypothesis that is there is significant difference in opinion of consumer to taking these services. so we can say that public and private sector are providing loans and insurance in different different manner. But by the group statistics we can also say that consumer are extremely satisfied by the private sector banks as compared to public sector banks.

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CORRELATIONAL STUDY BETWEEN JOB STRESS AND JOB SATISFACTION AMONG DOCTORS

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Abstract

The study is aimed to find out the relationship between job stress and job satisfaction among doctors working in public hospitals. A sample of 200 doctors has chosen for study. The instruments used in the study were the job satisfaction survey by Spector (JSS) and chronic work related stress evaluation ...

Keywords – Case study

METHODOLOGY

Sample

The study was conducted on a sample ...

... Spector in 1997. There are 36 items on this ... the highest possible score of 216 and the lowest possible score of 36. The responses are given on the basis of a 6 point scale, 1 is disagree very much, 2 is disagree moderately, 3 is disagree slightly, 4 is agree slightly, 5 is agree moderately and 6 agree very much. ... satisfaction was measured by ... based on this scale.

... job stress was measured by chronic work related stress evaluation instrument. It was invented by FRENCH CAPLAN IN 1972. This scale consists of statements. Responses may be given with the help of 5-point scale ranging from ... never. The highest possible score is ... the lowest possible score is 25.

Procedure

The research was designed to measure the relationship between satisfaction and job stress levels ... this purpose both the instruments administered on doctors to measure ... of job satisfaction and job stress ... collection the participants were the full cooperation and then data was analysed.

Scoring

The scoring for job satisfaction was as per the scale but for the items 8, 10, 12, 14, 16, 18, 19, 21, 23, 24, 27, 32, 34 and 36, the scoring was reversed 6=1, 5=2, 4=3, 3=4, 2=5, and 1=6.

A higher score indicates more of job satisfaction.

For chronic work related stress evaluation test the scoring was ... but items 2, 3, 4, 9, 11, 13, 16, and 20 ... scoring.

Results and discussions

Table 1 is the summary ... score and the mean score of the ... job satisfaction survey and chronic stress evaluation. The total ... participants on the job satisfaction ... 4139 and the mean score was 1 ... chronic work related stress evaluation ...

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अस्सी का दशक और हिन्दी नाटकों की नाटकीयता

डॉ. चीताभ शर्मा

सहायक आचार्य, हिन्दी विभाग, कानोडिया पी. जी. महिला महाविद्यालय, जयपुर, राजस्थान

"नाटक का तन्त्र लेखक को खुद निर्धारित करना पड़ता है। नाट्य-तत्व के नियमों से मार्ग-दर्शन होगा, लेकिन ऐसा नहीं कि उनके पालन से ही अच्छा नाटक लिखा जा सकता है। विश्व के बहुत से अच्छे नाटक तो इन नियमों के अपवाद ही साबित होंगे। नाटक का माध्यम खून में उतर जाना चाहिए, रग्ग पर उछलना चाहिए, उतनी चाहिए तभी कोई लेखक अच्छा नाटक लिख सकता है।" - विजय तेन्दुलकर

नाटक एक जीवंत अनुभव है। उसकी नाटकीयता अर्थात् रंगमंचीय संभावनाएँ कृति में ही विद्यमान रहती है और वह अपनी जीवंतता रंगमंच पर ही प्राप्त कर सकता है। नाटक का अपना नाटकीय यथार्थ होता है, जो यथार्थवादी नाटकों के यथार्थ से एकदम भिन्न है और जिसके लिए नाटककार की निजी रंग-दृष्टि पहली शर्त है। नाटककार का दृष्टिकोण ही कथ्य की परियोजना इस ढंग से करता है कि कथानक तत्व, पात्र तथा संवाद के खून एक दूसरे से जुड़े मूल कार्य का विकास करते चले जाते हैं और कथ्य अपने अनुरूप रंगमंच सृजित करता चलता है। कथ्य और रंगमंच जब कृति में एक साथ अस्तित्व पाते है तभी वह नाट्य कहा जाता है।

नाटक और रंगमंच अन्योन्याश्रित है। ये एक दूसरे से प्रभावित होते हैं और एक दूसरे को प्रभावित करते भी हैं। ये दोनों समाज से अपना रूपाकार ग्रहण करते है तथा समाज, अपने देश, काल और परिवेश से निर्धारित होता है। समय के साथ परिस्थितियाँ बदलती है और परिस्थितियों के साथ समाज। समाज का वह बदलाव धीरे-धीरे नाटक और रंगमंच दोनों को ही नहीं बल्कि साहित्य और कलाओं के सभी रूपों में परिवर्तन करता चलता है। जब यह परिवर्तन स्पष्ट और मुखर होकर प्रत्यक्षतः प्रकट होने लगता है तो हम पाते है कि समाज, साहित्य और कलाएँ अपने पिछले रूप रंग से कुछ अलग अथवा भिन्न है, तो हम उन्हें नये विशेषण से पुकारने लगते हैं वस्तुतः प्रत्येक नाटककार का अपना नया नाटक और नया रंगमंच होता है। रंगमंच नाटक का निचोड़ है। निस्संदेह रंगमंच की आत्मा नाटकीयता है तो नाटक की आत्मा रंगमंचीयता। रंगमंच नाटक की सही कसौटी है किन्तु नाटक एक मात्र कसौटी या निरा रंगमंच ही नहीं है। यदि नाटक में रंगमंचीयता या अभिनयता का अभाव होगा तो नाटक दिशा से भटक सकता है। नाटक न केवल साहित्य है और न केवल रंगमंचीय कला।

नाटक संवादात्मक होने के कारण उसमें वाच्य तत्व मुख्य हो जाता है। संवाद अभिनेता से ही दर्शक तक पहुंचते है और नाटक एवम् नाटककार से साक्षात्कार कराते है इसलिए भरतमुनि ने वाचिक अभिनय को नाटक का शरीर माना है। नाटक एक विधान से आबद्ध है - नाटककार, सूत्रधार (निर्देशक) और दर्शक; लेकिन अभिनेता और अन्य सारा समूह भी उसका अनिवार्य अंग है। इसलिए सारी नाटक-प्रक्रिया इनके निरन्तर तारतम्य

सहयोग, समन्वय से ही संभव है। कई बार कोई नाटक पढ़ने पर फीका लगता है और अभिनीत देखने पर प्रभावित करता है तो कभी अच्छे से अच्छा नाटक भी रंगमंच पर आकर मर जाता है, अतः नाटक एक सामूहिक संश्लेषणात्मक कला है जो रचनाकार से निर्देशक, निर्देशक से अभिनेता और अभिनेता से दर्शक तथा पूरी परिस्थितियों तथा रंगकर्मियों से होती हुई प्रेक्षक तक पहुंचती है।

अतः नाटक को रंगमंच से अलग करके नहीं देखा जा सकता जैसे कथानक, चरित्र, संवाद, भाषा इत्यादि की उपस्थिति के बावजूद उपन्यास को नाटक नहीं कहा जा सकता, उसी प्रकार किसी भी ऐसी संवादबद्ध रचना को नाटक नहीं कहा जाना चाहिए जिसमें नाटकीयता न हो अथवा जो रंगमंच से अनिवार्यतः जुड़ी न हो फिर चाहे उसका अलग से कितना ही साहित्यिक मूल्य क्यों न हो।

नये और समसामयिक रंगमंच ने सिद्ध कर दिया है कि नाट्यालेख और प्रेक्षागृह के स्पेस कोरेसा अनिवार्य एवम् आन्तरिक सम्बंध नहीं होता जैसा कि अब तक भारतीय और विदेशी नाट्यशास्त्र में माना जाता रहा है। निर्देशक और दृश्यांकनकार अपनी इच्छा एवम् कल्पनाशीलता से उसे बदल भी सकता है। इसी तरह प्रयोगधर्मी रंगकर्म और रंगस्थल के बीच केवल कलात्मक एवम् रचनात्मक ही नहीं, आर्थिक, सामाजिक तथा अन्य स्थूल रिश्ते भी होते है यही कारण है कि हिन्दी प्रयोगधर्मी रंगकर्म में दर्शकों की कमी घाटे का सौदा सिद्ध हो रही है। इसी क्रम में अंधेर नगरी के मंचन में निर्देशक सत्यव्रत सिन्हा द्वारा किये गये नवीन प्रयोग सराहनीय है।

नये और समसामयिक भारतीय हिन्दी नाटक ने बाह्य घटनात्मक स्थूल यथार्थ से आगे बढ़कर सूक्ष्म संवेदनात्मक अभ्यन्तर यथार्थ का विकास किया तथा आधुनिक व्यक्ति के आन्तरिक संकट और उसकी जटिल सूक्ष्म मानसिकता को विश्लेषित करने का प्रयास किया। प्रसाद काल से चली आ रही रंगमंच की खाई पाटी गयी और निर्देशक नामक एक संयोजक व्यक्ति का आविर्भाव हुआ। रंगकार्य में दर्शक की सत्ता और महत्ता स्वीकार की गयी। रस का स्थान द्वंद, तनाव और संघर्ष ने ले लिया। वर्जित दृश्यों और अनेक पुरातन रूढ़ियों से नाटक को मुक्ति मिली।

नाटक की नाटकीयता को समझने हेतु भाषा अपरिहार्य माध्यम है। नाटककार के भावों और विचारों को साकार रूप भाषा वैशिष्ट्य से प्रदान करता है। रचनाकार के लिए शब्द मात्र शब्द या वस्तु नहीं है - वह उन्हें नई संवेदना से छूता है। रचता है। वह लगातार संघर्ष करता है। शब्द को भावों की एक रेंज एक ताजगी देता है। रचनाकार की रचना का सत्य भाषा से भी फूटता है। शब्द विन्यास, भंगिमाएँ, लय, गति आदि अलग-अलग नहीं है। रचनाकार इनका विलक्षण संयोजन कर अपने अनुभव, युगीन संवेदना से जोड़ता है।

एक अर्थ, एक द्वंद्व, एक तनाव को अर्थ के नये आलोक में भरता है। ...भी है कि मानवीय अनुभवों का जटिल संसार भाषा की संवेदना से ...और व्यक्त किया जा सकता है।

...भाषा की शक्ति का समग्र विकास नाटक में ही होता है। नाटक की ...एक पूरी श्रृंखला होती है जिसमें स्थितियां, क्रिया, प्रतिक्रिया, पात्र की ...तथा अन्य भावों को व्यक्त करने की क्रिया व गतियां होती है। उसमें ...का कथन न होकर उसकी प्रस्तुति होती है। नाटक में भाषा स्वयं एक ...होती है क्योंकि वह पात्र को बोलने के लिए विवश कर देती है। नाटक ...को इस तरह रखा जाना महत्वपूर्ण होता है कि वे निर्देशक व ...को प्रेरित कर सके।

सरकारी मानक भाषा और बोलचाल की जुबान को हरकत भरी ...भाषा का रचनात्मक रूप देने के साथ बोलियों का या ...शब्दों एवम् अभिव्यक्तियों के नाटकीय इस्तेमाल ने भी नये हिन्दी ...की सृजनात्मक उपलब्धि के एक अभिनव आयाम का उद्घाटन किया ...सच है कि मोहन राकेश, जगदीशचन्द्र माथुर, लक्ष्मीनारायण लाल, ...धर्मवीर भारती, शरद जोशी, ज्ञानदेव अग्निहोत्री, सर्वेश्वर दयाल ...हमीदुल्ला, मणिमधुकर, भीष्म साहनी, बी.एम. शाह, रमेश बक्शी ...नाटककारों को हमने खो दिया है। परन्तु इस तथ्य से भी इन्कार नही ...जा सकता कि विपरीत परिस्थितियों के बावजूद, संख्या की दृष्टि से ...नये नाटककार सत्तर के दशक में उभरे हैं, उतने पिछले पचास वर्षों में ...नहीं उभरे थे।

अस्सी के दशक (1980 ई. से 1989 ई. तक) में जो नाटकीय ...हुए उनकी नींव नाटककार मोहन राकेश ने रखी। राकेश के नाटकों ...हिन्दी रंगमंच को सक्रियता ही नहीं दी, नाटक को सही मायने में रंगमंच ...जोड़ा, प्रचलित नाट्य रूढ़ियों को तोड़कर आधुनिक रंगमंच की कल्पना ...विकसित किया तथा प्रयोगशील कल्पना को साकार कर दिया। अस्सी के ...के नाटकों ने उनकी इसी परम्परा को आगे बढ़ाया। सत्तर के दशक में ...तो पर्याप्त संख्या में लिखे गये लेकिन जिन नाटककारों ने अस्सी के ...तक नाटकीय सम्भावनाओं को बनाए रखा उनमें प्रमुख रूप से डॉ. ...वर्मा कृत 'छोटे सैयद, बड़े सैयद' (1982), 'एक दूनी एक' ...शकुन्तला की अंगूठी' (1990)। शंकर शेष कृत 'आधी रात के ...(1981)। हम्मीदुल्ला कृत 'हरवार' (1986), शिवमूरत सिंह कृत ...सुदर्शन मजीठिया कृत 'चौराहा', नरेन्द्र मोहन कृत 'कहे कबीर सुनो ...सखा', विनय कृत 'एक प्रश्न मृत्यु', असगर वजाहत कृत 'जिन्न की ...दुष्यन्त सिंह कृत 'यमगाथा', नन्दकिशोर आचार्य कृत 'पागलघर', ...वध', 'देहान्तर', दयाप्रकाश सिन्हा कृत 'सीढ़ियां', इत्यादि ...रहे। इनके अतिरिक्त मृणाल पाण्डे, कुसुम कुमार तथा मृदुला गर्ग ...कम विशेष रूप से लिया जा सकता है। इस दशक की नाटकीयता ...जिन बिन्दुओं द्वारा समझा जा सकता है –

1. वे नाटक रंगमंच की अपेक्षाओं व जरूरतों को ध्यान में रखकर ...गये परन्तु कभी-कभी इन्होंने मौजूदा रंगमंच का अतिक्रमण करके, ...लिए नयी चुनौतियों की सृष्टि की।

2. यह वस्तु संरचना की दृष्टि से पारम्परिक नाट्य शास्त्रीय रूढ़ियों ...अस्वीकार करता ही है साथ ही पश्चिमी समस्या नाटकों के रंग-शिल्प ...नयी को ज्यों न अपनाकर कथ्य के अनुसार नये-नये रंग-प्रयोग ...रहा है।

03. इन नाटकों में संघर्ष और घटना की परिकल्पना और चित्रण का भी रूप बदल गया है। बाह्य परिस्थितियों या नियति से मनुष्य का संघर्ष अब महत्वपूर्ण नहीं रहा। आधुनिक व्यक्ति का मानस सदैव एक अन्तर्द्वन्द्व, दुविधा और तनाव की स्थिति में रहता है, अतः व्यक्ति मानस स्वयं परिस्थिति है और यह तनावग्रस्तता ही संघर्ष है।

04. मनुष्य की मनुष्य के रूप में पहचान और नवीन मानव सम्बन्धी एवम् मूल्यों का अन्वेषण और चित्रण इसकी मूलभूत शर्त है। यह इतिहास, पुराण और मिथक का प्रयोग एक साधन के रूप में महज सुविधा की दृष्टि से करता है। नया नाटककार मानता है कि मानवीय धरातल पर भी नही बल्कि मानवीय धरातल पर रहकर 'ही' जीवन में कुछ महान किया जा सकता है।

05. इन नाटकों में नायक, खलनायक और विदूषक की त्रिभेदक रेखाएं परस्पर घुलमिल गयी है। व्यक्ति के अन्तर्विरोधों का स्पष्ट चित्रण, नये नाटकीय चरित्रांकन की एक प्रमुख विशेषता है।

06. 'काव्यगत न्याय' और 'संकलन-त्रय' जैसे सिद्धान्त अब सर्वमान्य नहीं रह गये हैं। वर्जनाओं के बंधन यह नाटक नहीं मानता।

07. नारी अब केवल प्रेमिका, प्रेरणा या सजावट की वस्तु मात्र न रहकर एक सतत् संघर्षरत, जीवन्त और सम्पूर्ण चरित्र बन गयी है।

08. उच्चरित सार्थक सटीक शब्दों, अस्पष्ट ध्वनियों, मौन, मुद्राओं, क्रियाओं, मंच-सज्जा। उपकरण, संगीत और छाया-लोक से मिलकर बनी हरकत भरी समग्र नाट्य भाषा (बोलियाँ जिसका अनिवार्य अंग है) और चरित्रों की आन्तरिकता से उद्भूत संवाद-लय का रचनात्मक उपयोग इन नाटकों की प्रमुख पहचान है।

09. इन नाटकों पर भारतीय या पश्चिमी किसी भी विचार एवम् रंगधारा का प्रभाव हो सकता है। इसका कोई एक निश्चित या पूर्वनिर्धारित रूप, रंग नहीं है। यह मूलतः और अन्ततः प्रयोगधर्मी है।

10. प्रभावान्वित के अतिरिक्त यह किसी सिद्धान्त और नियम को पूरी तरह स्वीकार नहीं करता।

11. इसका उद्देश्य प्रेक्षक को रस विभोर करने के बजाय उसे विचलित तथा उत्तेजित कर, सोचने और प्रतिक्रिया करने पर मजबूर करना है। यह दर्शक की संवेदनशीलता को सजग, उदार और व्यापक बनाता है।

स्पष्ट है कि हिन्दी के इन नाटकों का फिलहाल कोई एक निश्चित और पूर्व निर्धारित रूपाकार नहीं है। इसे वर्ग में बांटना और पारम्परिक सिद्धान्तों के आधार पर विवेचित, विश्लेषित या पूरी तरह मूल्यांकित करना न तो सम्भव है और न ही उचित। प्रयोगधर्मिता ही उसकी परिकल्पना का मूल आधार है। फिर भी अस्सी के दशक के प्रमुख नाटककारों के प्रमुख नाटकों का एक विश्लेषण प्रस्तुत है।

सुरेन्द्र वर्मा के 'छोटे सैयद बड़े सैयद' नाटक में स्त्री पुरुष के काम सम्बन्धों के मिथ को तोड़ा है तो 'एक दूनी एक' में वे स्पष्ट करते है कि भीतरी रिक्तता ने स्त्री पुरुष, आदिम सहजात सम्बन्धों को भी ग्लोबल कर दिया जिससे उनके व्यक्तित्व जटिलताओं में फंस गये है। 'शकुन्तला की अंगूठी' नाटक में वे दुष्यन्त व शकुन्तला के बहाने स्त्री पुरुषों के काम सम्बन्धों के नियति दर्शनों की व्याख्या करते है। नाट्य शिल्प, भाषा सम्बन्धी दुर्बलताओं तथा काम सम्बन्धों के खुले चित्रण के बावजूद सुरेन्द्र वर्मा हिन्दी नाट्य को नवीन कथ्य, रंगमंच विधान तथा नयी प्रयोग दृष्टि देते है।

शंकर शेष एक पूर्णकालिक नाटककार थे। वे अपने चारों ओर नाटक ही नाटक देखते थे। नाटक की कोई प्रविधि ऐसी नहीं थी जिसका उन्हें

ज्ञान न हो। इसका कारण यह है कि शेष ने जीवन की विद्रूपताओं और विवशताओं को बहुत गहराई से महसूस किया। शंकर शेष की नाट्यकला का विस्तार बहुत व्यापक है। उन्होंने अपने नाटको में वर्तमान की पदचाप की हर लय को रूपान्तरित किया है। अपनी नाट्यधर्मी रचनात्मकता का प्रयोग उन्होंने जीवन बोध की व्याकुलता, अकुलाहट, संघर्षशीलता, अन्तर्द्वन्द्व आदि को व्यक्त करने के लिए किया है।

रंगमंच की दृष्टि से इनके नाटक पूरी तरह सफल है। इनके नाटको ने नया मंचीय इतिहास बनाया क्योंकि इनके नाटक बार-बार मंचित हुए है। शंकर शेष राकेशोत्तर साहित्य का एक विलक्षण और प्रयोगशील अध्याय है। डॉ. वीणा गौतम उनकी नाट्यकला पर विचार करते हुए लिखती है - ''शंकर शेष की अंदाज-ए-बयानी में काव्यात्मकता, चारुता व जीवन के सूक्ष्यात्मक मुहावरे एक ओर देहधारी होकर केशर-ली से लहकते है तो दूसरी ओर दहकते मध्यान्ह में झुलसते ग्रीष्म ऋतु के मरु उत्सव की सौन्दर्य ऊर्जा भी जगाते है। ... इनके प्रत्येक नाटक में नव्य परिबोध, शैली की वक्रता, भाषायी उठान, जल की तरह जगह बनाता कथ्य, आइना दिखाती सावादिक संरचना, जीते जागते सशरीर पात्र, महाकाव्यात्मक औदात्य, रंगधर्मी मंचीय कौशल आदि सभी दृष्टियों से शेष की नाट्यकला विस्तार मुखी है।

दूधनाथ सिंह की कृति 'यमगाथा' हिन्दी नाट्य साहित्य की आधुनिक चेतना से युक्त कृति है। हिन्दी कथा साहित्य में दूधनाथ एक प्रतिबद्ध कथाकार के रूप में चर्चित रहे है। 'यमगाथा' ऋग्वेद के मिथकीय संसार से पुरुरवा व उर्वशी के कथानक को आधार बनाता है। सिंह ने कालिदास के उत्कृष्ट रोमांटिक घटाटोप से पुरुरवा, उर्वशी को बाहर लाकर, उनके मिथक की नयी अर्थ उद्भावना पूरे तर्क के साथ की है। इसका कथ्य आगे चलकर सरलीकरण, आरोपित विचारधारा का शिकार हो जाता है और नाटक का स्वर कहीं कहीं निरर्थक तीव्रता से भर जाता है लेकिन उसकी नाटकीयता को क्षति नहीं पहुंचती। इसका शिल्प विशद् कैनवास पर शास्त्रीय पद्धति का विराटत्व लिये हुए है जिसके मंचन के लिए भारतीय परम्परा नाट्यशास्त्र के सैद्धान्तिक व्यवहारिक ज्ञान और वैदिक कालीन जीवन पद्धति आदि का पूर्ण ज्ञान अपेक्षित है। यह कृति प्रशिक्षित, समृद्ध और पूर्णत विकसित रंगमंच की मांग करती है। रंगमंचीय व्यवस्था, नाटक और काव्य के अंत सम्बन्ध की लय, अभिनय शैली, सौन्दर्यशास्त्र और सांस्कृतिक चेतना के बिना इसे समग्रंथित करना सम्भव नहीं है।''

लक्ष्मीनारायण लाल के नाटक 'बलराम की तीर्थ यात्रा' व 'कजरी वन' में अपने अन्य नाटकों की ही भांति वस्तु व शिल्प दोनों स्तरों पर अनेक प्रयोग किये है। सर्वेश्वर दयाल सक्सेना के बाद लोक नाट्य शैली का प्रयोग इन्होंने किया है। आधुनिक यूरोपीय नाट्य शैली और भारतीय नाट्य शैली सभी के प्रयोग इनके नाटकों में देखने को मिलते है। डॉ. बच्चन सिंह ने कहा है कि ''डॉ. लाल नाट्य कौशलों से पूरी तरह परिचित है लेकिन प्रयोग के उत्साह में उनका सम्यक समायोजन नहीं कर पाते। उनकी दूसरी दिक्कत है कि उनके पास कोई अपनी जीवनदृष्टि नहीं है। रह-रह कर प्रयोग साधन न होकर साध्य हो जाता है।

इसी क्रम में नन्दकिशोर आचार्य के नाटक भी अपने कथ्य, नाट्य संरचना, आन्तरिक गठन और चरित्रों की जटिल सांकेतिकता में उल्लेखनीय है। देहान्तर नाटक से चर्चित नन्दकिशोर आचार्य के अन्य नाटको में 'गुलाम बादशाह', 'पागलघर', 'इमिइदम राक्षम', व 'हस्तिनापुर' है इनके नाटको की नाट्यभाषा व शिल्प की मौलिकता, सूक्ष्मता व नुकीलापन महत्वपूर्ण है।

बहुत कम शब्दों में सघन और गहराई से अपनी बात कहते है। हस्तिनापुर नाटक में सर्जनात्मक शिल्प प्रयोग, तीव्र द्वन्द्वात्मक लय और सूक्ष्म काव्यात्मक नाट्यभाषीय प्रयोग द्रष्टव्य है। इनके नाटक, निर्देशक और अभिनेता को चुनौती देने वाले है तथा रंगमंच का नवीन सौन्दर्यबोध रखते है। अन्य नाटको में दयाप्रकाश सिन्हा का 'सीढ़ियां', वर्तमान कुचक्रों के बीच आदमी की महत्वाकांक्षा और उसकी परिणति का मार्मिक चित्र खींचता है। जिंदादिली और रवानगी इस नाटक की प्रमुख विशेषता है।

महिला नाटककारों में मन्नू भंडारी का 'महाभोज' (1982) उनकेउपन्यास महाभोज का नाट्य रूपान्तरण है। मृदुला गर्ग के 'एक और अजनबी' में पारिवारिक विघटन को मूर्त किया है। मृणाल पाण्डे का 'जो राम रचि रांखा' एक प्रसिद्ध नाटक है। इसके अतिरिक्त 'मौजूदा हालात को देखते हुए', दूसरा नाटक 'आदमी जो मछुआरा नहीं था' है।

निष्कर्ष रूप में कह सकते है कि नाटक सिर्फ पात्र साहित्य नहीं है न केवल रंगमंच। नाटक के साहित्येतर भी विविध आयाम है जो रंगमंच से सम्बद्ध है, नाटक केवल नाट्य या वाच्य संवाद नहीं है न केवल शब्दबद्ध रचना और भाषागत अभिव्यक्ति। जो शब्द किसी अनुभूति को, स्थिति को अभिव्यक्त करते है वे अभिनेता द्वारा उसकी सृजनात्मक प्रक्रिया से मंच पर रूपायित और मूर्त होते है। इसलिए नाटक को साहित्य और रंगमंच दो भागो में बांटकर नहीं देखना चाहिए।

मोहन राकेश के अनुसार नाट्य और रंगमंच के लिए निश्चित सिद्धान्त प्रतिपादित नहीं किये जा सकते क्योंकि बदलते समय और समाज के सरोकारों व सवालों से रंगकर्म में भी निरन्तर बदलाव बना रहता है। ''आज का रंगमंच पहले से कहीं अधिक निर्देशक का माध्यम बनता जा रहा है - नाटककार इसमें उपेक्षित होता जा रहा है। रंगमंच की पूरी प्रयोग प्रक्रिया में नाटककार केवल एक अभ्यागत, सम्मानित दर्शक या बाहर की इकाई बना रहे, यह स्थिति मुझे स्वीकार्य नहीं है।''

आज शक्तिशाली व व्यापक इलेक्ट्रोनिक मीडिया के भयानक आक्रमण ने नाटक और रंगमंच के सामने जबरदस्त चुनौती उपस्थित कर दी है परन्तु हमें विश्वास करना चाहिए कि जीवन्त अनुभव का यह प्राचीनतम और प्रखर अभिव्यक्ति माध्यम अपने प्रयोगधर्मी चरित्र के कारण ही कोई न कोई नया रूपाकार लेकर, इस वर्तमान संकट का न केवल मुकाबला करेगा बल्कि नित नवीन, कल्पनाशील और प्रभावशाली बना रहकर अधिकाधिक प्रेक्षकों, पाठकों को अपने जादू से बांधे रखने में सफल भी होगा क्योंकि -

''कल्पना की जीभ में भी धार होती है
बाण ही होते विचारों के नहीं केवल
स्वप्न के भी हाथ में तलवार होती है।''

सन्दर्भ सूची :-

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SECURITY ISSUES OF CLOUD COMPUTING

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Abstract : As technology is advancing in computer science, cloud computing or shared virtual computing resources is being adopted at a rapid pace. But Cloud computing has a fundamental difference from the traditional computing resources in terms of security wherein traditionally on-premise computer resources were protected by physical walls and security barriers. But cloud based computing resources being on the internet are virtually accessible by anyone - imagine 7 billion potential threats! This paper analyses various security aspect and challenges that cloud computing is bringing to the forefront and how a shift is required in IT department's approach to security with Cloud resources.

Keywords:-service model, Security architecture, ,issues, challenges ;

I. INTRODUCTION

As technology is advancing in computer science, of use Cloud Computing is rapidly increase and it is gathering a growing attention in the scientific and industrial communities. According to the study of Gartner [1] Cloud Computing considered as the first among the top most important technologies and with a better outcomes in subsequent years by companies and organizations.

Cloud Computing aims at providing shared resources and services via Internet. Cloud Computing enables ubiquitous, convenient, on-demand network access to a shared pool of geographic distant computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management(management not done by manual ,but by software)effort or service provider interaction[2][3].

II. SERVICE MODEL OF CLOUD COMPUTING

Cloud services are categories into three :-Saas, (ii)Paas(iii)Iaas

Software-as-a-service (SaaS)

In this model, Application Service Provider (ASP) provides on-demand software over the internet.Here, third party hosted the on-demand software and the data over the cloud environment and that third party is called cloud service provider, like your Gmail account, you use that application on someone else's system.[4]. Application services provided by Saas are basically on demand such as email, conferencing software, and business applications such as ERP, CRM, and SCM [9]. The adoption of SaaS applications may raise some security concerns. [6]

B .*Platform as Service (PaaS):* In Paas, you can use Web-based tools (like surveymonkey) todevelop applications so they run on systems software which is provided by another company, like Google App Engine[4] PaaS facilitates implementation of cloud-based applications irrelevent the cost of buying and retain the underlying hardware and software layers [7]. As with SaaS and IaaS, PaaS depends on a secure and reliable network and also a secure web browser. Application security in Pass comprises of two software layers: Security of the plateform of Paas itself (i.e., runtime engine), and Security of customer applications utilize on a PaaS platform [8]. PaaS providers are responsible for securing the platform software stack which includes the runtime engine that runs the customer applications

C. Infrastructure as Service (IaS):

It provides services to the companies with computing resources including servers, networking, storage, and data centre space on a rent-use basis[4]For example Amazon EC2 etc. IaaS provides a pool of resources such as servers, storage, networks, and other computing resources in the form of virtualized systems, which are accessed through the Internet [10]. Users are entitled to run any software with full control and management on the resources allocated to them [11]. With IaaS, cloud users have better control over the security compared to the other models as long there is no security hole in the virtual machine monitor [12]. They access control of software running in their virtual machines, and they are responsible to compose security policies correctly [13]. However, the underlying compute, network, and storage infrastructure is controlled by cloud providers. IaaS providers must undertake a considerable effort to secure their systems in order to minimize these risks that result from creation, communication, monitoring, modification, and mobility [14].

Among the three service models , Saas have less access control in terms of security.

III CLOUD SECURITY ARCHITECTURE

Using of others resources might be risky because have no control over that not managed by user themselves. And more concerning, when data stored over cloud is personnel and confidential, .Hence, proved that security is major concerns if use cloud services. Some of the important components of Service Provider Layer are SLA Monitor, Metering, Accounting, Resource Provisioning, Scheduler& Dispatcher, Load Balancer, Advance Resource Reservation Monitor, and Policy Management. Some of the security issues related to Service Provider Layer are Identity, Infrastructure, Privacy, Data transmission, People and Identity, Audit and Compliance, Cloud integrity and Binding Issues. Some of the significant components of Virtual Machine Layer creates lots of virtual machines and number of operating systems and its monitoring. Some of the security issues related to Virtual Machine Layer

are VM Sprawl, VM Escape, Infrastructure, Separation between Customers, Cloud legal and Regularity issues, Identity and Access management. Some of the significant components of Data Center (Infrastructure) Layer contains the Servers, CPU's, memory, and storage, and is henceforth typically denoted as Infrastructure-as-a-Service (IaaS). Some of the security issues related to Data Center Layer are secure data at rest, Physical Security: Network and Server[18].
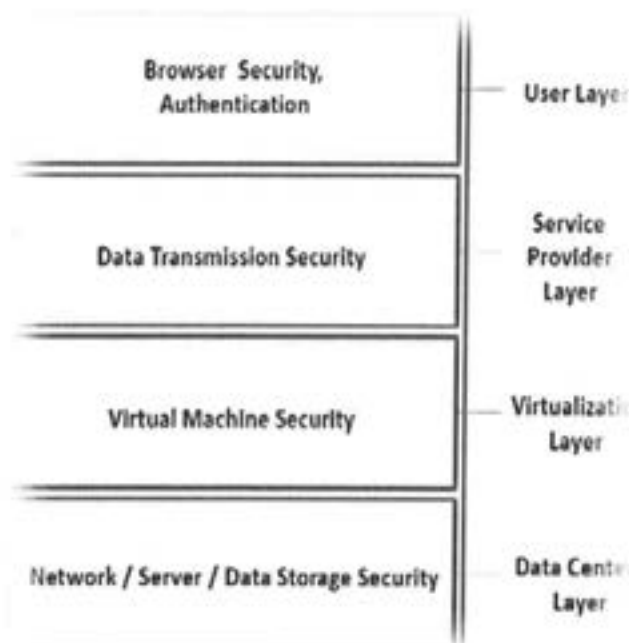
Fig. Security Architecture of Cloud computing

IV TYPES OF SECURITY ISSUES IN CLOUD COMPUTING

Top security issues in cloud computing environment as discovered by "Cloud Security Alliance" CSA are [16]: •

Network Security
Security issue generate in this category are DNS attack, reused IP address, outsiders attack etc.
DNS translate domain name into IP address. Here, in some cases the user routed to malicious cloud instead of requested cloud.
Reiterate IP address issue have been a big network security concern. When a particular user moves out of a network then the IP-address associated with him (earlier) is assigned to a new user. Sometimes this risks the security of the new user as there is a certain amount of time lag between the change of an IP address in DNS and the clearing of that address in the DNS caches.
Outsider attacks generates when it capture packets flowing in a network and if the data that is being transferred through these packets is not encrypted, it can be read and there are chances that vital information flowing across the network can be traced or captured. A sniffer program, through the NIC (Network Interface Card) ensures that the data/traffic linked to other systems on the network also gets recorded.
[15]
*Insecure Application Programming Interfaces (API):*In order to allocate computing storage, and networking resources for the requested cloud application or services, a Cloud API communicates with direct or indirect infrastructure. Providers must carefully ensure that security is integrated into their service models, while the users must be aware ofthe possible security risks [15].
*Wicked Insiders:*Since consumers do not have a clear sight of provider's policies and procedures, malicious insiders create a larger threat in cloud computing environment. Malicious insiders can gain unauthorized access into the organization and their assets [15].
Multi-tenancy nature: Major security concerns, sharing resources over Cloud Computing was the risk of data being exposed to third parties in a multi-tenant environment. Accessing of hardware by multiple customers affects the response time and performance for other customers. Resources are shared at each infrastructure layer, so security issue is major concern. [17]
*Data Transmission:*During transmission process, data should be encrypted. In cloud environment, data encryption is not done at processing time, data is encrypted to provide the confidentiality and integrity of data-in-transmission to and from cloud provider by making use of access controls such as authorization, auditing, authentication for using resources, and also ensuring the availability of the Internet-facing resources at cloud provider. Middle-man attacks is cryptographic attack is carried out when an attacker can place themselves in the communication's path between the users. And have use of data illegal.

.V Research Challenges in Cloud Computing
There are many research challenges in cloud computing technology and it tries to overcome this challenges in order to meet the requirements of next generation cloud architectures. The research is still at a very early stage. There are many issues in this technology which have not been fully addressed, while new challenges keep on emerging. Some of these challenges are [5]:
(i)   Data Encryption
(ii)   Service Level Agreements (SLA's)
(iii)   Reliability & Availability of Service
(iv)   Interoperability

(v)   Access controls

(vi)   Multi-tenancy

(vii)   Platform Management

Conclusion: - Cloud computing is useful technology having extra care measures   regarding to security. Security issue become rise in side channel way, at owner side etc. These all are challenging and future work continue

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AVIFAUNAL DIVERSITY FROM DIFFERENT WETLANDS OF BEAWAR (AJMER), INDIA

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Abstract:
The present study deals with the diversity and status of birds of Sedriya talab, Bichadli talab (company bag) and Bayla talab of Beawar region of Ajmer district of Rajasthan state on India. Total 108 birds were recorded from the Beawar. Out of them 94 Birds from Sedriya talab, 84 birds from Bayla Talab and 88 birds from Bichadli talab (company bag), it was also found that avian diversity of the study area is under great threat due to various anthropogenic and environmental problems.
Key-words: Avifauna, biodiversity, wetlands, Beawar, conservation

1. INTRODUCTION

Avifauna plays an important link of food chain in ecological unit of nature. Hence, it is very important to know their diversity, migratory status, population size, distribution pattern and conservation status (Kante *et al.*, 2013). Biodiversity at present is better understood for birds in many respects than any other major group of organisms because they probably inspire more extreme interest in humans, are often spectacular, relatively easily observed and not too cryptic to identify (Bhadja and Vaghela, 2013). Birds are essential animal group of an ecosystem and maintain a trophic level. They have their functional role in the ecosystem as potential pollinators and scavengers and are rightly called as bio-indicators (Joshi *et al.*, 2013). Therefore, detail study on avifauna and their ecology is important to protect them. Although wetlands are one of the most productive ecosystems and most severely affected habitats next to tropical forests, they are being neglected in densely populated countries like India (Datta, 2011). Even the wetlands of South Asia are facing tremendous anthropogenic pressure, which can greatly influence the structure of the bird community (BirdLife International 2010).

The loss of waterbird habitats through direct and indirect human interferences has led to a decline in several waterbird populations (Deka and Nath, 2013). Results of this study are valuable, as they serve as baseline information in the development of measures and strategies that will safeguard the wetland from destruction. Likewise, results of this study will also enable us to be aware of the ecological condition of our environment, as birds are important ecological indicators responsive to changes in the environment.

2. METHODOLOGY

2.1 Study area:

Figure 1 showing the studied area Beawar, one of the richest place of Rajasthan in Avifaunal diversity, is situated in district Ajmer (Rajasthan) India.

2.2 Tools were used:

A high quality digital camera (Canon SX10), binoculars, field guide, observation sheet, motor cycle and oxford pocket guide to the birds of the Indian subcontinent by Richard Grimmett, Carol Inskipp and Tim Inskipp were used during filed trip for the present investigation.

2.3 Data collection:

The study was based on the survey of the area. Point counts as well as line transect methods were used to survey the area. Quantitative avifaunal data were collected in the point count survey and combined with distance estimation with the help of binocular and camera, which, provide a means of estimating animal population densities. First we have selected the Sedriya talab, Bichadli talab (company bag) and Bayla Talab as a study site in Beawar and nearby area. These are rich in biodiversity in Avifaunal point of view. We use motorcycle as transportation. Periodical studies were made to know the status of birds. Direct count method and Visual encounter method were used. Birds were identified with the help of field guide (Grimmett *et al.*,1998)
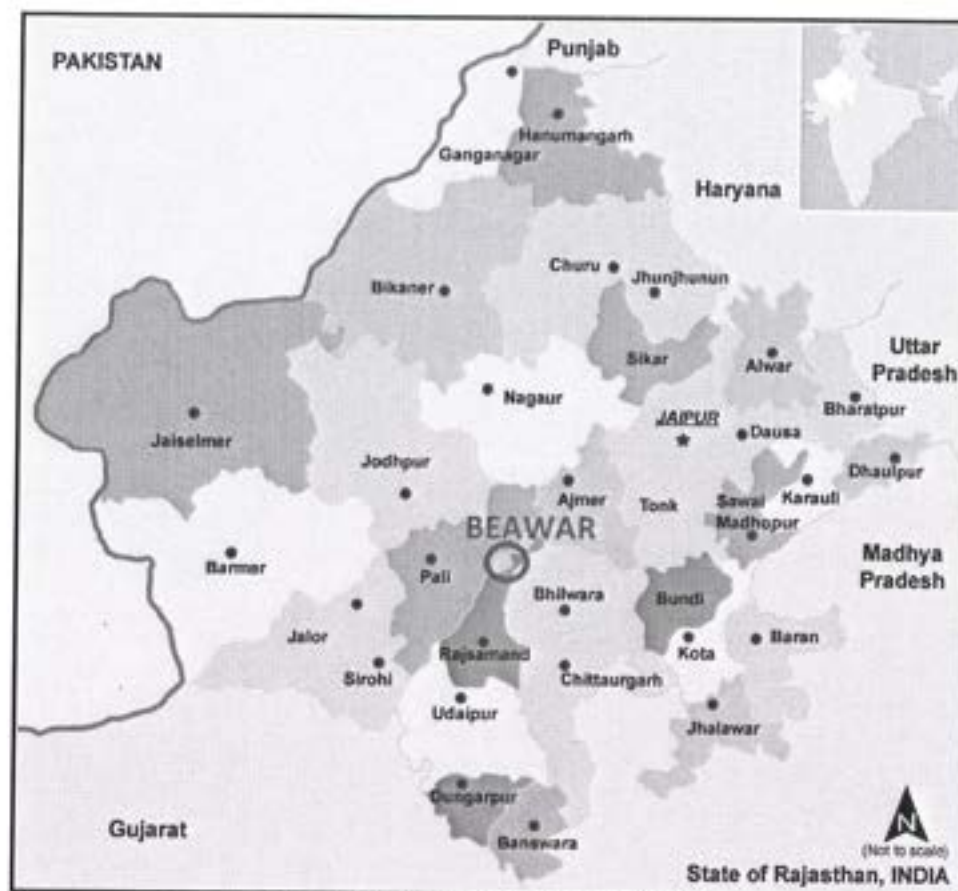
Fig.- 1: Beawar in the map of Rajasthan

Most of the aves species show their presence during the monsoon and winter season. Regular surveys were made near the breeding grounds. Representative cases were photographed from different angles in the nature so that these represented the natural colors. Morphometric observations were also made for the Taxonomic identification and compared with the standard diagnostic keys.

We divide the birds in three category MC-most common, C-common, R-rare according to the no of individual's. We also describe the IUCN status of the animals.

A- Sedriya talab
B- Bayla Talab
C- Bichadli talab(company bag)

Fig.- 2: Study site from Beawar (study area)

Figure 2 showing the wetland sites visited in the present study. Avifaunal records were collected from Sedriya talab (26°04'45.8"N 74°19'18.9"E), Bichadli talab (26.095714, 74.322974) and Bayla talab of Beawar (26.039725, 74.354637). Sedriya and Bichadli water bodies were at 2 km distance and Bayla was quite far approx. 7 km towards south.

3. RESULT & DISCUSSION:

Table- 1: Studies of avifaunal diversity of different wetlands of Beawar and nearby area, Rajasthan, India

S. No.	Common name	Scientific name	Family	Residential status	Status	A	B	C
1	Black shouldered kite	Elanus caeruleus	Accipitridae	Res	MC	+	+	+
2	Shikra	Accipiter badius	Accipitridae	Res	C	+	+	-
3	Ashy crowned sparrow lark	Eremopterix grisea	Alaudidae	Res	MC	+	+	+
4	Crested lark	Galerida cristata	Alaudidae	Res	MC	+	+	+
5	Pied kingfisher	Ceryle rudis	Alcedinidae	Res	C	-	-	+
6	White throated kingfisher	Halcyon smyrnensis	Alcedinidae	Res	MC	+	+	+
7	Common kingfisher	Alcedo atthis	Alcedinidae	Res	R	+	-	+
8	Ruddy shelduck	Tadorna ferruginea	Anatidae	WV	C	+	+	+
9*	Bar headed goose	Anser Indicus	Anatidae	WV	R	-	-	+
10	Spot billed duck	Anas poecilorhyncha	Anatidae	Res	MC	+	+	+
11	Comb Duck	Sarkidiornis melanotos	Anatidae	Res	C	-	-	+
12	Eurasian wigeon	Anas Penelope	Anatidae	WV	C	+	-	+
13	Gadwall	Anas Strepera	Anatidae	WV	C	+	-	+
14	Mallard	Anas platyrhynchos	Anatidae	WV	C	-	-	+
15	Northern pintail	Anas acuta	Anatidae	WV	MC	-	-	+
16	Northern shoveler	Anas clypeata	Anatidae	WV	MC	+	-	+
17	Common Teal	Anas crecca	Anatidae	WV	C	+	+	+
18	Garganey	Anas Querquedula	Anatidae	WV	C	-	-	+
19	Common pochard	Aythya ferina	Anatidae	WV	C	-	+	+
20	Tufted duck	Aythya fuligula	Anatidae	WV	R	+	+	+
21	Ferruginous Pochard	Aythya nyroca	Anatidae	WV	R	-	-	+
22	Great egret	Casmerodius albus	Ardeidae	Res	MC	+	+	+
23	Intermediate egret	Mesophoyx intermedia	Ardeidae	Res	MC	+	+	+
24	Little egret	Egretta garzetta	Ardeidae	Res	MC	+	+	+
25	Cattle egret	Bubulcus ibis	Ardeidae	Res	MC	+	+	+
26	Grey heron	Ardea cinerea	Ardeidae	WV	C	+	+	+
27	Indian pond heron	Ardeola grayii	Ardeidae	Res	MC	+	+	+
28	Black crowned night heron	Nycticorax nycticorax	Ardeidae	Res	C	-	+	-
29	Indian grey hornbill	Ocyceros birostris	Bucerotidae	WV	R	+	-	-
30	Yellow wattled lapwing	Vanellus malabaricus	Charadriidae	Res	C	+	+	+
31	Red wattled lapwing	Vanellus indicus	Charadriidae	Res	MC	+	+	+
32	Little ringed plover	Charadrius dubius	Charadriidae	Res	MC	+	+	+
33*	Woolly-necked stork	Ciconia episcopus	Ciconiidae	WV	R	-	+	-
34*	Painted stroke	Mycteria leucocephala	Ciconiidae	WV	R	+	+	-
35*	Ashian open bill	Anastomus oscitans	Ciconiidae	WV	R	+	+	-
36	Ashy prinia	Prinia socialis	Cisticolidae	Res	C	+	+	+
37	Eurasian collared dove	Streptopelia decaocto	Columbidae	Res	MC	+	+	+
38	Laughing dove	Streptopelia senegalensis	Columbidae	Res	MC	+	+	+
39	Red collared dove	Streptopelia tranquebarica	Columbidae	Res	MC	+	+	+
40	Rock pigeon	Columba livia	Columbidae	Res	MC	+	+	+
41	Yellow footed green pigeon	Treron phoenicoptera	Columbidae	WV	C	+	+	+
42	Indian roller	Coracias benghalensis	Coraciidae	Res	MC	+	+	+
43	European roller	Coracias garrulous	Coraciidae	SV	C	+	-	+
44	House crow	Corvus splendens	Corvidae	Res	MC	+	+	+
45	Common raven	Corvus corax	Corvidae	Res	R	+	+	+
46	Rufous Treepie	Dendrocitta vagabunda	Corvidae	Res	C	+	-	-
47	Asian koel	Eudynamys scolopacea	Cuculidae	Res	MC	+	+	+
48	Greater coucal	Centropus sinensis	Cuculidae	Res	MC	+	+	+
49	Black drongo	Dicrurus macrocercus	Dicruridae	Res	MC	+	+	+
50	Indian silver bill	Lonchura malabarica	Estrildidae	Res	MC	+	+	+
51	Red rumped swallow	Hirundo daurica	Hirundinidae	Res	MC	+	+	+
52	Streak throated swallow	Hirundo fluvicola	Hirundinidae	Res	C	+	+	+
53	Wire tailed Swallow	Hirundo Smithii	Hirundinidae	Res	MC	+	+	+
54	Pheasant tailed jacana	Hydrophasianus chirurgus	Jacanidae	Res	C	+	-	-
55	Bronze winged jacana	Metopidius indicus	Jacanidae	Res	C	+	-	-

56	River tern	*Sterna aurantia*	Laridae	Res	C	+	-	+
57	Jungle babbler	*Turdoides striatus*	Leiothrichidae	Res	MC	+	+	+
58	Common babbler	*Turdoides caudatus*	Leiothrichidae	Res	MC	+	+	+
59	Green bee eater	*Merops orientalis*	Meropidae	Res	MC	+	+	+
60	Olive backed pipit	*Anthus hodgsoni*	Motacillidae	WV	C	+	+	+
61	White browed wagtail	*Motacilla maderaspatensis*	Motacillidae	Res	MC	+	+	+
62	White wagtail	*Motacilla alba*	Motacillidae	WV	C	+	+	+
63	Yellow wagtail	*Motacilla flava*	Motacillidae	WV	C		+	+
64	Citrine wagtail	*Motacilla citreola*	Motacillidae	WV	C	+	+	+
65	Oriental magpie robin	*Copsychus saularis*	Muscicapidae	Res	MC	+	+	+
66	Indian robin	*Saxicoloides fulicata*	Muscicapidae	Res	MC	+	+	+
67	Common stone chat	*Saxicola torquata*	Muscicapidae	WV	MC	+	+	+
68	Pied bushchat	*Saxicola caprata*	Muscicapidae	WV	C	+	+	+
69	Purple sunbird	*Nectarinia asiatica*	Nectariniidae	Res	MC	+	+	+
70	Eurasian golden oriole	*Oriolus oriolus*	Oriolidae	SV	C	+	-	-
71	House sparrow	*Passer domesticus*	Passeridae	Res	MC	+	+	+
72	Great cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	Res	MC	+	-	-
73	Little cormorant	*Palacrocorax niger*	Phalacrocoracidae	Res	MC	+	+	-
74	Grey francolin	*Francolinus pondicerianus*	Phasianidae	Res	MC	+	+	+
75	Indian pea fowl	*Pavo cristatus*	Phasianidae	Res	MC	+	+	+
76*	Greater flamingo	*Phoenicopterus ruber*	Phoenicopteridae	PV	R	-	+	-
77	Baya weaver	*Ploceus philippinus*	Ploceidae	Res	MC	+	+	+
78	Little grebe	*Tachybaptus ruficollis*	Podicipedidae	Res	C	+	+	+
79	Rose ringed parakeet	*Psittacula krameri*	Psittacidae	Res	MC	+	+	+
80	Plum headed parakeet	*Psittacula cyanocephala*	Psittacidae	WV	C	+	-	+
81	Red vented bulbul	*Pycnonotus cafer*	Pycnonotidae	Res	MC	+	+	+
82	White eared bulbul	*Pycnonotus leucotis*	Pycnonotidae	Res	C	+	+	+
83	White breasted waterhen	*Amaurornis phoenicurur*	Rallidae	Res	MC	+	+	+
84	Common moorhen	*Gallinula chloropus*	Rallidae	Res	MC	+	+	+
85	Common coot	*Fulica atra*	Rallidae	Res	MC	+	+	+
86	Purple swamphen	*Porphyrio porphyria*	Rallidae	Res	MC	+	+	+
87	Pied avocet	*Recurvirostra Avosetta*	Recurvirostridae	WV	MC	+	+	+
88	Black winged stilt	*Himantopus himantopus*	Recurvirostridae	Res	MC	+	+	+
89	White browed fantail	*Rhipidura aureola*	Rhipiduridae	Res	C	+	+	+
90	Common red shank	*Tringa tetanus*	Scolopacidae	WV	C	+	+	+
91	Common green shank	*Tringa nebularia*	Scolopacidae	WV	C	+	+	+
92	Common sand piper	*Actitis hypoleucos*	Scolopacidae	WV	C	+	+	+
93	Common snipe	*Gallinago gallinago*	Scolopacidae	WV	C	+	+	+
94	Black-tailed godwit	*Limosa limosa*	Scolopacidae	WV	R	+	-	-
95	Ruff	*Philomachus pugnax*	Scolopacidae	WV	C	+	+	+
96	Forest owlet	*Athene blewitti*	Strigidae	Res	C	+	-	+
97	Spotted owlet	*Athene brama*	Strigidae	Res	C	+	-	+
98	Asian pied starling	*Sturnus contra*	Sturnidae	Res	MC	+	+	+
99	Brahminy starling	*Sturnus pagodarum*	Sturnidae	Res	MC	+	+	+
100	Rosy Starling	*Sturnus roseus*	Sturnidae	PV	C	+	+	-
101	Common myna	*Acridotheres tristis*	Sturnidae	Res	MC	+	+	+
102	Bank myna	*Acridotheres ginginianus*	Sturnidae	Res	MC	+	+	+
103	Eurasian spoonbill	*Platalea leucorodia*	Threskiornithidae	Res	C	-	+	-
104	Black headed ibis	*Threskiornis melanocephalus*	Threskiornithidae	Res	C	+	+	-
105	Glossy ibis	*Plegadis falcinellus*	Threskiornithidae	PV	R	-	+	-
106	Black ibis	*Pseudibis papillosa*	Threskiornithidae	Res	MC	+	+	+
107	Common hoopoe	*Upupa epops*	Upupidae	Res	MC	+	+	-

(Res): Resident; (MC): Most Common; (WV): Winter visitor; (C): Common; (SV): Summer visitor; (R): Rare; (PV): Passage visitor; (A): Sedriya talab, (B): Bayla talab; (C): Bichadli talab (company bag); (*): Number of Individuals Less than 5; (+): Present; (-): Absent

All the observed bird species is compiled in Table 1. Total 108 different types of species were recorded from the study area. Out of them 94 species were recorded only from Sedriya talab and its nearby area, 84 species from Bayla Talab and 88 species from Bichadli talab. Observations showed that 54 species of birds were found as most common, 42 as commonly found and 12 birds were found under

rare category. Some of observed birds fallen under rare category are Ashian open bill, painted stroke, wooly necked stroke, Indian grey hornbill, common kingfisher, ferruginous pochard, greater flamingo, bar headed goose, tufted duck, glossy ibis and black-tailed godwit. Out of 108 species it was found that 71 species were resident, 32 were winter visitor, 03 were passage visitor and 02 were found as summer visitor. Rosy starling, greater flamingo and glossy ibis were passage visitor where as European roller and Eurasian golden oriole were summer visitor.

4. CONCLUSION:

This study includes avian diversity of Sedriya, Bayla and Sedriya wetlands of Beawar region of Ajmer district of Rajasthan state of India. The present research work revealed that even though the urban sites are continuously disturbed, still these sites have supported significant number of avifauna. It is concluded that in order to attract more and more avifauna to urban areas, we should plant diverse varieties of fruiting trees in our backyards and also offer artificial nesting sites to birds. This is especially true in the light of documented impacts of habitat loss, fragmentation, degradation and other anthropogenic factors on forest avifauna across the globe in the past two decades. Our study was carried out in part to document the occurrence of such bird species to facilitate their conservation.

5. ACKNOWLEDGMENT:

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Research Article

STATISTICAL ANALYSIS OF PERCEPTION OF CUSTOMERS ABOUT DIGITAL BANKING SERVICES PROVIDED BY PUBLIC AND PRIVATE SECTOR BANK: A COMPARATIVE STUDY

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ABSTRACT

In today's rigorous world, Banking is an imperative part of financial activity and digital banking in India is highly advanced. Digital banking is also called internet banking or online banking. When a bank provides its services online and customers can make transactions, submit requests, and handle other banking activities online, it is called digital banking. The first bank in India which offer internet banking was the ICICI bank in 1996. Since then a number of other banks have followed and currently most of the banks provide online banking facilities to their customer's. Digital Banking plays an integral role in providing Banking services in more easy and convenient way to its customers in their day to day working. Moreover, now-a-days it's a vast challenge for both the public and private sector banks to identify that which bank facilitate to the customers is best regarding as the digital banking services. This study attempt to analyze the Customers perception about the digital banking services provided by public and private sector banks. The overall study was based on the primary data which was collected through well-structured questionnaire and the data collected was tested by non-parametric Mann whitney u test.

INTRODUCTION

Digital banking in a broader context is the move from traditional banking to online banking, where all the banking services are delivered over the internet. Traditional banks are facing growing competition and they shift towards online services. The shift from traditional banking to digital banking has been moderate and remains ongoing, and is constituted by differing degrees of digitization of banking service. It saves time and money as customers has no longer to travel to a bank to carry out transactions. Digital banking involves high levels of process automation and web-based services. It provides the ability for users to access financial data through desktop, mobile and ATM services as well as bankers see potential to improve customer relationship through digital banking.

There is a lot more to digital banking than just a few features that we can see on the surface. Some major benefits of digital banking are Business efficiency, Cost savings, Increased accuracy, Improved competitiveness, Greater agility, Enhanced security.

Importance of Digital Banking in India

Digital Banking is an important feature in today's world. The benefits of digital banking stress its importance by themselves.

With a high rate of crime and corruption, digital banking is a safe way to handle financial transactions. One of the most important things for businesses these days is time, and so they want to use it on something that is providing them more value. The digital banking helps the businesses to easily transfer payments in their employee bank accounts. Hence the option of paying by credit or debit card, or through online wallets is a much safer option. There are a plethora of options that people can opt for when it comes to banking. Now people can check their bank account details, pay their bills online, transfer money to other accounts, and all of this can be done from the very comfort of their home through Digital Banking Services.

Public sector bank: These are banks where majority stake is held by the Government of India.

Examples of public sector banks are: SBI, Bank of India, Canara Bank, etc.

Private Sector Banks: These are banks majority of share capital of the bank is held by private individuals. These banks are registered as companies with limited liability.

Examples of private sector banks are: ICICI Bank, Axis bank, HDFC, etc.

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REVIEW OF LITERATURE

The impact of innovative technology on customer satisfaction vis-à-vis public sector and private sector banks in Bhopal city. Primary data was collected from customers of these banks and analyzed, which has given significant results on the subject. Among the population of customers of SBI and ICICI Bank, a sample size of 200 was selected for study, which included 100 customers each of largest branches of SBI and ICICI Bank in Bhopal. These banks were considered as representative banks since these were largest in their own segment (i.e. public sector and private sector). It was found that private sector banks were having an edge in terms of success in innovation were covered by Jitendra K. Sharma (2017). Ankit Kesharwani & Gajulapally Radhakrishna (2013) This paper has reviewed the most of seminal studies in the area of diffusion of innovation and makes an attempt to do an empirical research that looked into the factors that drives and inhibits internet banking usage in India. An exploratory factor analysis followed by a confirmatory factor analysis has been applied on 362 internet banking users. Findings resulted in seven factors – perceived benefit, hacking and fraud risk, performance risk, computer self-efficacy, technology complexity, social influence, and pricing concerns. The results suggest that acceptance and usage of internet banking services can turn into a vital concern for future research, as the drivers overcoming the inhibitors over time at an influencing rate. Moreover, this study also compares the findings with existent diffusion of innovation literature and identified several additional factors that can affect internet banking adoption in India. Rajesh Kumar Srivastava (2007) The research is focused on what are the customer's perceptions about internet banking and what are the drivers that drive consumers. How consumers have accepted internet banking and how to improve the usage rate were the focus of research area in this study. Qualitative exploratory research using questionnaire was applied. 500 respondents were selected for study after initial screening. They were all bank customers. When investigating all the variables and the response by consumers, this study reveals that the perception of the consumers can be changed by awareness program, friendly usage, less charges, proper security, and the best response to the services offered.

RESEARCH METHODOLOGY

The whole study is done by the primary data. The primary data were obtained through well-structured questionnaire which is tested for reliability and validity and were collected by the customers who have account in both public sector bank as well as private sector bank by the mailing method or door to door method. The sample size was taken 248.

Objective of the study

1. To analyze the digital banking services(ATM, Internet Banking, Mobile Banking) of public and private sector banks
2. To evaluate which bank provide better digital banking services.

Research variables

For this study we considered some digital banking services which is our research variable and these areas following:

Technology preference by customers: This variable means that from which bank, customer most like to take technical services. And also this variable" comprises of 'Conducting financial transactions online at home', 'Communicating bank officials via E – mail', 'Use of ATM / Debit card / Credit card / Online banking services in financial transaction', 'E – payments for utility and other services' and 'Electronic Fund Transfer IMPS/NEFT/RTGS'.

ATM service: ATM, or automated teller machine, is a machine normally used to dispense money. The customers are identified via a debit card or an ATM card and after the verification via a pin code, the customers can withdraw money as cash from their account without joining up behind queues and filling withdraw slips. Almost all the private and public banks tend to have their ATMs in every city, town and most of the villages of the country. This variable comprises "Number of Transactions, The quality of notes (currency), Located at every possible prominent place, Located in your vicinity, Machine response, Presence of Guard".

Internet Banking Services: Internet banking has become a trend in the recent times as people get attractive rewards and can get all the services such as fund transfer, e-tax filing, e-billing. This variable comprises "Account information and balance enquiry, Payments /Transfers, Bill payments, Fixed deposit, E- Tax".

Statistical analysis

For the purpose of analysis of data, a number of statistical techniques have been used in this study. The date was tested for normality by Shapiro wilk test and Kolmogorov-Smirnova and found non normal. So, we are using non parametric assumption and using Mann Whitney u test for compare the groups of bank.

Research hypothesis

1. For normality :

H_0: The data is distributed normally
H_1 : The data is distributed non normal.

2. For testing the difference in perception of customers

H0: There is no significant difference in perception of customers for providing digital banking services which comprises Technology preference by customer, ATM service, Internet banking by public and private sector banks.

H1: there is significant difference in perception of customers for providing digital banking services which comprises Technology preference by customer, ATM service, Internet banking by public and private sector banks.

RESULT AND DISCUSSION

Table 1

	Bank	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Technology preference by customer	Public	.122	248	.000	.921	248	.000
	Private	.208	248	.000	.851	248	.000
ATM Services	Public	.134	248	.000	.926	248	.000
	Private	.141	248	.000	.915	248	.000
Internet banking Services	Public	.159	248	.000	.884	248	.000
	Private	.215	248	.000	.845	248	.000

Tests of Normality

So, by the table 1 we can conclude that for all the three services (Technology preference by customer, ATM Services, Internet banking Services) the p value is less than 0.05 that means we reject our hypothesis that data is normal. So data is non-normal. Now we use non parametric assumptioni.e using MannWhitney u test for testing better services by public and private sector bank.

Table 2

				Bootstrapa			
	Bank	Statistic	Bias	Std. Error	95% Confidence Interval		
						Lower	Upper
Technology preference by customer	Public	N	248				
		Mean	2.1061	-.0011	.0415	2.0206	2.1888
		Std. Deviation	.65924	-.00082	.01920	.62044	.69619
		Std. Error Mean	.04186				
	Private	N	248				
		Mean	2.2421	.0002	.0467	2.1532	2.3321
		Std. Deviation	.72292	-.00156	.01998	.68281	.76159
		Std. Error Mean	.04591				
ATM Services	Public	N	248				
		Mean	2.1076	-.0006	.0505	2.0054	2.1970
		Std. Deviation	.79964	-.00170	.02848	.74286	.85580
		Std. Error Mean	.05078				
	Private	N	248				
		Mean	2.1031	-.0002	.0505	2.0002	2.2002
		Std. Deviation	.80798	-.00326	.02743	.75073	.85651
		Std. Error Mean	.05131				
Internet banking Services	Public	N	248				
		Mean	1.9974	-.0009	.0556	1.8895	2.1036
		Std. Deviation	.83486	-.00294	.03205	.77225	.89531
		Std. Error Mean	.05301				
	Private	N	248				
		Mean	2.1960	.0002	.0499	2.0954	2.2931
		Std. Deviation	.74459	-.00259	.02158	.69848	.78364
		Std. Error Mean	.04728				

From the table 2 we can say that the respondents from both Public and Private Banks were found satisfied with 'Technology preference by customer' attribute.

For attribute 'ATM services, and Internet banking Services' majority of the respondents from both Public and Private Banks quoted these services good.

Table 3

	Bank	N	Mean Rank	Sum of Ranks
Technology preference by customer	Public	248	233.24	57844.00
	Private	248	263.76	65412.00
	Total	496		
ATM Services	Public	248	249.02	61756.00
	Private	248	247.98	61500.00
	Total	496		
Internet banking Services	Public	248	230.73	57220.00
	Private	248	266.27	66036.00
	Total	496		

For Technology Preference by Customer category, Public sector banks have 248 observations whose total sum of ranks is 57844.00. This results in a mean rank of 233.24. By contrast for Technology Preference by Customer category, Private

sector banks also have 248 observations whose total sum of ranks is 65412.00. This results in a mean rank of 263.76. So in TECHNOLOGY PREFERENCE BY CUSTOMER category Private sector banks have a larger mean rank than Public sector banks and thus tend to take larger values.

For ATM SERVICES category, Public sector banks have 248 observations whose total sum of ranks is 61756.00. This results in a mean rank of 249.02. By contrast for ATM SERVICES category, Private sector banks have 248 observations whose total sum of ranks is 61500.00. This results in a mean rank of 247.98. So in ATM SERVICES category Public sector banks have a larger mean rank than Private sector banks and thus tend to take larger values.

For INTERNET BANKING SERVICES category, Public sector banks have 248 observations whose total sum of ranks is 57220.00. This results in a mean rank of 230.73. By contrast for INTERNET BANKING SERVICES category, Private sector banks have 248 observations whose total sum of ranks is 66036.00. This results in a mean rank of 266.27. So in INTERNET BANKING SERVICES category Private sector banks have a larger mean rank than Public sector banks and thus tend to take larger values

Table 4

Test Statistics				
	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Technology preference by customer	26968.0	57844.0	-2.4	0.0
ATM Services	30624.0	61500.0	-0.1	0.9
Internet banking Services	26344.0	57220.0	-2.8	0.0

It can be observed from the above table that the p value for, 'Technology preference by customer', 'Internet banking Services' is less than 0.05. so we reject the null hypothesis for both the parameter's that there is significant difference in perception of customers for providing digital banking services for Technology preference by customer and internet banking by public and private sector banks. Whereas in ATM Services', 'p' value is greater than 0.05. We therefore have significant evidence to accept the null hypothesis that ATM service is same in Public and Private Banks.

CONCLUSION

Since, forTechnology preference by customer and internet banking the null hypothesis is rejected that means there is significant difference in perception of customers of providing services by public and private sector banks, and by the group statistics for Technology preference by customer and internet banking private banks have greater mean than public banks so customers are little more satisfied with private banks. And for the ATM service customers perception were found same for both bank.

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Principal
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RESEARCH ARTICLE

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Elliptical shaped wide slot monopole patch antenna with crossed shaped parasitic element for WLAN, Wi-MAX, and UWB application

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Abstract

This paper illustrates the design and performance of microstrip feed elliptical shaped patch antenna having crossed shaped parasitic element. The overall size of antenna is 40 mm × 40 mm × 1.59 mm. For optimization of the performance of antenna, CST Microwave studio 2014 simulator is used while antenna is tested with available facilities under laboratory conditions. Proposed antenna provides triple impedance bandwidth extended between frequency ranges of 2.28-2.62 GHz, 2.70-3.96 GHz, and 5.1-6.29 GHz with flat gain (close to 3-5 dBi) in the desired frequency range. Good circular polarization conditions are realized at frequency 5.90 GHz for different sets of elevation and azimuth angles with maximum axial ratio bandwidth close to 600 MHz at the same frequency. The SAR values at desired frequencies are much lower than those for specified frequencies of modern communication systems. This antenna may be a useful structure for Wi-Fi, WLAN, Wi-MAX communication bands and lower and median UWB bands.

KEYWORDS

bandwidth, circular polarization, gain, parasitic element, SAR

1 | INTRODUCTION

In modern wireless communication systems, multiband antennas have their crucial role.[1,2] IEEE 802.11 and IEEE 802.16 standards allocated 2.4/5.2/5.8 GHz as WLAN bands and 2.5/3.5/5.5-GHz as Wi-MAX bands, respectively. These bands have wide applications in smart phones, hand hold computers, and various wireless portable devices. Designing of circularly polarized multiband monopole planar antennas covering all these bands and having desired characteristics such as low profile, compact size, omni-directional pattern, and small SAR value is a challenging task.[3-5] Various antenna designs have been reported by researchers to minimize the instinctive limitations of planar patch structure.[6-13] Dual band multistrip monopole patch antenna with modified ground was designed by Kaur et al[6] for WLAN/IMT/BLUETOOTH/Wi-MAX applications. Behera et al[7] applied triple U-slots in the radiating patch to attain WLAN and Wi-MAX communication. Compact radiator patch structure was proposed by Sun et al[8] which covered all the bands of WLAN. Ring slotted circularly polarized U-shaped printed monopole antenna was proposed by Jangid et al[9] for various wireless applications. A dual layer circular patch structure was reported by Chen and Liu[10] for WLAN and Wi-MAX applications. The parasitic patch was strongly coupled with lower patch with the help of slots located in the lower patch. Sharma and Gangwar[11] reported a low profile cylindrical dielectric resonator for wireless application.[11] Cheong et al[12] reported a novel CPW structure with three fractal S-shaped patches for WLAN and Wi-MAX applications. It was found that the number of resonance is directly proportional to the number of fractal s-shape patches. A square spiral patch antenna was presented by Beigi et al[13] for multiband operations. In this communication, various frequency resonances were obtained by using square spiral patch with two L-shape strips. All these reported antennas[6-13] have wide physical size and do not show circular polarization.

The main aspire of this communication is to provide a compact planar design which has multi band performance with concurrent advancement in gain and axial bandwidth. It is a realized fact that circular polarization can be easily achieved with an elliptical design in comparison to conventional rectangular or circular configuration. In this investigation, design and performance of an elliptical patch structure having a crossed shaped parasitic element with defected ground structure is discussed. This crossed shaped parasitic element is placed just on upper side of the patch to revamp the electric field without disturbing the radiation performance of

the proposed antenna. Circular polarization is obtained by introducing dual elliptical rings and T-slot structure in the ground plane. The CST Microwave Studio 2014 is utilized for the simulation analysis of antennas while antennas are tested by using Vector Network Analyzer (R&S-ZVA 40) and RF signal generator. In Section 2, the design and analysis of proposed patch antenna is described. Experimental validation of the simulations results is also discussed in this section. Discussion and Conclusion are included in Sections 3 and 4, respectively.

2 | ANTENNA DESIGN AND RESULT ANALYSIS

2.1 | Antenna designing

The front and back view of proposed elliptical shaped monopole patch antenna with crossed shaped parasitic element is shown in Figure 1A-D. The antenna is fabricated on FR-4 substrate having relative permittivity (ε_r) of 4.4, thickness of 1.59 mm, and loss tangent (tanδ) of 0.025. The use of low-cost FR4 as substrate introduces some additional complexity on the antenna design. This additional complexity is due to the inaccuracy of the FR4 relative permittivity and its high loss tangent. Variations in the FR4 electrical permittivity can shift the operating frequency. The antenna consists of a tapered-shape patch. The inclusive size of the well thought-out design is 40 mm × 40 mm × 1.59 mm. The structure is placed in the X-Y plane and perpendicular direction is analogous to Z-axis. A 50 Ω microstrip feed (width = 1.9 mm) is

TABLE 1 Optimized dimensions of patch structure of proposed antenna

Dimension of proposed antenna design	Value (in mm)
$A \times B$	26 × 12
$a \times b$	6.9 × 0.5
c	1.4
$d \times i$	0.5 × 8.0
$f \times m$	1.2 × 0.2
$g \times k$	14 × 1.0
$j \times d$	4.0 × 0.5
$e \times l$	1.7 × 0.5
h	6.15
$W1 \times L1$	1.9 × 11

TABLE 2 Optimized dimensions of ground plane of proposed antenna

Dimension of proposed antenna design	Value (in mm)
$L \times W$	40.0 × 40.0
a	33.7
b	16.0
c	12.8
d	13.7
$f \times e$	27.6 × 4.9
$g \times j$	17.6 × 4.6
h	15
i	8.8
k	2.2
l	4.0
m	0.2
$n \times o$	36 × 1
$p \times q$	5 × 1

connected to stimulate the proposed antenna. The optimized parameters of the projected configuration are reported in Tables 1 and 2.

2.2 | Various steps of modification in patch geometry with finite unmodified ground plane

The resonant frequency of a conventional elliptical patch can be calculated as[14]:

$$f_t = \frac{k_{nm}c}{2\pi r_e \sqrt{\varepsilon_{eff}}} \qquad (1)$$

Here c is the velocity of light, k_{nm} is the mth zero root derivative of Bessel function of order n;

ε_{eff} is the effective dielectric constant of the substrate material which is calculated for elliptical patch antenna by using relation[15]:

FIGURE 1 A-D, Front and back views of geometrical model of proposed structure [Color figure can be viewed at wileyonlinelibrary.com]
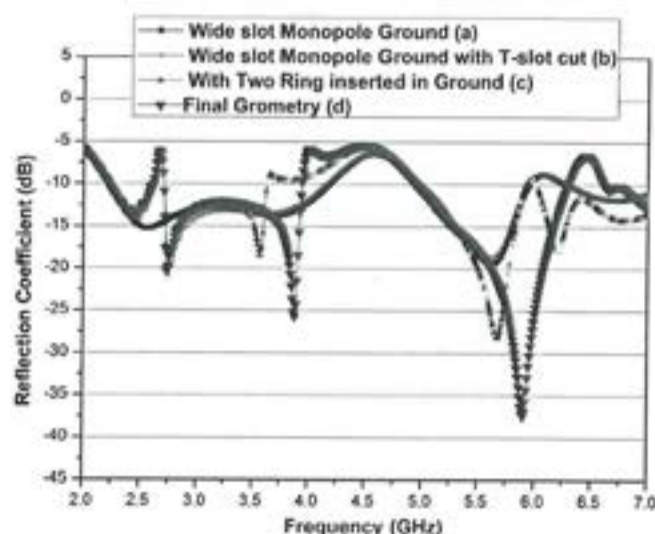
FIGURE 5 Variations of reflection coefficients with frequency for different antenna designs shown in Figure 4A-D with common patch as shown in Figure 2 [Color figure can be viewed at wileyonlinelibrary.com]

prototype is fabricated as per achieved optimized dimensions with the support of simulation software. The impedance parameters of designed antenna are obtained by using VNA R&S-ZVA 40. The simulated and measured reflection coefficients as a function of frequency are shown in Figure 6. The simulation results show that the considered antenna resonates efficiently at four frequencies namely 2.44, 2.74, 3.87, and 5.90 GHz while the measured results provide resonances at 2.49, 2.73, 3.94, and 5.84 GHz. The measured impedance bandwidths in three realized bands are 34 MHz, 1.26 GHz, and 1.19 GHz which are in close agreement with corresponding simulated results. The minor difference between measured and simulated results is perhaps due to design limitations of structure.

The simulated peak gain values of the antenna at frequency 2.44, 2.73, 3.87, and 5.90 GHz are 3.24, 3.02, 3.55, and 4.98 dBi, respectively which are shown in Figure 7.

The variation of axial ratio for different sets of elevation angle (θ) and azimuth angle (ϕ) as a function of frequency is shown in Figure 8. For more than three sets of elevation and azimuth angles circular polarization at frequency 5.9 GHz is achieved. The maximum axial ratio bandwidth close to 600 MHz is achieved at a particular set of elevation and azimuth angles that is ($\theta = 90°$ and $\phi = 85°$).

Figure 9 illustrates the simulated details of surface current distributions on the patch at frequencies 2.44, 3.87, and 5.90 GHz. The maximum current density concentrates mainly around the patch and feed line at first and third resonance frequencies whereas the presence of second resonance frequency is a combined effect of rectangular cut applied in the patch and elliptical ring inserted in the ground plane.

The two dimensional measured radiation patterns in two principle planes (E-Plane and H-Plane) of proposed
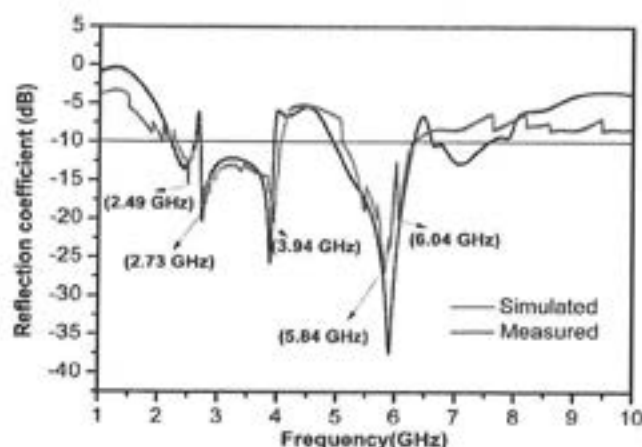
FIGURE 6 Variation of simulated and measured reflection coefficients with frequency for proposed antenna geometry (Figure 1C, D) [Color figure can be viewed at wileyonlinelibrary.com]
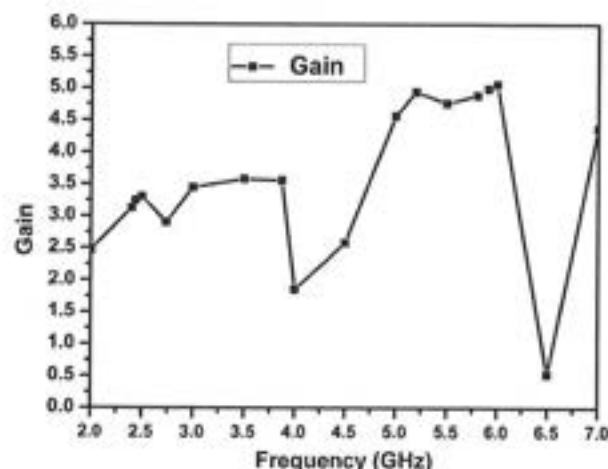
FIGURE 7 Variation of simulated gain values with frequency for proposed antenna geometry
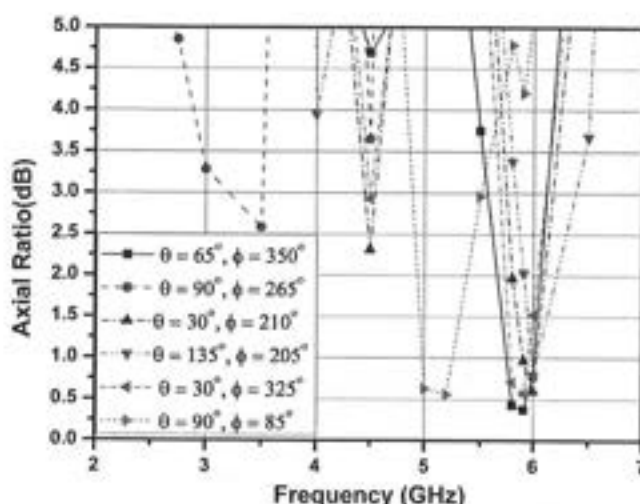
FIGURE 8 Variations of axial ratio with frequency at different directions [Color figure can be viewed at wileyonlinelibrary.com]
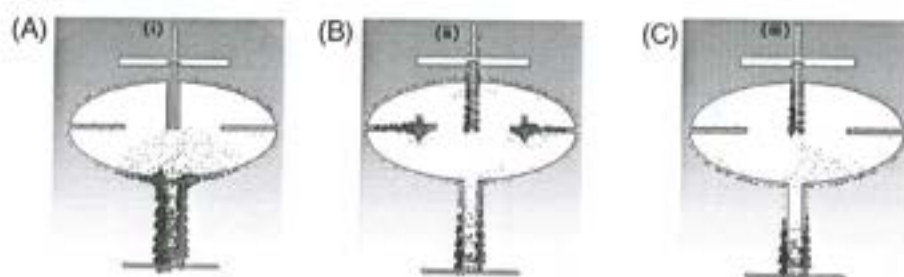
FIGURE 9 Simulated current distribution at (A) 2.44 GHz, (B) 3.87 GHz, (C) 5.90 GHz [Color figure can be viewed at wileyonlinelibrary.com]
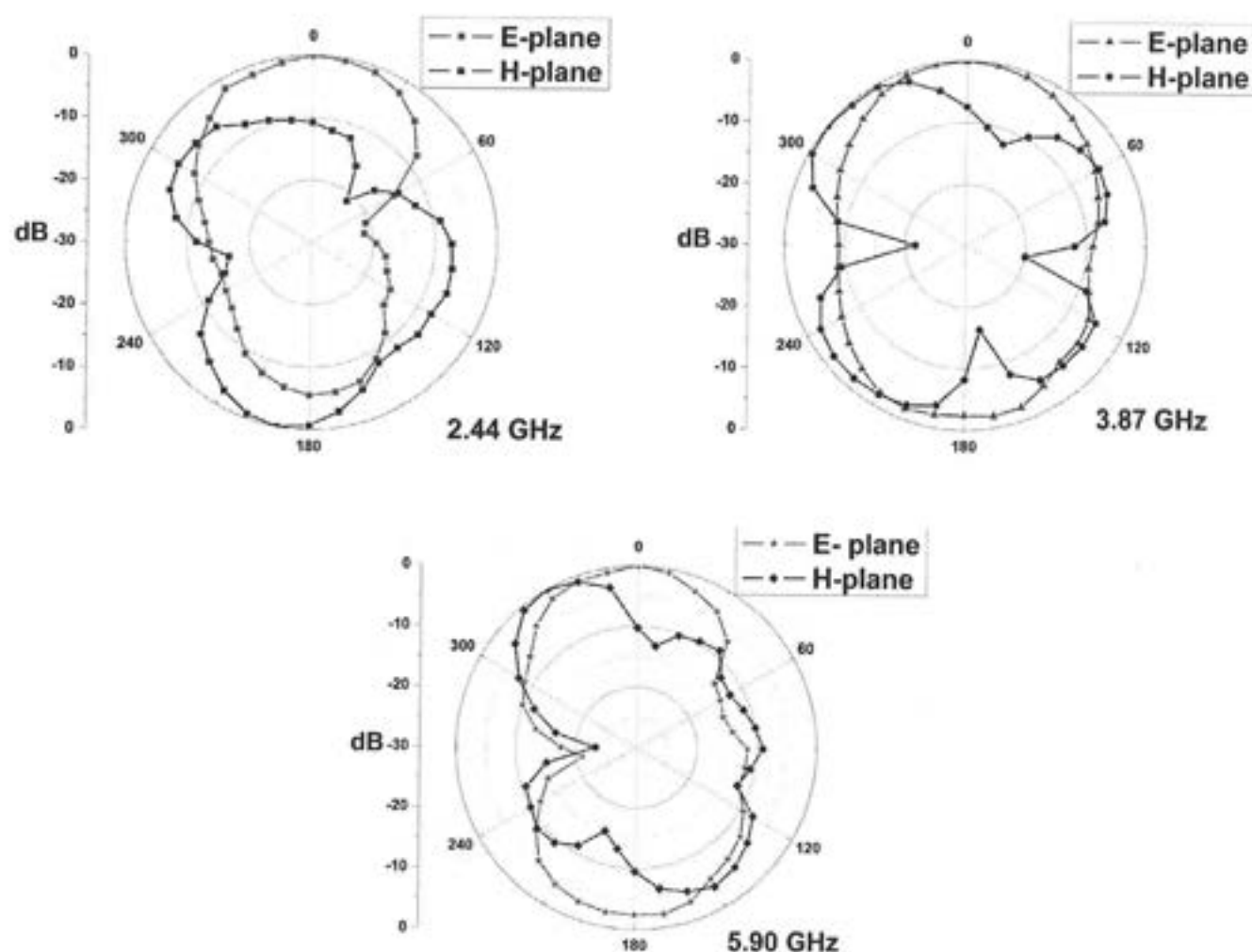
FIGURE 10 Measured radiation patterns at different frequencies [Color figure can be viewed at wileyonlinelibrary.com]

geometry are obtained at three resonance frequencies 2.44, 3.87, and 5.90 GHz and are shown in Figure 10. The E-plane patterns at these frequencies indicates that at all three frequencies the 3 dB beamwidth is close to 50° and the shape of pattern resembles with that of a monopole antenna. The radiations in back direction are also realized due to introduction of defects in the ground plane.

Comparisons of performance of the proposed antenna with other multi band designed antenna is shown in Table 3

which indicates that proposed design is compact in size and covers whole WLAN and Wi-MAX bands. The average peak gain at different resonance is significantly better than that for comparative geometries.[16-20]

4 | SAR VALUE

The rate of RF (radiofrequency) energy absorption by the human head from the source (mobile phone) has been

TABLE 3 Comparisons of performance of the proposed antenna with other multi band designed antenna

Ref. Proposed antenna	Size (mm²)	Operating frequency band (GHz)	Avg. peak gain (dBi)
Proposed antenna	40 × 40	2.28-2.62 GHz, 2.70-3.96 GHz, 5.10-6.29 GHz	3.5-5
16	28 × 58.6	1.9-5.20 GHz	4.5
17	39 × 46	2.27-4.64 GHz	2.85
18	20 × 30	2.29-2.56 GHz, 4.04-7.02 GHz	2-5
19	40 × 50	2.39-2.59 GHz, 3.1-3.57 GHz, 5.45-6.5 GHz	-
20	20 × 40	2.4-2.5 GHz, 5.00-6.00 GHz	1-2

analyzed at 2.44, 3.87, and 5.9 GHz, which is depicted in Figure 11. The SAR values at 2.44 GHz is 0.000118 W/kg, at 3.87 GHz is 0.000755 W/kg, and at 5.9 GHz is 0.003782 W/kg for 1 g of tissue which are much lower than the value specified by the FCC. Thus, the proposed antenna acquired lower SAR values by the human head than that of a dipole and helical antenna. The comparison of SAR values and other important antenna parameters at different resonant frequencies are depicted in Table 4.

5 | CONCLUSION

This paper presents the design and performance of microstrip feed elliptical shaped patch antenna with crossed type parasitic element through simulated and measured results. This antenna provides triple impedance bandwidth extended between frequency ranges 2.28-2.62, 2.70-3.96, and
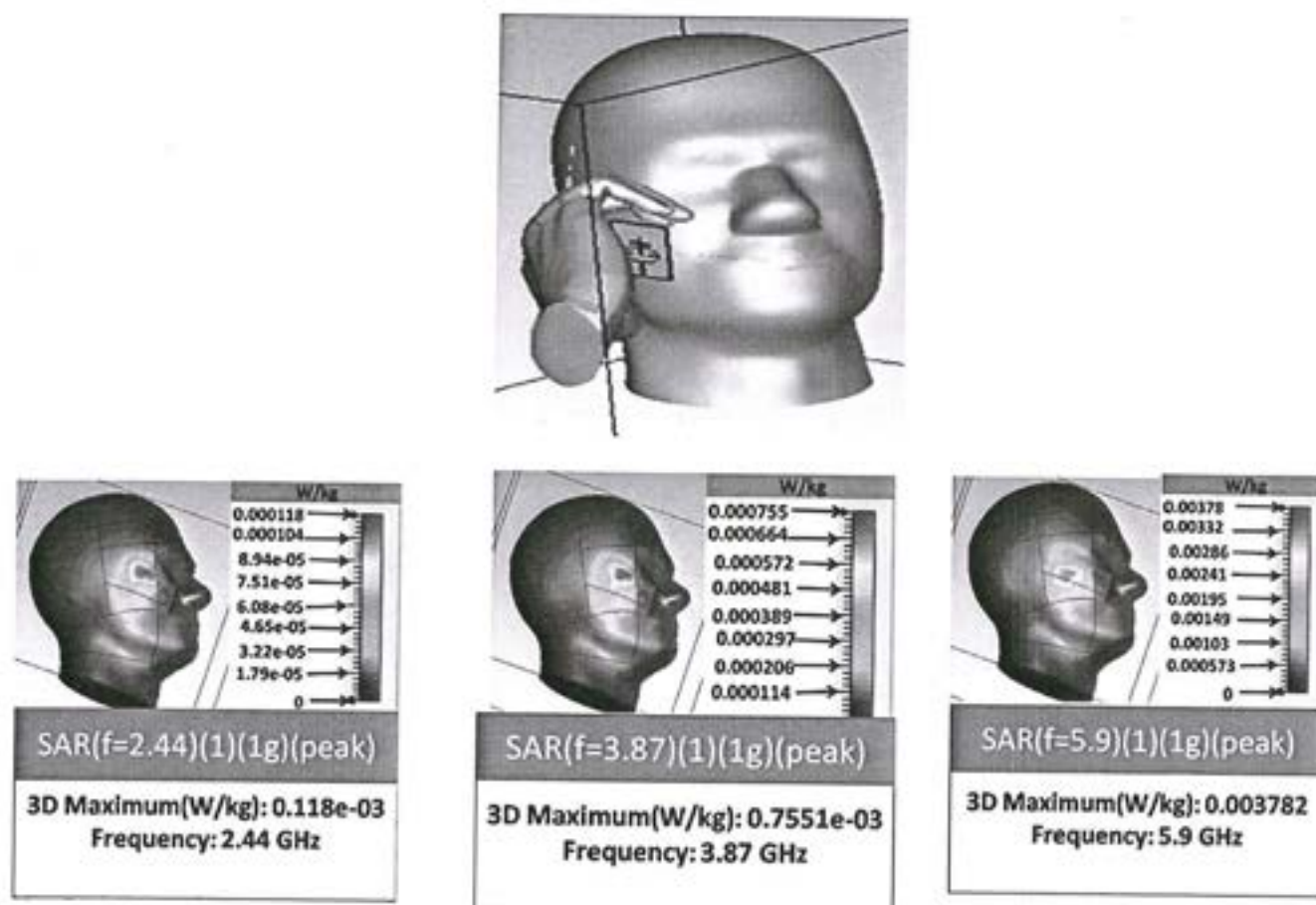
FIGURE 11 SAR values at different frequencies for proposed antenna geometry [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 4 Comparison of different antenna parameters for radiation pattern at different resonant frequencies

S. No.	Operating frequency (GHz)	Bandwidth with respect to central frequency (GHz)	Gain (dBi)	Axial ratio bandwidth (MHz)	SAR value (W/kg)
1	2.44	0.396	3.25	No circular polarization	0.000118
2	3.87	1.24*	3.54	250	0.000755
3	5.9	1.34	4.98	600	0.003782

* Bandwidth with respect to center frequency 3.30 GHz.

5.1-6.29 GHz, maximum axial ratio bandwidth of 600 MHz at particular angle ($\theta = 90°$ and $\phi = 85°$) with flat gain (close to 3-5 dBi) and good radiation patterns and acceptable SAR value in the desired frequency range. This antenna may be a useful structure for Wi-Fi, WLAN, Wi-MAX communication bands and lower and median UWB bands.

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ARTICLE

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Green approach for the synthesis of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol 3-yl)methylene)-1H-pyrazole-5(4H)-ones and their DNA Cleavage, antioxidant, and antimicrobial activities

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Abstract

3-Methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones (5a-i) was prepared by the condensation reaction of different 3-formyl-2-phenylindole derivatives (2a-i) and 3-methyl-1-phenyl-2-pyrazoline-5-one in quantitative yield by applying various green synthetic methods as grinding, microwave irradiation using different catalysts under solvent-free mild reaction conditions with high product yields. The structures of the synthesized compounds were characterized on the basis of elemental analysis, infrared, ^{1}HNMR, ^{13}C NMR, and mass spectral data. The synthesized compounds were screened for free radical scavenging, antimicrobial, and DNA cleavage activities. Most of the tested compounds belonging to the 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones series exhibited promising activities.

1 | INTRODUCTION

Heterocycles are useful due to their combination of compact and robust molecular structure with a high degree of molecular diversity that results in properties, which can be finely adjusted to needs of sophisticated application.[1,2]

The heterocycles possessing indole, pyrazole, and isoxaline moiety deserve a special mention due to their versatile use in pharmacological and biochemical studies.[3,4] The important role of Indole nucleus in the field of pharmaceutical chemistry and biochemistry is well-established form last many decades.[5] Chemical studies reveal that the naturally occurring as well as synthetic hallucinogenic drugs such as LSD, harmine, psilocin, psilocybin, and DMT, most of them are derivatives of tryptamine, β-[(3-indolyl)ethyl]amin.[6] The importance of serotonin (5-hydroxytryptamine) has been recognized as a modulator of CNS neurohormonal activity.[7,8] Various biological activities like anticancer,[9,10] antirheumatoidal,[11] anti-

HIV,[12] anti-inflammatory,[13] antidiabetic,[14] antihistaminic,[15] anticonvulsant,[16] antihelminthic,[17] antihypertensive,[18] antioxidant,[19] and antimicrobial[20] have been attributed to indole derivatives. Phenyl group at 2-position of indole moiety enhances biological activities like antimicrobial, monoamine oxidase inhibition.[21] The derivatives of 2-phenylindoles exhibits have shown potent CNS depressant activity[22] and cytotoxic activity.[23]

Pyrazole is an important pharmacophore, which exhibits a wide spectrum of biological activities, such as antitumor,[24] antidepressant,[25] antidiabetic,[26] antiamoebic,[27] and COX-2 inhibitor.[28] Incorporation of pyrazoline in indole framework enhances pharmacological importance, according to the review of literature indole derivatives bearing pyrazoline moiety possess diverse biological activities like antitumor,[29] antioxidant,[30] anticancer,[31] antimicrobial,[32] and anti-inflammatory.[33]

DNA cleavage studies have been of great interest for biologists and chemists. The cleaved DNA under

physiological conditions has been developed as artificial nucleases; these synthetic nucleases have provided important tools in the hand of chemists to manipulate DNA and cooperate with molecular biologists.[34] The nature of substituents and interaction of the compound with DNA molecule would help in the design of newer drugs and develop new selective, efficient DNA recognition and cleaving agent.

Free radicals have been implicated in several human diseases such as diabetic's Mellitus, stroke, diabetes, Alzheimer's diseases, atherosclerosis, arthritis, and neurodegenerative Parkinson's disease.[35] Melatonin and serotonin are good free radical scavengers and antioxidant that shows an important role in the immune system. N-substituted indole-2/3-carboxamide and ester derivatives are also showed excellent antioxidant activity against superoxide free radicals.[36]

Reactions in Grindstone Chemistry have initiated itself by grinding crystals of substrate and reagent with the generation of the small amount of energy in the form of heat through friction.[37] Such reactions are easy to handle, comparatively cheaper to operate, and ecologically more favorable. Silica-supported catalysts have great interest and special attention of chemists due to high reactivity, more efficient, eco-friendly nature, recyclable, and easy to handling.[38]

Another solvent-free popular technique is Microwave Chemistry since microwave irradiation is a well-known, eco-friendly, and convenient synthetic method.[39] Montmorillonite KSF showed catalytic activity for this condensation reaction and has many advantages over catalysts like NaOH, KOH such as easy to handle, low cost, and elimination of metal waste. Keeping in view these observations and continuation of our studies towards the synthesis of a variety of bioactive heterocycles,[40] herein, we have designed various strategies to synthesize some noble indolyl pyrazoline derivatives. To make the efficiency and comparative study of these synthetic routes, we have used conventional and solvent-free methods (Grindstone and microwave irradiation). An inexpensive catalyst likes Mg $(HSO_4)_2/SiO_2$ and KSF are used to obtain the target molecule. All the synthesized compound screened for DNA cleavage, free radical scavenging, and antimicrobial activity.

2 | MATERIALS AND METHODS

Melting points of all the synthesized compounds are determined in open capillary tubes and are uncorrected. The infrared (IR) spectra (v_{max} in cm^{-1}) were recorded on a Perkin Elmer-557 model. Reactions are monitored by thin-layer chromatography (TLC) using silica gel-G as adsorbent, and the spots were visualized using ultraviolet light and iodine. ^1H NMR and ^{13}C NMR spectra were recorded on BRUKER AVENE II 400-MHz NMR spectrometer using tetramethylsilane as an internal standard and DMSO-d_6/CDCl$_3$ as a solvent. The mass spectral data were obtained on a JEOLD-300 spectrometer. Microwave-assisted reactions were carried out in a domestic MW oven (LG MS-194A) operating at 2450 MHz.

2.1 | Biological activities

2.1.1 | Free radical scavenging assays

Free radical scavenging activity was done by α, α-diphenyl-β-picry-hydrazyl radical scavenging (DDPH) assay. The DPPH is a stable free radical and is widely used to assess the free radical scavenging activity of antioxidant compounds. This method is based on the reduction of DPPH in methanol solution in the presence of hydrogen-donating antioxidant due to the formation of the nonradical form DPPH-H (Blois, 1958). This transformation results in a color change from purple to yellow, which was measured by spectrophotometrically. The disappearance of the purple color monitored at 517 nm. The free radical scavenging activity can be measured by using 2, 2-diphenyl-1-picryl-hydrazyl or 2, 2-diphenyl-2-picryl-hydrazyl by the method of McCune and Johns (2002). The reaction mixture (3.0 mL) consists of 1.0 mL of DPPH in methanol (0.3 mM), 1.0 mL of various concentrations of test compounds (50, 75, and 100 µg mL^{-1}), and 1.0 mL of methanol. It incubated for 10 minutes in dark, and then the absorbance was measured at 517 nm. In this assay, the positive controls can be ascorbic acid used as standard; the percentage of inhibition can be calculated using the formula.

$$Inhibition\ (\%) = (A_0 - A_1/A_0) \times 100,$$

where A_0 is the absorbance of the control and A_1 is the absorbance of the sample. The test was carried out in triplicate.

2.2 | DNA cleavage analysis

2.2.1 | Preparation of culture media

DNA cleavage experiments were done according to the literature method.[41] Nutrient broth [Peptone, 10; yeast extract, 5; NaCl, 10; in (g/L) was used for culturing of Escherichia coli. About 50-mL media was prepared, autoclaved for 15 minutes at 121°C under 15-lb pressures. The autoclaved media were inoculated for 24 h at 37°C.

2.2.2 | Isolation of DNA

The fresh bacterial culture (1.5 mL) was centrifuged to obtain the pellet, which was then dissolved in 0.5 mL of lysis buffer (100 mM tris pH 8.0, 50 mM EDTA, and 10 % SDS). To this, 0.5 mL of saturated phenol was added and incubated at 55°C for 10 minutes, then centrifuged at 10 000 rpm for 10 minutes and to the supernatant, an equal volume of chloroform: isoamyl alcohol (24:1) and 1/20th volume of 3 M sodium acetate (pH 4.8) was added. This was further centrifuged at 10 000 rpm for 10 minutes, and to the supernatant, three volumes of chilled absolute alcohol was added. The precipitated DNA was separated by centrifugation, and the pellet was dried and dissolved in TAE buffer (10 mM tris pH 8.0, 1 mM EDTA) and stored in cold condition.

2.2.3 | Agarose gel electrophoresis

The cleavage products were analyzed by agarose gel electrophoresis method [41]. Test samples (1 mg/mL) were prepared in dimethylformamide (DMF). The samples (25 mg) were added to the isolated DNA of E coli. The samples were incubated for 2 hours at 37°C, and then 20 mL of DNA sample (Mixed with bromophenol blue dye at 1:1 ratio) was loaded carefully into the electrophoresis chamber wells along with standard DNA marker containing TAE buffer (4.84 g tris base, pH 8.0, 0.5 M EDTA/1 L) and finally loaded on agarose gel and passed the constant 50 V of electricity for 30 minutes. Removing the gel and stained with 10.0-mg/mL ethidium bromide for 10e 15 minutes, the bands were observed under Vilber Lourmat Gel documentation system and then photographed to determine the extent of DNA cleavage. The results are compared with standard DNA marker. DNA ladder was used 100 to 1000bp (100 bp step up ladder, Merck).

2.3 | Antibacterial assay

Antibacterial bacterial activity is done by Kirby-Bauer well diffusion method. Mueller-Hinton Agar plates were prepared for the antibacterial activity. ATCC Cultures of E coli (ATCC 25922) and Staphylococcus aureus (ATCC 29213) were inoculated in Peptone water and were kept for incubation for 24 hours at 37°C. Inoculum size of bacteria was adjusted using McFarland Turbidity Standard as reference. The bacterial suspensions were compared with 0.5 McFarland Turbidity Standard. Bacterial cultures were swabbed onto the Mueller Hinton Agar surface. About 50 μL of dilution of sample (5a-i), the positive control (Streptomycin (5mg/mL (w/v)) and the negative control (DMSO) was loaded into the respective wells. The

antibacterial plates were kept for incubation at 37°C for 24 hours. The zone of inhibition was measured and compared with the controls.

2.4 | Antifungal assay

Antifungal activity was also done by the disk diffusion method. Sabouraud Dextrose Agar plates were prepared for antifungal activity. Cultures of the fungal strain of Candida albicans and Aspergillus niger were inoculated in Peptone water and were kept for incubation for 24 hours at 37°C. Fungal cultures were swabbed onto the Sabouraud Dextrose Agar surface. About 50 μl of dilution of sample (5a-i), the positive control Itraconazole (5mg/well) and the negative control (DMSO), was loaded into the respective wells. The antifungal plates were kept for incubation at 37°C for 24 hours. The antifungal activity of each compound was compared with Itraconazole as standard drug. Inhibition zones were measured and compared with the controls.

2.5 | Preparation of silica-supported magnesium hydrogen sulfate

Anhydrous magnesium chloride (5.0 g, 50 mmol) was charged in the 50-mL suction flask equipped with dropping funnel; concentrated sulfuric acid (98 %, 9.43 g, 50 mmol) was added drop wise over the period of 45 minutes with stirring at room temperature. HCl evolved immediately through a funnel and adsorbed by the solution of water and alkali, while the residual HCl eliminated by suction. The Mg (HSO$_4$)$_2$ (8.36 g) was obtained as white gel and mixed by silica gel (7.65 g) to get the desired catalyst.

2.6 | Synthesis of 2-phenyl-1H-indole-3-carbaldehyde (2a-i)

Phosphorus oxychloride (6.0 mmol) was added slowly, with stirring to dimethylformamide (DMF; 5 mL) at 10 to 15°C. The solution was further stirred for 15 minutes at the same temperature until an orange-colored syrupy liquid was formed; to this, 2-phenylindoles (5 mmol) was added in portions with stirring at 40–50°C. The solution was further stirred for 45 minutes and then poured into ice water (100 mL). Sodium hydroxide solution (2 N, 10 mL) was added to it and the mixture was heated on a water bath for 1 hour. It was cooled, filtered, and recrystallized from acetone (80%) to obtain pure compounds (2a-i).

2.7 | Synthesis of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazole-5(4H)-ones. (5a-i)

2.7.1 | General method (i): Solvent-free synthesis of (5a-i)

A mixture of 2-phenyl-1H-indole-3-carbaldehyde (2a-i) (3 mmol) and Mg (HSO₄)₂/SiO₂(0.5 g) was grinded at room temperature for 2 to 5 minutes in mortar and pestle to generate yellow colored enolate. Then 3-methyl-1-phenyl-2-pyrazoline-5-one (3 mmol) was added to it and grinding continues further to give orange-red colored tacky solid within 10 to 20 minutes. The reaction proceeds exothermically indicated by the rise in temperature (5-10°C). After completion of the reaction (checked by TLC), the mixture was dissolved in CH_2Cl_2 and catalyst was filtered; the residue washed many times with CH_2Cl_2. After evaporation of the solvent under reduced pressure, almost pure compound was obtained. Further purification was achieved by recrystallization from ethanol. The catalyst was washed with diethyl ether, dried at 70°C for 50 minutes, and reused in another reaction. The compounds of the series (5a-i) also synthesized by the above method.

2.7.2 | General method (ii): Microwave-assisted solvent-free synthesis of (5a-i)

The reaction was carried out in domestic microwave (800 W, 2450 MHz). A mixture of 2-phenyl-1H-indole-3-carbaldehyde (2a-i) (3 mmol), 3-methyl-1-phenyl-2-pyrazoline-5-one (3 mmol), and montmorillonite KSF (0.4 g) was mixed thoroughly in a pestle mortar. This mixture was then transferred into a conical flask (100 cm³) and irradiated with microwaves for 5 to 11 minutes. After completion of the reaction (checked by TLC), ethanol was added and the mixture was filtered; the filtrate was concentrated and then the crude product so obtained was recrystallized from ethanol to obtain pure compound (5a-i). The catalyst left as the residue was washed 2 to 3 times with ethanol and dried in vacuum for reuse. The compounds of the series (5a-i) also synthesized by the above method.

2.7.3 | Method (iii) conventional procedure of synthesis (5a-i)

2-Phenyl-1H-indole-3-carbaldehyde (2a-i) (3 mmol) and 3-methyl-1-phenyl-2-pyrazoline-5-one (3 mmol) were dissolved in a minimum amount of ethanol (25 mL) and then stirred at room temperature for 5 minutes. Sufficient 2N

NaOH solution (40 mL) was added to it, and the whole reaction mixture was further stirred for half an hour, neutralized with 2N HCl (3 mL) diluted with water, and left overnight to get solid compound, which was filtered and recrystallized from ethanol to obtain pure compound. Result and conditions of the synthesis of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones (5a-i) are tabulated in Table 1. The compounds of the series (5a-i) also synthesized by the above method.

3 | RESULT AND DISCUSSIONS
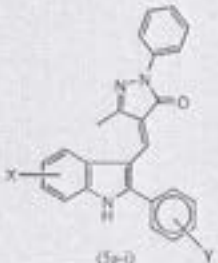
3.1 | Synthesis

p-Fluorophenylhydrazine was prepared by the method of Chattaway et al.[42] 2-Phenylindole derivatives, which have been prepared by the Fischer indole synthesis and by the method of Joshi et al, were subjected to formylation with phosphorous oxychloride (POCl₃) and DMF under Vilsmeier-Haack Formylation reaction. We carried out condensation reaction between various 3-formyl-2-phenylindole derivatives (2a-i) and 3-methyl-1-phenyl-2-pyrazoline-5-one and get desired product 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones (5a-i) (Scheme 1). The reaction was conducted by employing various reaction conditions. In the traditional conventional method, the reactants (compounds 2a-i and appropriate 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones) were dissolved in ethanol and then aqueous NaOH was added dropwise with continuous stirring. In contrast under solvent-free conditions, the condensation reaction of the same reactants can be carried out by adding and 0.5g amount of Mg (HSO₄)₂/SiO₂ under grinded conditions using mortar and pestle to afford target compound (5a-i) in higher yield and lesser time. Grinding together the solid reagents without the addition of catalyst reveals that in some cases, liquid melt is observed, while in others, the discrete crystalline phase of solid reagents remains. More important, upon addition of the catalyst, a rise in temperature (5-10°C) occurs only those systems that exhibit a phase change to a melt. Thus, the existence of a liquid phase is a prerequisite for reaction in these systems. The microwave-assisted reaction using a catalytic amount of KSF clay and solvent-free environment proceeds efficiently and completed within 5 to 11 minutes with excellent yield (78-90%). The result obtained is presented in [Table 1].

The IR spectra of 2-Phenyl-1H-indole (1a-i), N—H stretching absorption appears as a strong absorption band in the range of 3460 to 3420 cm⁻¹. The C—N frequencies have been assigned to the 1275 to 970 cm⁻¹ region. In ¹H

TABLE 1 Result and conditions of the synthesis of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones (5a-i)

(5a-i)

| Compound | X | Y | % Yield | | | Time required | | | Temp. °C |
			i	ii	iii	I, min	II, min	III, min	II
5a	H	H	87.8	82.1	68.2	10	5	30	70
5b	H	4-F	92.0	89.3	78.5	10	7	30	60
5c	H	4-Cl	89.2	82.3	75.6	14	8	40	50
5d	H	4-Br	93.4	90.1	67.5	10	11	45	65
5e	H	4-CH₃	88.7	84.5	77.6	11	9	30	60
5f	H	4-OCH₃	87.6	84.4	65.0	10	6	50	75
5g	H	3-Cl, 4-F	84.7	78.5	70.5	13	5	30	55
5h	H	2-Cl, 4-F	91.0	83.0	71.3	12	8	40	60
5i	F	4-F	92.0	87.0	72.4	9	6	30	60

Note. (i) By grinding with Mg (HSO₄)₂/SiO₂. (ii) By microwave irradiation with Montmorillonite KSF; reaction was carried out in an LG MS-194A household microwave even with maximum 800W power. (iii) By conventional method.
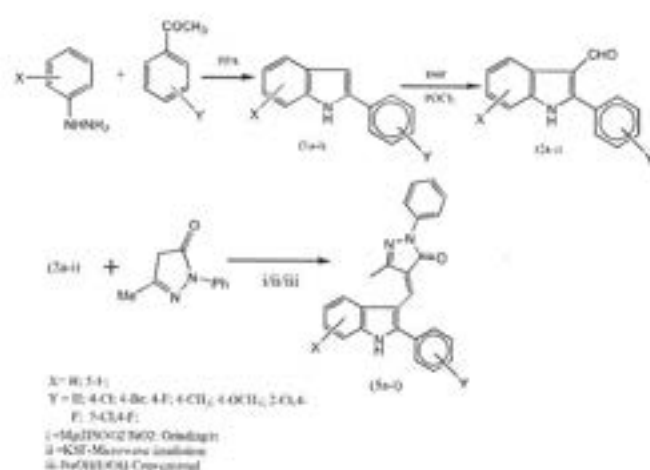
SCHEME 1 Schematic representation for the synthesis the synthesis of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl) methylene)-1H-pyrazol-5(4H)-ones

NMR spectra of 2-phenyl-1H-indole, methine proton at C-3 of indole moiety shows a resonance signal at δ 6.6 ppm, N—H resonance signal appears at δ 8.2 to 8.4 ppm as a broad singlet. Aromatic protons are observed at multiplet from δ 7.8 to 8.0 ppm.

In the IR spectra of 2-phenyl-1H-indole-3-carbaldehyde derivatives (2a-i), the absorption band of the N—H stretching is shifted towards lower wave number 3300 to

3150 cm^{-1} due to the presence of –CHO group at position 3- of the indole ring. The strong absorption band in the range $1230-1060 \text{ cm}^{-1}$ has been attributed to Ar-F stretching mode. The characteristic absorption due to–CHO group appears 1675 to 1625 cm^{-1}. Analysis of IR spectra of 2-phenyl-1H-indole-3-carbaldehyde shows one special feature that the appearance of two broad strong peaks in –NH stretching region. This may be due to the intermolecular hydrogen bonding between the N—H group of one molecule and the –CHO group of the second molecule. In ^{1}H NMR spectra of 2-phenyl-1H-indole-3-carbaldehyde derivatives, the N—H resonance signal is observed in the region of δ 10.2 to 11.6 ppm as a broad singlet. Aromatic protons are observed as multiplet from δ 7.2 to 7.9 ppm. Singlet due to –CHO proton appears in the region δ 9 to 10.0 ppm.

In the IR spectra of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones (5a-i), the N—H absorption appears as a broad band 3170 to 3010 cm^{-1}. Characteristic absorption due to carbonyl group appears in the range of 1625 to 1605 cm^{-1}. The downfield shift is due to conjugation of the carbonyl group with the olefinic double bond, which results in delocalization of electrons of carbonyl group giving ionic resonance structures. The olefinic double bond (C=C) appears between the range of 1600 to 1525 cm^{-1}. The ^{1}H NMR spectra of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)

TABLE 2 Free radical scavenging activity of synthesized compounds (5a-i)

	Concentration, µg mL^{-1}		
Compound	50 Mean ± SD	75 Mean ± SD	100 Mean ± SD
5a	63.46 ± 0.14	64.73 ± 0.19	66.96 ± 0.16
5b	37.45 ± 0.35	39.67 ± 0.39	41.48 ± 0.87
5c	40.43 ± 0.26	42.68 ± 0.22	43.96 ± 0.27
5d	38.36 ± 0.15	40.53 ± 0.34	42.73 ± 0.16
5e	74.26 ± 0.10	76.43 ± 0.18	78.54 ± 0.25
5f	78.72 ± 0.43	80.45 ± 0.12	82.27 ± 0.21
5g	65.25 ± 0.32	67.67 ± 0.23	68.98 ± 0.13
5h	67.34 ± 0.65	69.26 ± 0.14	70.67 ± 0.34
5i	63.50 ± 0.17	65.72 ± 0.14	67.56 ± 0.37
Ascorbic acid	76.24 ± 0.10	78.48 ± 0.12	80.26 ± 0.17

methylene)-1H-pyrazol-5(4H)-ones (5a-i) exhibit a complex splitting pattern. N—H resonance signal appears as a broad singlet from δ 11.24 to 12.30 ppm. A singlet at δ 9.9–8.7 ppm assigned for the vicinal proton. Aromatic proton appears as a complex multiplet in the region δ 7.3 to 8.2 ppm. ^{13}C NMR Spectrum of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones has displayed a downfield signal at δ182-169 for carbonyl carbon and δ 23 and 20 integrated for methyl carbon. The mass spectrum of compound 5a has shown ion peak at m/z 378 [M+1]$^{+}$

3.2 | Spectral data of compound

3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-one (5a). Yield 82% (ethanol): mp 235–237°C; IR (υ max cm^{-1}, KBr): 3150, 3053, 2895, 1630, 1550; ^{1}H NMR (400MHz, DMSO-d_6,δ ppm): 12.32 (s, 1 H indole NH), 9.94 (s, 1H,—CH=), 8.2(d, 1H, indole Ar-H),7.6−7.2 (m, 13H, Ar-H), 2.3(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 182.2 (C=O), 149.8, 140.1, 136.4, 130.1, 127.4, 126.0, 124.8, 122.2, 120.5, 113.9, 112.3 and 21.4; ESI-MS: m/z = 378 [M + 1]$^{+}$. Anal. Calcd. for C$_{25}$H$_{19}$N$_3$O (377): C, 79.55; H, 5.07; N, 11.13%. Found: C, 79.53; H, 5.09; N, 11.11%

4-((2-(4-fluorophenyl)-1H-indol-3-yl)methylene)-3-methyl-1-phenyl-1H-pyrazol-5(4H)-one (5b). Yield 75% (ethanol): mp 283–285°C; IR (υ max cm^{-1}, KBr): 3232, 3164, 2870, 1620, 1540; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 12.02 (s, 1 H indole NH), 9.24 (s, 1H, —CH=), 8.22(d, 1H, indole Ar-H),7.9−7. 3(m, 12H, Ar-H), 2.27(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 182.5 (C=O), 144.4, 142.1, 133.4, 129.1, 126.3, 124.7, 123.1, 120.6, 118.3, 115.3, 112.5 and 20.3; ESI-MS: m/z = 396[M + 1]$^{+}$, 397 [M + 2]$^{+}$ Anal. Calcd. for C$_{25}$H$_{18}$FN$_3$O (395): C, 75.93; H, 4.59; N, 10.63%. Found: H, 4.43; N, 10.67%

4-((2-(4-chlorophenyl)-1H-indol-3-yl)methylene)-3-methyl-1-phenyl-1H-pyrazol-5(4H)-one (5c). Yield 79% (ethanol): mp 245–248°C; IR (υ max cm^{-1}, KBr): 3152, 3054, 2896, 1634, 1552; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 11.89 (s, 1 H indole NH), 9.84 (s, 1H, —CH=), 8.3(d, 1H, indole Ar-H),7.8−7.2 (m, 12H, Ar-H), 2.33(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 172.8 (C=O), 145.4, 140.1, 137.4, 129.1, 127.3, 125.4, 123.4, 121.6, 120.3, 113.3, 111.5 and 21.3; ESI-MS: m/z = 413 [M + 2]$^{+}$, 415 [M + 4]$^{+}$ Anal. Calcd. for C$_{25}$H$_{18}$ClN$_3$O (411): C, 72.90; H, 4.40; N, 10.20%. Found: C, 72.94; H, 4.43; N, 10.24%

4-((2-(4-bromophenyl)-1H-indol-3-yl)methylene)-3-methyl-1-phenyl-1H-pyrazol-5(4H)-one (5d). Yield 89% (ethanol): mp 305–307°C; IR (υ max cm^{-1}, KBr): 3187, 3068, 2817, 16, 1557; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 11.87 (s, 1 H indole NH), 8.98 (s, 1H, —CH=), 8.22(d, 1H, indole Ar-H),7.8−7. 2(m, 12H, Ar-H), 2.24(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 172.5 (C=O), 143.4, 142.1, 137.7, 128.1, 126.2, 124.7,
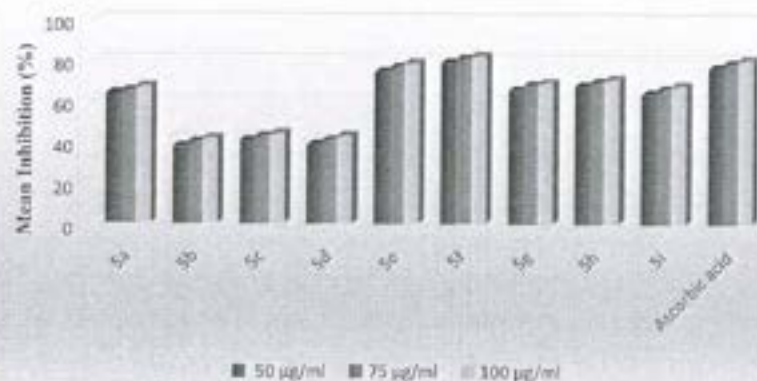
FIGURE 1 Free radical scavenging activity of synthesized compounds (5a-i) [Color figure can be viewed at wileyonlinelibrary.com]
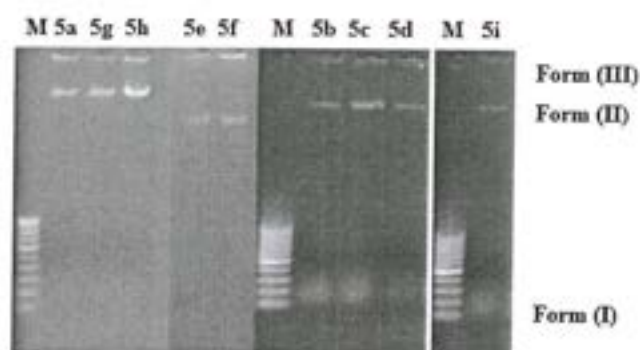
FIGURE 2 DNA cleavage activity of synthesized compounds (5a-i) [Color figure can be viewed at wileyonlinelibrary.com]

123.3, 121.4, 118.2, 115.0, 112.8 and 22.2; ESI-MS: $m/z =$ 456 [M + 1]$^+$, 458 [M + 2]$^+$ Anal. Calcd. for $C_{25}H_{18}FN_3O$ (455): C, 65.80; H, 3.98; N, 9.21%. Found: C, 65.76; H, 3.95; N, 9.23%

3-methyl-1-phenyl-4-((2-p-tolyl-1H-indole-3-yl) methylene)-1H-pyrazol-5(4H)-one (5e). Yield 87% (ethanol): mp 270–272°C; IR (υ max cm^{-1}, KBr): 3145, 3050, 2890, 1632, 1545; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 12.26 (s, 1 H indole NH), 9.92 (s, 1H,–CH=), 8.1(d, 1H, indole Ar-H),7.4–7.1 (m, 12H, Ar-H), 2.3(s, 3H, CH$_3$), 2.2(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 173.3 (C=O), 148.5, 139.4, 135.2, 130.0, 127.3, 125.7, 123.6, 122.1, 121.4, 113.8, 112.2, 22.1, ; ESI-MS: $m/z = 392$ [M + 1]$^+$. Anal. Calcd. For $C_{26}H_{21}N_3O$ (391): C, 79.77; H, 5.41; N, 10.73%. Found: C, 79.75; H, 5.39; N, 10.71%

4-((2-(4-methoxyphenyl)-1H-indol-3-yl)methylene)-3-methyl-1-phenyl-1H-pyrazol-5(4H)-one (5f). Yield 89% (ethanol): mp 278–280°C; IR (υ max cm^{-1}, KBr): 3167, 3064, 2824, 1630, 1560; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 12.56 (s, 1 H indole NH), 8.79 (s, 1H, –CH=), 8.34(d, 1H, indole Ar-H),7.7–7. 15(m, 12H, Ar-H), 3.4(s, 3H, CH$_3$), 2.24(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 177.5 (C=O), 146.4, 143.8, 136.9, 130.1, 128.8, 128.2, 124.4, 123.1, 120.4, 118.2, 115.0, 55.4, and 22.2; ESI-MS: $m/z = 408$ [M + 1]$^+$, Anal. Calcd. for $C_{26}H_{21}N_3O_2$ (407): C, 76.64; H, 5.19; N, 10.31%. Found: C, 76.62; H, 5.16; N, 10.29%

4-((2-(3-chloro-4-fluorophenyl)-1H-indol-3-yl) methylene)-3-methyl-1-phenyl-1H-pyrazol-5(4H)-one (5g). Yield 82% (ethanol): mp 292–294°C; IR (υ max cm^{-1}, KBr): 3170, 3065, 2870, 1620, 1547; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 12.27 (s, 1 H indole NH), 9.14 (s, 1H,–CH=), 8.72(d, 1H, indole Ar-H),7.9–7. 1(m, 11H, Ar-H), 2.23(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 178.5 (C=O), 147.4, 145.1, 136.7, 126.6, 124.6, 123.7, 122.4, 120.4, 117.2, 113.8, 111.9, and 21.7; ESI-MS: $m/z = 431$[M + 2]$^+$, 433[M + 4]$^+$ Anal. Calcd. for $C_{25}H_{17}ClFN_3O$ (429): C, 69.85; H, 3.99; N, 8.25%. Found: C, 69.81; H, 3.94; N, 8.28%

TABLE 3 Zone of inhibition (mm) of compounds (5a-i) against tested bacterial strains

		Bacterial strains	
Entry	Compound	S. aureus (ATCC 29213)	Escherichia coli (ATCC 25922)
1	5a	17.2± 0.6	16.4 ± 0.3
2	5b	18.2 ± 0.4	16.8± 0.4
3	5c	19.4 ± 0.5	18.3 ± 0.2
4	5d	18.9 ± 0.2	17.7 ± 0.3
5	5e	21.3 ± 0.2	22.0 ± 0.6
6	5f	22.1 ± 0.3	22.1 ± 0.4
7	5g	20.0 ± 0.2	19.4± 0.3
8	5h	20.7 ± 0.4	20.4± 0.2
9	5i	19.5 ± 0.4	18.6 ± 0.3
10	Standard	27.5 ± 0.6	24.4 ± 0.3

Note. Streptomycin was used as a standard. About 50 µl/mL. of the compound in each well.

4-((2-(2-chloro-4-fluorophenyl)-1H-indol-3-yl) methylene)-3-methyl-1-phenyl-1H-pyrazol-5(4H)-one (5h). Yield 93% (ethanol): mp 300–302°C; IR (υ max cm^{-1}, KBr): 3182, 3074, 2860, 1650, 1560; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 12.30 (s, 1 H indole NH), 9.25 (s, 1H,–CH=), 8.80(d, 1H, indole Ar-H),8.4–7. 4(m, 10H, Ar-H), 2.23(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 178.5 (C=O), 145.4, 143.1, 132.7, 129.6, 126.6, 125.7, 123.4, 120.4, 118.2, 114.3, 112.9, and 21.3; ESI-MS: $m/z = 431$[M + 2]$^+$, 433[M + 4]$^+$ Anal. Calcd. for $C_{25}H_{17}ClFN_3O$ (429): C, 69.85; H, 3.99; N, 8.25%. Found: C, 69.88; H, 3.98; N, 8.23

4-((5-fluoro-2-(4-fluorophenyl)-1H-indol-3-yl) methylene)-5-methyl-2-phenyl-2,4-dihydro-3H-pyrazol-3-one (5i). Yield 92% (ethanol): mp 149-150°C; IR (υ max cm^{-1}, KBr): 3240, 3165, 2860, 1620, 1540; ^{1}H NMR (400MHz, DMSO-d_6, δ ppm): 11.97 (s, 1 H indole NH), 9.20 (s, 1H,–CH=), 8.20(d, 1H, indole Ar-H),7.9–7. 3(m, 11H, Ar-H), 2.26(s, 3H, CH$_3$)^{13}C NMR (DMSO-d_6) in δ (ppm): 182.4 (C=O), 144.0, 142.0, 133.2, 128.4, 126.4, 125.7, 124.1, 120.4, 118.4, 115.5, 112.3 and 20.4; ESI-MS: $m/z = 413$ [M]$^+$, 414 [M + 1]$^+$ Anal. Calcd. for $C_{25}H_{17}F_2N_3O$ (413): C, 72.63; H, 4.14; N, 10.16 %. Found: C, 72.61; H, 4.16; N, 10.14 %

3.3 | Biological activities

3.3.1 | Free radical scavenging assay

The free radical scavenging activity of synthesized compounds was done by α, α-diphenyl-β-picry-hydrazyl radical
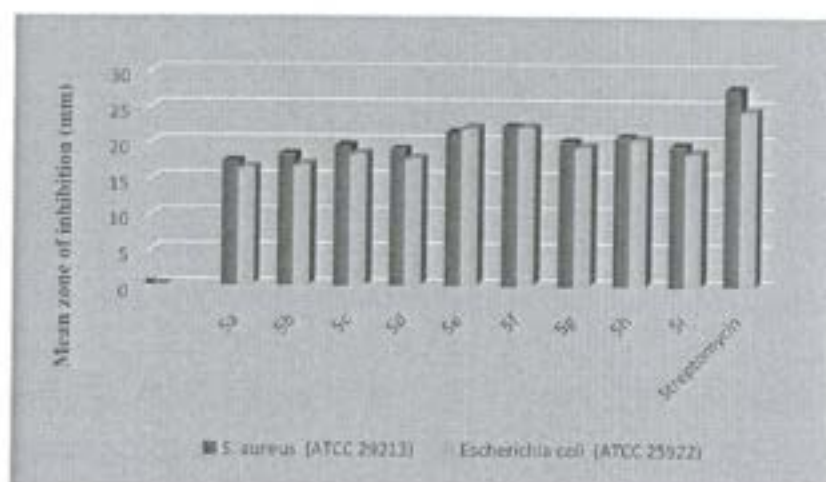
scavenging (DDPH) method. Samples were prepared at concentrations of 50, 75, and 100 µg/mL, and ascorbic acid is taken as standard. The experimental data on the antioxidant activity of the compounds (5a-i) and control drug are presented in Table 2. Among synthesized -CH₃- and -OCH₃- substituted indole derivatives (5e) and (5f) have very good scavenging activity, simple indole derivative (5a) and Di-halogen-substituted indole derivatives (5g), (5h), and (5i) have shown moderate activities and mono-halogen-substituted derivatives (5b), (5c), and (5d) have shown least activity compare with the standard. Therefore, such compounds containing substitutions -CH₃ and -OCH₃ on 2-phenyl indole moiety enhance the free radical scavenging activity. Further, the synthesized compounds scavenged the DDPH radicals in a concentration-dependent manner. The bar graph representation of the percentage of mean free radical scavenging activity is shown in Figure 1.

3.4 | DNA cleavage analysis

The DNA cleavage activity of 3-methyl-1-phenyl-4-((2-phenyl-1H-indol-3-yl)methylene)-1H-pyrazol-5(4H)-ones (5a-i) was studied by agarose gel electrophoresis method. The pictures of gels are presented in Figure 2. DNA cleavage study is considered by observing the conversion of super coiled DNA (form I) to nicked DNA (form II) and linear DNA (form III) under anaerobic condition. DNA cleavage was not observed in (lane 1) in which the compound was absent. All the compounds (5a-i) can induce the observable cleavage of the DNA plasmid at the 100-µM concentration. At this concentration, all synthesized compounds can promote 70 to 90% conversion of super coiled DNA to nicked and linear DNA. It was observed that DNA cleavage not effective at lower concentrations. The studies revealed that -CH₃- and -OCH₃-substituted indole derivatives (5e) and (5f) exhibit much higher cleaving

TABLE 4 Zone of inhibition (mm) of compounds 5a-i against tested fungal strains

| Entry | Compound | Fungal strains | |
		Candida albicans	Aspergillus niger
1	5a	18.2± 0.6	15.6 ± 0.5
2	5b	19.2 ± 0.2	16.5 ± 0.2
3	5c	21.6 ± 0.3	20.2 ± 0.7
4	5d	20.2 ± 0.5	18.8 ± 0.6
5	5e	22.6 ± 0.2	21.7 ± 0.2
6	5f	23.3 ± 0.4	22.2 ± 0.2
7	5g	20.2 ± 0.5	19.3 ± 0.8
8	5h	21.4 ± 0.3	20.4 ± 0.9
9	5i	21.4 ± 0.5	20.3 ± 0.3
10	Standard	27.4 ± 0.6	23.4 ± 0.2

Note. Itraconazole was used as the standard. About 50 µl/mL of the compound in each well.

efficiency shown in the (Figure 2); the super coiled DNA was completely converted to form II and form III, and well defined. The significant activity was shown by simple indole derivative (5a) and Di-halogen-substituted indole derivatives (5g), (5h), and (5i); least activity was shown by mono-halogen-substituted indole derivative (5b), (5c), and (5d). Therefore, compounds having -CH₃ and -OCH₃ substitutions on 2-phenylindole moiety were more capable of abstract hydrogen from deoxyribose sugar to cleave DNA compare than other substituted indole derivative

3.5 | Antibacterial studies

All the synthesized compounds (5a-i) were screened for their antibacterial activity against Escherichia coli (ATCC 25922) and Staphylococcus aureus (ATCC 29213) by
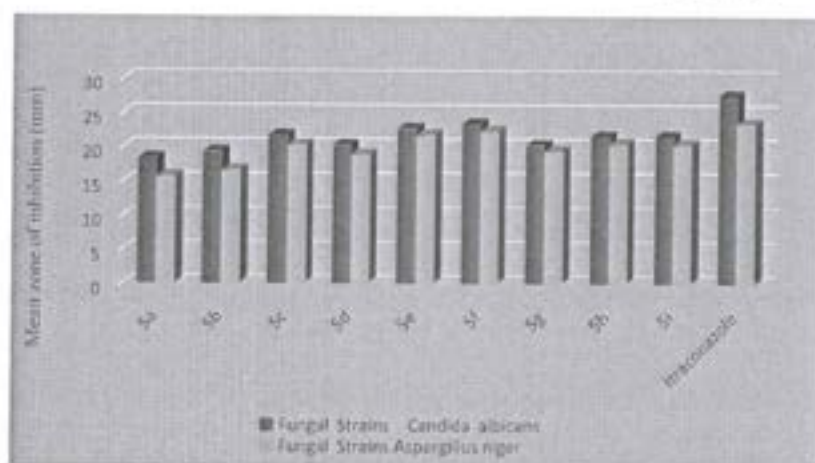
FIGURE 4 Zone of inhibition (mm) of compounds 5a-i against tested fungal strains [Color figure can be viewed at wileyonlinelibrary.com]

Kirby-Bauer well diffusion method with reference to Streptomycin. The observation of antibacterial screening data revealed that all the tested compounds (5a-i) showed promising antibacterial activities. Compound 5e and 5f showed more potent antibacterial activity with the zone of inhibition more than 22 mm; this is due to that the electron-donating methyl and methoxy substituents on indole nucleus have enhanced binding interactions with biological targets. The bacterial zones of inhibition values are summarized in (Table 3). The bar graph representation zone of inhibition (mm) of compounds (5a-i) against tested bacterial strains is shown in Figure 3.

3.6 | Antifungal studies

The antifungal activity of tested compounds (5a-i) was compared with *Itraconazole* (standard), and results are tabulated in Table 4. The antifungal screening of the compounds revealed good to moderate activity. Compound (5e) and (5f) were showed good inhibitory activity against *Candida albicans* and *Aspergillus niger*. The bar graph representation zone of inhibition (mm) of compounds (5a-i) against tested fungal strains is shown in Figure 4.

4 | CONCLUSION

In conclusion, we have designed, synthesized, and characterized a new series of 3-methyl-1-phenyl-4-((2-phenyl-1*H*-indol-3-yl)methylene)-1*H*-pyrazol-5(4H)-ones (5a-h) by various simple, efficient, solvent-free greener methods. The synthesized compounds screened for free radical scavenging activity, DNA cleavage, and antibacterial analysis. Some of the synthesized compounds, viz., -(5e) and (5f) having -CH$_3$ and -OCH$_3$ substituted at indole moiety exhibit as more prominent for all screening analysis. This is because of that the electron-donating substituents on phenyl ring have increased selectivity for their biological

targets and enhanced interactions with binding sites. Consequently, there is a good scope to develop a synthetic less harmful drug to reduce oxidative stress and good antioxidant and also capable to inhibit the growth of the pathogens by cleaving their genome.

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GROWTH OF FOOD TECH STARTUPS: A STUDY ON VARIOUS FOOD DELIVERY SERVICES

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Abstract

Almost in each and every sector, e-commerce has opened up its branches widely and strongly from online shopping to ticket bookings, cab bookings, healthcare and entertainment. One of its applications is in e-food industry, which has brought a revolution in food industry and many restaurants at a single platform. Food startups in India have become popular in a short span of time and have revolutionized the way people look around for places to take their food. Now decision for the best places to order food is only a single click away. One can pick the best reviewed place and order from it. The study comprises the factors which affect the rise and growth of various foodtech startups. By studying the operating strategies of Zomato, Swiggy, Foodpanda and Ubereats etc. our motive is to analyze how these all affect the Indian market. This study also focuses on understanding the behavior of consumers that how they select and use that goods and services to satisfy their needs. This paper helps to find out what consumers like, what they want, what makes them to shift towards digital technology and which application they are satisfied with.

Keywords: E-commerce, E-food industry, Food startups

Introduction:

The idea of getting a food with a single click at home has done a revolution in the field of food business. Digital platform and social media have played a vital role in setting the trend of getting cooked meals at their doorstep. This is changing the food habits of the people. People now ordering their food at home, office and at random places instead of going and eat. The habit of people using smart phones has proved to be a boon for the food industry. Increased demand and advanced technology has become a right hand of this industry. The offers and discounts offered by the food applications have mesmerized the customers and affixed them with applications. This phenomenon pushed them to order instead of cooking. Today the food delivery services industry is fastest growing industry with a huge benefit. In this paper, we will observe the behavior of the consumer towards online food industry. Ease of getting cooked food on a reasonable price, more convenient and accessible and 24/7 availability convinced them to order online. The motive of choosing this as a study topic to analyze which one is offering best service among Zomato, Swiggy, Foodpanda and Ubereats in terms of rates, discounts and offers, choices of restaurants, delivery time, food quality and quantity.

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ICT AS A TOOL FOR BUILDING INNOVATIVE KNOWLEDGE SOCIETY

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Abstract

This paper attempts to highlight the role of ICT in building innovative knowledge society for the 21st century. The paper has argued that ICTs have impacted on various fields of society. In a today's globalization era where information is considered as a planned resource, building the knowledge society is very significant for every single nation. Now a days the development of societies has shifted from an idea of information to knowledge society. "Knowledge Society" refers to a society where knowledge is the principal creation resource instead of any other resource like capital and labor etc. The real use of the Information Communication Technology offers real visions for human, sustainable development and the building of more independent knowledge-based societies.The new information and communication tools including internet, social networking, Big data network have created new opportunities for the formation, preservation, distribution and use of information and knowledge. The present revolution in information technology and networks makes communication systems of different significance to native peoples – for educating, sharing, informing, generating income and strengthening independence. In fact new information and communication technologies have considerably increased communities' capacity to access information and to share experience and practices in almost any part of the world. These ICTs have enough potential to break through geographic and social hurdles.

Thus the paper suggests that ICT in knowledge society is a way of socio-economic development of the nation. With the support of ICTs the consequences really could be revolutionary in various fields like education, agriculture, human resources, health, environmental management, and transport and business development. ICT is the enabler for innovative and knowledge Society. A knowledge society cannot be realized, supported or further developed without the ICT.

Keywords : Knowledge society, education, innovation, information technology

INTRODUCTION

The knowledge society represents new quality of life support systems. It is a human structured organization based on contemporary developed knowledge. It indicates the necessity to fully understanding distribution of knowledge, access to information and capability to transfer information into knowledge. The main challenge is understanding of knowledge while defining a knowledge society. The knowledge society signifies a new model for future development. Knowledge is more than information. The worldwide authentication of information is intrinsic to the knowledge society. The main driving force for the development of knowledge society is access to the global information pool. The ability for information transformation into knowledge is represented by the capability of the cultural system to convert available information into scientific and technological values used in everyday life. The notion "knowledge society" emerged toward the end of the 90s and is used as an alternative to the "information society". Coming up with new ideas about how to do things better or faster is the Innovation. It is about that no one had thought of before. It is basically putting new ideas to work in innovativeness and having a skillful work force that can use those new ideas. The success of enterprises, and of national economies, becomes increasingly dependent on the information communication technology infrastructure that is necessary for the gathering and utilization of knowledge.

The term knowledge society was first introduced by Peter Drucker in his book "Post Capitalist Society". At his book, Drucker says "we are entering the era of knowledge society in which economic resources are no longer in the form of capital, natural resources, or labor, but of knowledge and knowledge workers will play an important role".The role of knowledge society in contemporary life depends on the level of the new development of the

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ROLE OF ICT IN COMMUNITY OUTREACH AND SUPPORT SERVICES

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ABSTRACT

Information Technology (IT) could be a terribly promising sector of the Indian economy likewise as alternative dimensions of social development. This paper reviews many roles of knowledge communication technology within the development of varied fields of India's economy. India lacks behind the foremost as so much as ICT is bothered. Data and Communication technology trade has brought revolution in India. Government agencies square measure providing the use of Information and Communication Technologies (ICT) like E-governance. It helps in enhancing the effectiveness and potency of state and alters its relationship with the general public. E-Commerce refers to purchasing, selling, selling and mating over the web and alternative networks. E-Commerce in India is simply charming off with the beginning of Railway and on-line Air bookings and web banking. Thus it's potential to boost the semi-permanent growth prospects through increased productivity in nearly every sector of the Indian economy. Data and communications technologies (ICTs) have created folks round the world additional connected. ICTs are useful to develop teaching and learning through varied on-line platforms additionally to social activities. ICTs are taken into account as a very important tool within the struggle against the economic condition, illiteracy and social development. It may be a powerful tool to develop rural India. Secondary knowledge from educational articles with attention on India square measure accustomed analyze the contribution of ICTs within the development of varied fields.

KEYWORDS: *ICT, Indian Economy, Economic Development, E-learning, E-commerce.*

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Introduction

The planet is choked with technology within the recent era. We tend to travel through vehicles, aeroplanes. Homes square measure being adorned with varied good devices like cars, air-conditions, area coolers and heaters. Movies square measure choked with technology adventures. folks square measure communication with the planet through varied devices like mobile phones, e-mails and totally different chatting apps. The world isn't to date from people's approach, as they will comprehend the problems occurring around them through newspapers, news channels, or social media. The technological explosion in communication could be a boon. Thus it's a priority to prepare method in an exceedingly democratic manner on the premise of full awareness of the social impact of various alternatives. The preparation of technological impact serves may be a useful gizmo to assess the results for designs relevancy for unfortunate sectors of society, cultural influence, effects on employment pattern and similar factors.

This is notably necessary whereas creating decisions with relation to the event of communication infrastructures. Educated communities around the whole India square measure underneath increasing pressure to use new data communication technology to show students the competencies and skills they have within the twenty-first century. ICT may be used properly to boost teaching and learning additionally to affecting staff opportunities. In developing countries to supply technically skilled and economical student's faculties should be equipped with laptop facilities and qualified academics square measure necessary related to technology-assisted instruction (Burnett, 1994

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CORPORATE SOCIAL RESPONSIBILITY AND ROLE OF INDEPENDENT DIRECTORS IN GOOD GOVERNANCE

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Abstract:

An organization is a shared forum for different stakeholders, such as clients, staff, investors, shareholders, etc. It is a tool that can attract huge business capital. Every transaction in a company should be fair to its stakeholders and transparent. A company with good corporate governance and an efficient Management Board attracts investors and guarantees investment. The Board's independence is critical to ensure that the Board objectively fulfils its role and holds the management of the company accountable. Practice across jurisdictions shows that the independent director presence is the answer. The current report explores the current scenario in the Indian corporate sector and examines the role of the Independent Manager for Corporate Governance and particularly the role of the investigator as an independent director.

I. INTRODUCTION

Corporate governance is a process and system through which businesses are run. Conglomerates and listed companies have different set of stake holders like shareholders, lenders, suppliers, bankers, customers, employees, government and society at large. As the businesses grow, the complexities of managing a business also increase. This will lead to various governance issues like providing justice to all the stakeholders of the business, maintaining high ethical standards and most importantly running a sustainable business in the long run. To achieve these objectives, a strong system and process needs to be in place which is termed as corporate governance.

The significance and development of corporate governance in India is profoundly affected by the essence of the relationship between, on the one hand, the business worlds and, on the other, Indian state policies. Twin pressures are exerting themselves on this relationship. Between the post-independence period [post-1947] and the pre-liberalization period, the relationship between industry and the state

was especially vulnerable to a lack of transparency for certain corporate governance norms. This time can be understood to a large degree in terms of the relationship-oriented governance models that have been widely adopted in Japan and India. The relationship structure between the industry and the state did exist, but was rather flawed from the point of view of corporate governance norms. In the post-liberalization phase [post-1991], market openness brought its own collection of challenges and opportunities. Although the relationship between the state and industry has not fully dissolved, it appears that market-oriented governance models are capable of providing important insights into the workings of companies. The understanding of corporate governance in India therefore demands that lessons be drawn from both insider-oriented models and market-oriented models. Both of these models give us a good view of their respective strengths and limitations. India is at a particular crossroads to map a new path towards the implementation of a corporate governance model. It needs to take due account of the perspectives of both schools of thought and maybe create a new integrated model for other emerging economies. The Indian model of corporate governance, at least for the time being, has shown no signs of convergence towards a single form of governance. More so, given its political pre-conditions and path-dependent circumstances, Indian corporate governance, which is now a good mix of the strengths of the two famous versions, would do well in its present state as it is.

II. THE ROLE OF THE
INDEPENDENT DIRECTORS

With the proliferation of corporate scandals due to mismanagement and bribery in recent years, regulators around the world have been introducing a range of policies aimed at strengthening corporate governance and ensuring that businesses obey ethical and normative business laws. Part of this programme was to allow businesses to appoint a certain percentage of their board of directors to individuals who are not affiliated with the organization. These are the so-called independent directors who sit on the board of directors of companies in a strictly professional way without having a hand in the day-to-day operation or other activities of the company.

The argument about the independent directors is that they are selected from a group of experts who have had broad business experience and are eligible to sit on the boards of the companies. What makes this mechanism desirable to regulators is that these independent directors will carry with them the much-needed viewpoint that is impartial and fair, because they are not related to or controlled by the company and thus do not have secret agendas.

In India, SEBI and the Ministry of Corporate Affairs have agreed that between 10% and 15% of the membership of the Board must be made up of independent directors. The goal of this move is to add more objectivity to the art of corporate governance and to implement openness and accountability on the part of directors drawn from the management ranks. This law has been applied in the face of corporate scandals such as Satyam, where the top management itself has indulged in bribery and unethical business practices. The line of thought, therefore, is that bringing in independent directors will lead to greater control of the operations of these businesses. Since the Satyam Scandal was because the board looked the other way when its founder was indulging in defrauding the firm, this rule is being enforced by the Ministry of Corporate Affairs in order to enforce greater oversight.

In the US, independent directors have been known to bring new insights to bear, as well as to monitor the runaway market actions driven by income and personal benefits. In many US corporations, independent directors are often the ones that prohibit management from taking decisions based on personal gain rather than on the interests of the shareholders. In addition, independent directors are charged with reviewing cases of corporate malfeasance and unethical conduct due to their perceived objectivity. However, there have been times where the independent directors themselves have admitted to misconduct by the companies and their boards of directors. The response to this has been the effort to make the independent directors responsible for the Board's decisions so that they have an interest in ensuring that the Board does not stand on the wrong side.

Lastly, independent directors often have the much-needed technical skills, as they are individuals with considerable experience in the management of businesses as well as the fact that they sit on the boards of other firms, which ensures that they are up to date with the latest innovations. Regulators have worked in many countries to ensure that independent directors do not have conflicts of interest, and these have been codified into rules governing how many firms they can work with, and the sectors and industries they serve.

III. STATEMENT OF THE PROBLEM

Milton Friedman, Nobel Prize winner in Economics, has once argued that the primary purpose of a company is and should be to maximize shareholder value. According to him, the social missions are the responsibility of people, social organizations and the government. However, people's modern thought is different from that of Milton Friedman. Only the largest of the big modern companies has achieved the present scale, thanks to the full support of shareholders, suppliers of long-term and short-term properties, lenders, suppliers of raw materials, workers, the government, the local community and society at large, including both existing and future customers. Every firm is so dependent on its social environment that it can neither thrive nor develop without the complete social acceptance and approval of all environmental stakeholders in particular, society as a whole and the government as a whole. Here comes an illustration of the idea of business ethics. The concept of ethical philosophy is both old and new.

According to Dr. Subhash Sharma, we can see the change in history from an organisational point of view. Three distinct historical transformations can be observed from the point of view of the Kingdom State, the Nation State and the Corporate State. The Emergency of Corporate as a State is a new phenomenon. They have to adapt increasingly to people's new expectations. In the new age of corporate governance, the emphasis is on corporate governance. As corporates play a major role in people's lives and affairs, high expectations in terms of business ethics, social responsibility and corporate governance are natural. But the existing corporate governance models measure the transparency and disclosure norms to a large extent and corporate social responsibility to some extent. The ethical dimension in corporate governance is very essential for the sustainable growth of the organizations. Hence, the researcher proposes to undertake this study on corporate governance from a holistic perspective which includes **Social Responsibility and Role of Independent directors in good governance.**

Process and ensuring compliance with various rules, regulations. Clause 49 of the listing agreement with stock exchanges

provides the code of corporate governance prescribed by SEBI for listed Indian companies. With the introduction of clause 49, compliance with its requirements is mandatory for such companies.

IV. OBJECTIVES OF THE STUDY

To analyze dependency between Explicit Social Responsibility and Role of Institutional investors in good governance

HYPOTHESIS

Null Hypothesis (Ho): Explicit Social Responsibility and role of independent directors in good governance are independent

Alternate Hypothesis (H1): Explicit Social Responsibility and role of independent directors in Good governance are NOT independent

V. SCOPE OF THE STUDY

This study is conducted both on conceptual and empirical basis. Firstly, by conducting a thorough literature review and by reviewing the existing models of corporate governance, a new model of corporate governance is conceptualized and it is called SREE model (Social, regulatory, ecological and ethical). The four parameters mentioned are considered for measuring the corporate governance of an organization. This model is then tested on 74 companies. The companies are listed on the BSE and are publicly traded. All the companies are Indian companies. Firstly by using the SREE model corporate governance score for each company will be arrived. Later this score will be linked to study the importance and implications of corporate governance scores on the market performance and accounting performance indicators.

VI. TYPE OF THE STUDY

The study is conceptual, qualitative and quantitative.

A. Conceptual

The study is conceptual as a new model of corporate governance called SREE model is developed by the researcher.

B. Quantitative

The study is quantitative as it is analyzing the relationship between corporate governance scores and market performance and accounting performance through various statistical tools. The study is also analytical and empirical in nature. The researcher is also administering a questionnaire on which various statistical tools and techniques will be used for interpreting the results.

C. Qualitative

The study is qualitative as the researcher is also conducting a content analysis by administering a questionnaire.

VII. METHOD OF SAMPLING

Random sampling method is adopted for this study. Out of BSE 500 (Bombay Stock Exchange top performing 500 companies) 74 companies are chosen randomly. After a random selection, for further analysis a post stratification method of the sample selected is done. The sample is classified based as service companies and manufacturing companies for certain analysis.

VIII. TOOLS FOR DATA

COLLECTION

2 questionnaires were used to collect the data. The first questionnaire was used to collect the data to develop a corporate governance score and the second questionnaire was used to interpret the present state of corporate governance in

India and the road ahead. The respondents for the survey are chartered accountants, company secretaries, directors and executives representing the management.

HYPOTHESIS TESTING

Analysis of the dependency between Explicit Social Responsibility and Role of Independent directors

Null Hypothesis (Ho): Explicit Social Responsibility and role of independent directors in good governance are independent

Alternate Hypothesis (H1): Explicit Social Responsibility and role of independent directors in Good governance are NOT independent

Table showing the chi-square analysis between explicit social responsibility and role of independent directors in good governance

Observed Values	Role of Independent Directors					
Explicit Social Responsibility	Strongly Disagree*	Disagree*	Can't say	Agree	Strongly Agree	Grand Total
Can't Say	0	0	0	1	2	3
No	0	0	1	3	6	10
Yes	0	0	0	26	28	54
Grand Total			1	30	36	67

	Role of Independent Directors					
Explicit Social Responsibility	Strongly*	Disagree	Can't say	Agree	Strongly agree	Grand total
Can't say	0	0	0.04	1.34	1.61	3
No	0	0	0.14	4.47	5.37	10
Yes	0	0	0.80	24.17	29.01	54
Grand Total	0	0	1	30	36	67

Chi square Value	6.61
Degrees of Freedom (df)	(3-1) x (3-1) = 4 (* columns not considered in degrees of freedom as there are null values)
Alpha Value	0.05 or 5% (95% confidence Level)
(α) Critical	9.49
Value Result	Accept Null Hypothesis – Ho as Chi Square Value < Critical Value

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IX. INTERPRETATION

Table describes the opinion statistics of people for importance of explicit social responsibility and role of Independent directors in good governance. It is evident from observed values that 98.5% people strongly agreed and agreed that that explicit social responsibility and role of independent directors are important in good governance. Chi square value for the hypothesis is 6.61 with 4 degree of freedom. Critical value is 9.48 with 95% confidence level (alpha=0.05). Since Chi Square Value < Critical Value Accept Null hypothesis i.e. Explicit Social Responsibility and role of independent directors in Good governance are independent.

X. CONCLUSIONS

The role of the Board of Directors has been the subject of public discussion in recent years as a result of their Failure to uphold corporate governance. The research evaluated that the more autonomous the board is the easier it is to add productivity to the business. They help in the right way the functioning of the organization, due to the fact that they do not have a material interest,
Business and they are really going to represent interest.

India has an important domestic institutional shareholder base as well as a significant presence of foreign institutions, especially in large companies. Domestic fund managers tend to have been much more involved at least in terms of voting at shareholder meetings during the last decade. The transition to a new eligibility date in 2005 definitely underpinned this growth and also attracted international investors. There have also been a number of times when domestic institutional investors have expressed their disappointment at the company's conduct. In the past, such investors may have been more passive, but now they have expanded to the first proxy

war over the Supervisory Board, defeated agenda items and counter-motions carried out by some companies (e.g. Heidelberg Cement, Infineon and Siemens).

However, it is difficult to draw conclusions about the efficacy and scope of this agreement, since little information is available from fund management firms about compliance with the governance voluntary code of conduct. The code is limited in terms of corporate governance structures for investment firms, but it is now obligatory in other fields, such as accountability, openness and preventing overcrowding of shares.

More focus also needs to be given to the governance of fund management firms. The recommendation of the Code that there should be only one member of the supervisory board independent of controlling shareholders is not adequate in India, given the substantial ownership of institutional investors by banks and insurance companies. The improvement of the supervisory board may also include an independent audit committee.

The most significant weakness in the institutional framework is the openness to international investment. There are two sides of it. Indian funds may have substantial international investments, but their voting activity is marginal and other participation behaviors could be much less likely. There are, of course, complicated problems surrounding cross-border voting and the costs that still need to be addressed, including record dates so far in advance of the shareholders ' meeting. However, other steps may also be required, such as an updated code of conduct requiring them to vote on their major foreign investments. On the other hand, foreign investors are now a major force in India, but all evidence suggests reduced voting conduct and commitment compared to domestic investors, except for one or two exceptions.

Although this is a more general problem in the global economy, the German authorities should consider what possible domestic policy options are open. Among others, it will be necessary to step towards a further simplification of the voting chain, even though a great deal has already been accomplished (e.g. electronic voting, proxies).

In view of India's institutional framework, proxy advisors are thought to have a major role to play. It is suspected that some investors are asking proxy advisors to follow the principles of corporate governance of the investor rather than their own. Whether conflicts of interest have been resolved remains uncertain.

The rules regulating collaboration between investors have been clarified since 2009 but remain potentially restrictive. This is because they aim to prevent investors from "influencing the strategic course of an organization in a permanent and strategic manner." This is understandable in India, because company law assigns management responsibility for the plan with a substantial input from the Works Councils in a cooperative process. It does, however, mean that investors must express their views in a highly customized manner in order to avoid debating a policy that is genuinely their concern. This tends to minimize market transparency.

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CONTENT PAGE

The Impact of Dairy Effluent on Germination Parameters of Seeds of Mung bean (*Vigna radiata*) and Mustard (*Brassica nigra*)

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Abstract

The advancement of a country depends upon its industrialization. Of all industrial sectors, the food processing units have highest consumption of water and are biggest producers of effluent per unit of production.The concentration and composition of the effluent depends upon operating methods andthe size and design of the processing plant.The dairy industry generates on an average 6-10 litres of waste water per litre of the milk processed. It has relatively high organic matter, suspended solids, trace organic nutrients which are essential for growth of crop plant. Thus, the utilization of the dairy effluent for irrigation can be an eco friendly approach for its disposal. The present study was carried out to study the influence of dairy effluent on seed germination, seedling growth and biomass production in mung bean (*Vigna radiata*) and mustard (*Brassica nigra*). The seeds of both the plant species were grown in petriplates and pots irrigated with various concentrations of dairy effluent (20, 40, 60, 80 and 100%). The dairy effluent concentration of 20% was more favorable for total growth parameters viz., the germination percentage, the shoot length, dry weight and wet weight both in mustard and mung bean. Among different concentrations, 100% concentration of effluent caused inhibitory effect. Thus, it is recommended that only after suitable dilution, the dairy effluent can be effectively used for irrigation.

Keywords: Dairy effluent, mung bean, mustard, germination, seedling growth

1. Introduction

The advancement of a country depends upon its industrialization. But water pollution caused by industries is a serious concern throughout the world (Braio and Taveres, 2007; Mustafa et al., 2010). Of all industrial sectors, the food processing units have highest consumptions of water and are biggest producers of effluent per unit of production (Ramjeawon, 2000; Prabhakar et al., 2006; Tikariha and Sahu, 2014). Safe disposal of industrial effluent has become an ecological challenge. Continuous disposal of waste water into the water bodies has deteriorated surface water quality because of the mixing of various chemical pollutants of the effluent with water (WHO, 2003; Al-Dulaimi et al., 2014; Khaleel et al., 2012). The physico-chemical techniques used for removing pollutants from the environment are inefficient, costly, of limited applicability, and sometimes producing large amounts of toxic waste which is difficult to dispose off or form hazardous by-product. The lack of efficient effluent treatment facilities and proper system of waste water disposal has increased pollution of water bodies day by day and adversely effected soil, water, flora and fauna due to presence of toxic and persistent chemicals.

The industrial effluent has been used for agricultural irrigation in developing as well as developed countries. The soil has a great capacity for receiving and decomposing various types of wastes and pollutants and thus it act as an excellent purifying media. The land disposal of agricultural, dairy, municipal and industrial waste is widely practiced as a major and economic source of nutrients and organic matter for growing cereal in arid and semi-arid regions of the country, where shortage of water becomes limiting factor (Gaikar et al., 2010). Further, the industrial effluent is rich in plant nutrients and can be effectively utilized as liquid bio- fertilizer for the soil restoration and sustainable land production.The usage of the treated effluent for recreational activities is due to the demand of the water worldwide. Thus, Finding suitable eco-friendly techniques for the potential utilization of these released effluents as a source of nutrients become essential (Parmar et al., 2017). The effluents generated from food processing industries like fruits and vegetable processing, meat and poultry processing, dairy industries etc are rich in nutrients like carbohydrates, minerals and nitrogenous compounds which when supplied in optimal concentrations enhance the plant growth (Kumar, 2011; Kumar et al., 2013).

In India, dairy industry is one of the most important agro-based industries and is important commodity entering trades. The dairy operations involve processing of raw milk into pasteurised and sour milk, hard, soft and cottage cheese,

cream and butter products, ice cream, yoghurt, milk powders, condensed milk and various types of dessertsfor the consumer. Enormous amount of water is used in various stages of dairy operations, such as, milk processing, cleaning, packaging and cleaning of the milk tankers and resulting in generation of significant quantities of waste water which is known as dairy effluent (Belyea et al., 1990; Manu et al., 2012). The quantity of dairy effluent released by a milk processing plant depends upon the size of the plant, generally expressed in terms of the maximum weight of milk handled in a single day, and the processes involved.The dairy industry generates on an average 6-10 litres of waste water per litre of the milk processed. It has relatively high organic matter, suspended solids, trace organics nutrients, inorganic nutrients which are essential for growth of crop plant (FAO, 1992; Kharbanda and Prasana, 2016; Verma and Singh, 2017).

The present investigation was carried out to study the effective and suitable concentrations of dairy effluent in promoting germination, wet weight and dry weight of mung bean (*Vigna radiata*) and mustard (*Brassica nigra*). The study also aimed at physicochemical characterization of effluent from Jaipur dairy.

2. Materials and Methods

2.1. Experimental procedure

The study was conducted in biotechnology laboratory at the Kanoria P. G. Mahila Mahavidyalaya, Jaipur to study the effect of dairy effluent on the germination of seeds of mung bean (Vigna radiata) and mustard (Brassica nigra) in November 2019. Maximum temperature during the study period varied between 18°C – 32°C.

2.2. Sample area and sample collection

The effluent samples were collected from Jaipur Dairy from a discharge point in a clean plastic container which was rinsed with HNO_3 and distilled water. The sample container transferred to biotechnology laboratory and stored at 4°C until used for further analysis.

2.3. Physicochemical characterization of dairy effluent

Effluent samples were analyzed for physico-chemical parameters such as pH, temperature, salinity, nitrate, BOD and COD by standard protocols given in American Public Health Association (APHA) (1998). Color, temperature and pH of the effluent were recorded at the sampling point. All other parameters were analyzed within 24 hrs.

2.4. Seed germination experiment

Effluent samples were analyzed for physico-chemical parameters such as pH, temperature, salinity, nitrate, BOD and COD by standard protocols given in American Public Health Association (APHA) (1998). Color, temperature and pH of the effluent were recorded at the sampling point. All other parameters were analyzed within 24 hrs.

2.4. Seed germination experiment

The healthy seeds of Mung bean and Mustard were selected and surface sterilized with 0.1% mercuric chloride (HgCl$_2$)

and washed with distilled water. Twenty seeds were placed equispacially in sterilized petriplates which were lined with filter paper soaked with different concentrations of effluent (20%, 40%, 60%, 80% and 100%) and tap water as control. These petriplates were irrigated with different concentration of effluent uniformly. Number of seeds germinated was counted on 7th day and total growth parameters viz., the germination percentage, the shoot length, dry weight and wet weight were calculated. The shoot length was measured at the area of contact between the stem and root; mean shoot length was expressed in centimetres using a measuring tape (cm). The wet weight of seedlings was taken and then they were dried overnight in oven and again weighed for estimation of the dry weight. Data were taken from three replicates of seedlings.

2.5. Statistical analysis

The values of different parameters are presented as mean of replications. The treatments were designed in completely randomized block design with three replications. The statistical analysis was done by using online software OPSTAT.

3. Results and Discussion

3.1. Physicochemical characterization of dairy effluent

From the data presented in Table 1, it is clear that dairy effluent was white in colour. The pH and temperature of the effluent was recorded as 6.8 and 26°C, respectively. These results were similar to the findings by Dhanam (2009) for dairy industrial effluents. Dairy waste streams have higher annual temperature (17–25°C) than that of municipal waste water (10–20°C), thus, a faster biological degradation occurs in dairy waste water as compared to sewage treatment plants (Ahmad

Table 1: Physicochemical characterization of dairy effluent

Sl. No.	Parameters	Units	Values	Permissible limits (APHA)
1.	Colour	-	White	-
2.	pH	-	6.8	6.5-8.5
3.	Temperature	°C	26	shall not exceed 5°C above the receiving water temperature
4.	Alkalinity	mg l^{-1}	1.93	-
5.	Chlorides	mg l^{-1}	260	600
6.	Nitrate	mg l^{-1}	22	10
7.	BOD	mg l^{-1}	310	30
8.	COD	mg l^{-1}	680	250

et al., 2019). The values of alkalinity, chlorides, nitrate, BOD and COD of the effluent were 1.93 mg l^{-1}, 260 mg l^{-1}, 22 mg l^{-1}, 310 mg l^{-1}, 680 mg l^{-1}, respectively.

3.2. Seed germination experiment

Among various concentrations ranging from 20% to100%, the dairy effluent samples showed favourable effects on seed germination and other growth parameters of both mung bean

and mustard. The results presented in Table 2 revealed that among various effluent concentrations, maximum percent germination of seeds of Mung bean (97%) in petriplates was observed with 20% effluent concentration which is statistically at par with that of control (tap water), 60% and 80% effluent concentration. The minimum germination (80%) of mung bean

Table 2: Effect of different concentrations of dairy effluent on percentage germination of Mung bean seeds

Concentration of effluent (%)	Germination (%) in petriplates	Germination (%) in pots
20	97[a]	84[a]
	(9.89)[*]	(66.70)[**]
40	85[b]	52[b]
	(8.77)	(46.32)
60	95[a]	60b
	(9.79)	(51.00)
80	95[a]	83[a]
	(9.79)	(65.64)
100	80[c]	25[c]
	(9.00)	(29.82)
Control	100[a]	85[a]
	(9.89)	(67.31)
CD (p=0.05)	0.262	6.227
SEm±	0.084	1.999

*Figures in parentheses are square root transformed values;
**Figures in parentheses are angular transformed values

seeds was at 100% effluent concentration. Similar results were obtained in pots, the seeds of mung bean showed maximum percentage germination at 20% effluent concentration (84%) which was statistically at par with that of control and 80% effluent concentration. Lower concentration of dairy effluent showed promoting effect on seed germination, seedling growth, dry matter production (Dhanam, 2009). The minimum percentage germination (25%) was observed at 100% effluent concentration. Results of present investigation are supported by the previous work on black gram and green gram irrigated by dairy effluent (Prasannakumar et al., 1997). The promotion of seedling growth by lower concentration of effluent might be due to the presence of plant nutrient in the effluent.

In case of mustard seeds grown in petriplates, the highest percentage germination (100%) was recorded at 20% effluent concentration which was statistically at par with that of control (95%). In pots, the maximum mustard seed germination (52%) was recorded at control which was at par with seed germination at 20% (48%) and 60% (45%) effluent concentration (Table 3).

The dairy effluent at low concentration had greatly supported the growth of both mung bean and mustard seedlings. From Table 4, it could be inferred that there is statistically significant

differences in seedling growth (cm), wet weight and dry matter production (g) depending on the concentration of

Table 3: Effect of different concentrations of dairy effluent on the percentage germination of Mustard seeds

Concentration of effluent (%)	Petriplate Germination (%)	Pot Germination (%)
20	100[a*]	48[ab**]
	(10.05)	(40.18)
40	72 c	30[b]
	(8.517)	(33.02)
60	80[b]	45[a]
	(8.97)	(42.01)
80	90[ab]	48[a]
	(9.56)	(44.02)
100	80[b]	32[b]
	(8.99)	(34.16)
Control	95[a]	52[a]
	(9.79)	(45.94)
CD (p=0.05)	0.699	7.808
SEm±	0.224	2.506

*Figures in parentheses are square root transformed values;
**Figures in parentheses are angular transformed values

effluent used. In case of mung bean, seedling in petriplates, the maximum shoot length (5 cm) was recorded in the 20% concentration which was statistically at par with that of control. This is followed by growth of seedling at 80% (2.26 cm), 60% (2.20 cm) and 40% (1.95 cm) and 100% effluent (1.78 cm).

The magnitude of reduction in seed germination and seedling growth was higher at 100% concentration which may be probably due to higher osmotic pressure. Nagda et al. (2006) also reported that osmotic pressure of the effluent at higher concentration of total salt makes imbibition more difficult and retards germination. Suppression of seedling growth by effluent concentrations above 20% observed in the present study is in reference with the earlier studies of Singh et al. (2002) in *Triticum aestivum*, Gaikar et al. (2010) in Soyabeans, Lakshmi and Sundaramoorthy (2000) in Ragi and Koushik et al. (2005) in wheat.

In Petri plates, maximum dry weight (0.52 g) and wet weight (2.12 g) of mung bean seedlings was recorded at 20 and 60% effluent concentration, respectively (Table 4). However, in pot experiment, the seedlings showed maximum dry weight (0.41 g) and wet weight (1.98) at 20% effluent concentration (Table 5).

However, the seedlings of mung bean when grown in pots showed maximum shoot growth (10.14 cm) with 40% effluent concentration and it was at par with the 20% effluent (9.26 cm). Further, the increase in effluent concentration from 60-

Table 4: Effect of dairy effluents on growth parameters of mung bean in petriplates

Concentration of effluent (%)	Shoot length (cm)	Dry weight (g)	Wet weight (g)
20	5ª	0.52ª	1.49 c
	(5.00)*	(0.52)*	(1.49)*
40	1.95ᵇ	0.40ᵇ	1.12ᵈ
	(2.13)	(0.40)	(1.13)
60	2.2 b	0.43ᵇ	2.12ª
	(2.47)	(0.43)	(2.13)
80	2.26ᵇ	0.41ᵇ	1.98ª
	(2.27)	(0.41)	(2.00)
100	1.78ᵇ	0.18ᶜ	1.76ᵇ
	(1.80)	(0.19)	(1.76)
Control	4.43	0.38	1.41
	(4.67)ª	(0.39)ᵇ	(1.40)ᶜ
CD (p=0.05)	0.983	0.071	0.192
SEm±	0.316	0.023	0.062

*Figures in parentheses are square root transformed values

Table 5: Effect of dairy effluents on growth parameters of Mung bean in pots

Concentration of effluent (%)	Shoot length (cm)	Dry weight (g)	Wet weight (g)
20	9.26ª	0.41ª	1.98ª
	(9.267)*	(0.41)*	(1.98)
40	10.14ª	0.21ᶜ	0.95ᶜ
	(10.83)	(0.21)	(0.95)
60	8.3ᵇ	0.23ᶜ	1.12ᵇᶜ
	(8.33)	(0.23)	(1.12)
80	6.5ᶜ	0.33ᵇ	1.44ᵇ
	(6.63)	(0.33)	(1.49)
100	6.85ᶜ	0.18ᶜ	0.9ᶜ
	(6.83)	(0.18)	(0.91)
Control	5.2ᵈ	0.38ᵃᵇ	1.41ᵇ
	(5.20)	(0.36)	(1.41)
CD (p=0.05)	1.113	0.077	0.437
SEm±	0.357	41.05	0.14

*Figures in parentheses are square root transformed values

100% inhibited the seedling growth (Table 5). This showed that the seedling growth was inversely proportional to effluent concentrations. The results are supported by findings of Dhanam (2009), who observed that lower concentrations of dairy effluent showed promoting effect on seed germination,

seedling growth, and biomass production.

The results from Table 6 revealed that mustard seedlings

Table 6: Effect of dairy effluent on growth parameters of Mustard in petriplates

Concentration of effluent (%)	Shoot length (cm)	Dry weight (g)	Wet weight (g)
20	0.86ᵈᵉ	0.56ª	2.2ª
	(0.86)*	(0.56)	(2.20)
40	0.9ᵈ	0.24ᵈ	0.9ᵉ
	(0.91)	(0.24)	(0.90)
60	0.83ᵉ	0.22ᵈ	0.97ᵈ
	(0.83)	(0.22)	(0.97)
80	1.42ª	0.43ᵇ	1.41ᵇ
	(1.42)	(0.43)	1.41
100	1.29ᵇ	0.33ᶜ	1.28ᶜ
	(1.29)	(0.33)	(1.28)
Control	1.17ⁱ	0.46ᵇ	1.43ᵇ
	(1.17)	(0.46)	(1.43)
CD (p=0.05)	0.072	0.058	0.07
SEm±	0.023	0.019	0.022

*Figures in parentheses are square root transformed values

showed maximum dry and wet weight i.e. 0.56 g and 2.20 g at 20% effluent in petriplates. In pot experiments also the maximum wet and dry weight of mustard seedlings were recorded at 20% effluent concentration (Table 7). However,

Table 7: Effect of dairy effluent on growth parameters of Mustard in pots

Concentration of effluent (%)	Shoot length (cm)	Dry weight (g)	Wet weight (g)
20	1.36ᶜ	0.24ᵇ	0.78ᶜ
	(1.35)*	(0.24)*	(0.78)*
40	2.01ª	0.19ᶜ	0.73ᶜ
	(2.01	(0.19)	(0.73)
60	1.1ᵈ	0.3ª	0.85ᵇ
	(1.10)	(0.30)	(0.85)
80	1.95ª	0.26ª	1.04ª
	(1.95)	(0.26)	(1.04)
100	1.02ᵉ	0.18ᶜ	0.72ᶜ
	(1.02)	(0.18)	(0.72)
Control	1.56ᵇ	0.27ª	0.76ᶜ
	(1.55)	(0.27)	(0.76)
CD (p=0.05)	0.072	0.051	0.068
SEm±	0.023	0.016	0.022

*Figures in parentheses are square root transformed values

100% dairy effluent retarded the growth of mustard seedling as shoot length measured as 1.02 cm and it also reduced the biomass production (0.18 g). Pandey and Soni (1994) also suggested that the interaction between the various constituents of the effluent and native microbes might be responsible for the inhibition of seedling growth.

4. Conclusion

The effluent sample at low concentration (20%) showed a remarkable response in growth and germination compared to other concentrations. Since, the higher concentrations of the treated dairy effluent inhibits the plant growth, it is recommended that only after suitable dilution, dairy effluent can be effectively used for irrigation. However, some more extensive research work is needed to make such recommendation in order to minimize the risk.

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GRAPHENE OXIDE AND ITS APPLICATION IN WATER PURIFICATION

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Abstract-

Graphene Oxide is a 2-Dimensional material, decorated with Oxygen-containing functional group. The Graphene Oxide was successfully prepared via the Modified Hummers method. The suspension of graphite flakes was sonicated repeatedly with the help of centrifugation;hence graphene oxide was prepared. Characterization of Graphene Oxide films were conducted. The structural and physiochemical properties of Graphene Oxide were investigated with the help of XRD, RAMAN SPECTROSCOPY, UV SPECTROSCOPY, FT-IR. UV-visible spectra of Graphene Oxide exhibits maximum absorption peak at ~237nm shows π-π^* transition of the atomic and carbon-carbon bonds. Water bodies are heavily polluted due to contamination of heavy metal particles, toxic dyes, and other harmful wastes. Graphene is used for the removal of harmful contaminants present in water bodies. In this paper, the preparation methods of Graphene Oxide membrane are reviewed. We measured that the percentage of impurity in graphene based purified water is much lower than that of wastewater. Finally, the application of Graphene membrane in water treatment was discussed.

Key words: Graphene Oxide, XRD, Hummers, FT-IRAbsorption, Membrane

INTRODUCTION

Nanoscience and Nanotechnology in particularly deals with the exploration, synthesis, and characterization of Nanomaterials. Graphene is a carbon material, atomically-thin, a 2-D sheet of sp^2 carbon atoms in a honey comb lattice structure gives it many extraordinary characteristics, such as one of the lightest, transparent and being the strongest material in the world. Graphene could also be obtained using BOTTOM UP METHOD. Some recent results demonstrated that the structure graphene which we called it a "wonder material" has many properties such as electrical conductivity, high mechanical strength.Graphene Oxide is an oxidized form of graphene containing hydroxyl (OH), alkoxy (C-O-C), carbonyl (C=O), carboxylic acids (-COOH) and O-based functional group. These oxygenated groups are accountable for many advantages over graphene which includes higher solubility aside from the synthesis. The oxidation of graphite in protonated solvents forms graphite oxide, which consist of multiple stacked layers of graphene oxide.

It has high electrical properties and electron transport (200,000 cm^2/v.s.), excellent thermodynamic properties (5300w/m.k.) and large surface area (2600m^2/g), while the carbon nanotubes have a surface area of 1000m^2g. There is a strong Vander Waals force between the graphene sheets.

The two important characteristics of GRAPHENE OXIDE: -

(1)   Highly Hydrophilic.

(2)   Cost effective chemicals are used with a high yield.

Researchers use nanomaterials in the form of nanotubes, nano-adsorbents, semi permeable membrane which are made from nano fibres, nanoflake, catalysts in nano-sized, etc. Graphene naturally repels water, but when small narrow pores are made in it, quick water permeation occurs. Graphene sheets which are having perforated holes are studies as a method of water filtration because of their ability to pass the water molecules but block the passage of contaminants. Graphene's small size and small weight make it ultra-light Hydrophilic property of graphene oxide is one of the most useful features for water treatment as it has large negative charge.

Graphene oxide is synthesized by certain methods including Hummers Method, Modified Hummers method, Staudenmaier, Hoffmann, Brodie. Hummers method is one of the adequate as well as faster method for the preparation of graphene oxide. Another advantage of this method is producing graphene oxide with high carbon – oxygen ratio Graphene Oxide is commonly sold in powder form, or as coating on substrates.

OBJECTIVE AND METHODOLOGY

OBJECTIVE

The main objective of this paper is to study synthesis techniques of graphene oxide, characterization of graphene oxide by spectral and microscopic data and its application in H_2O purification.

MODIFIED HUMMERS METHOD

➢ CHEMICALS REQUIRED: -

    I.   Graphite Flakes

    II.   Concentrated H_2SO_4

    III.   Potassium Permanganate

    IV.   Hydrogen Peroxide

    V.   Hydrochloric Acid

➢ This method of synthesis involves both oxidation and exfoliation of graphite sheets due to thermal treatment of solution.

➢ The stepwise synthesis method given as follows: -

(1)   Graphite flakes (2gm) were mixed in 50ml concentrated H_2SO_4 (98%) in 1000 ml volumetric flask.

(2)   Then the mixture was cooled under ice water-bath with continuous stirring and the suspension was obtained.

(3)   Then 6 gm of oxidizing agent Potassium Permanganate ($KMnO_4$) was added moderately into the suspension under controlled temperature below 10^0C.

(4)   The suspension was then stirred at room temperature for 145min to 1 hour, followed by sonication in an ultrasonic bath for 8 min.

(5)   Then 250 ml of distilled water was added into mixture with repetition of stirring- sonication process 10 times at 450 rpm.

(6)   After that 30ml of H_2O_2 was added to exfoliated graphite oxide achieved by ultrasonication of dispersed solution for 1 hour. Then the solution is centrifuged at 10,000 rpm.

(7)   Then graphene oxide was washed with 2M HCl to remove excess of metal ion to make it neutral.

(8)   The resulting mixture was washed repeatedly by distilled water or deionized water several times until the pH comes to~7. (pH-neutral)

(9)   Then graphene oxide was washed with 2M HCl to remove excess of metal ion to make it neutral.

(10)   The resulting mixture was washed repeatedly by distilled water or deionized water several times until the pH comes to~7. (pH-neutral)

(11)   The resulting graphene oxide precipitates were then dried at room temperature for 24hr to graphene oxide powder.

RESULTS AND DISCUSSION

Experimental yield of GRAPHENE OXIDE prepared = 1.48gm

CHARACTERIZATION:

RAMAN SPECTRA:
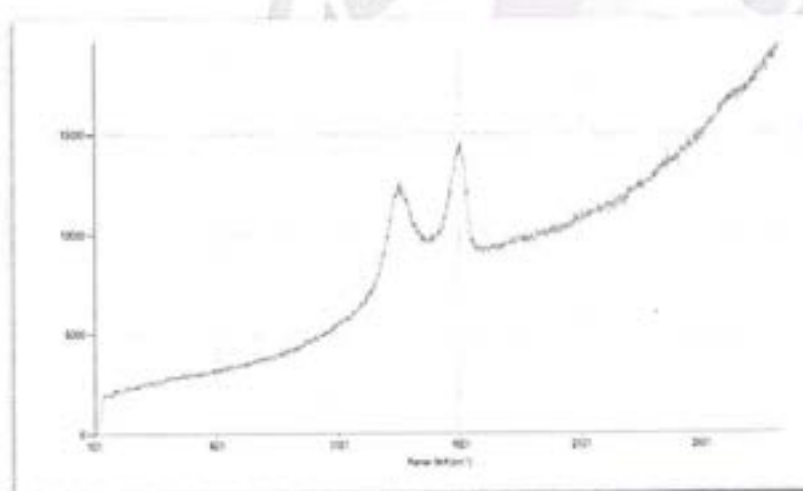
XRD SPECTRA:
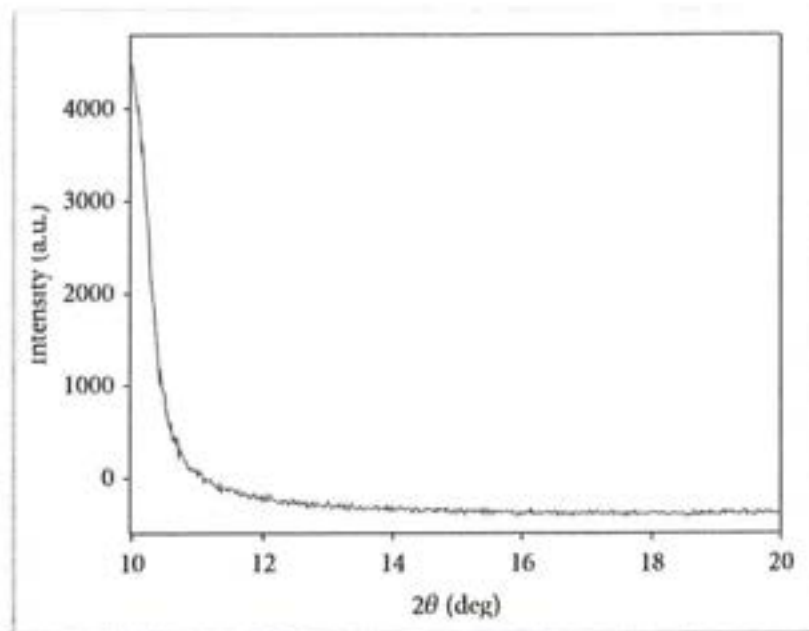
FT-IR SPECTRA:
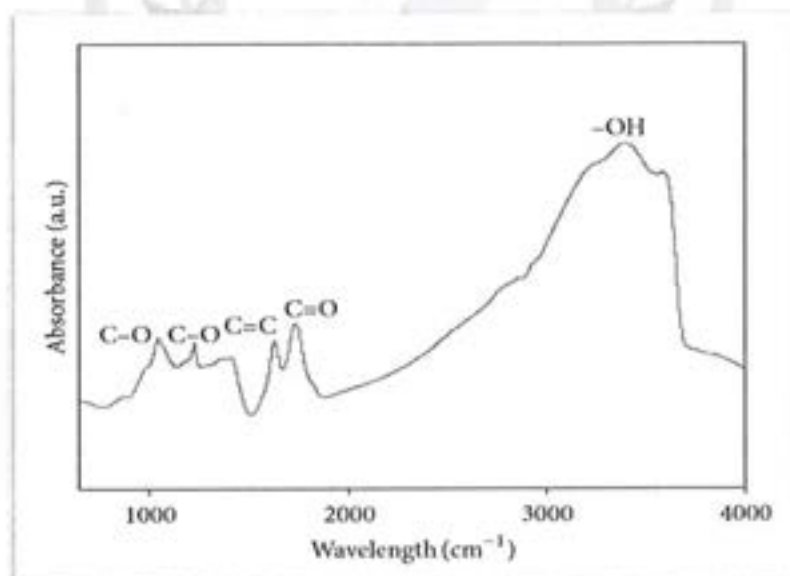
UV-VIS SPECTRA:
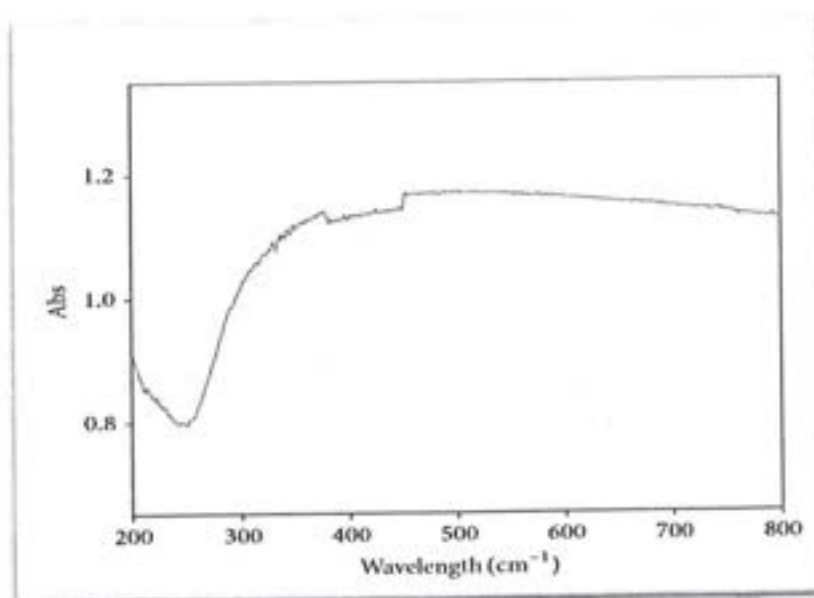
VARIABLE PARAMETERSS

VARIABLE PARAMETERS OF WASTEWATER:

PARAMETERS	SAMPLE1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5
Ph	5.5	5.8	6.3	7.3	8.2
ELECTRICAL CUNDUCTIVITY (mS/cm)	218.6	229.5	246.2	254.1	267.6
DO (mg/L)	3.1	3.5	4.3	4.1	5.3
BOD (mg/L)	2102	2275	2570	2650	2772
COD (mg/L)	2900	3412	3812	3902	4005
CALCIUM HARDNESS (mg/L)	15.5	12.2	10.5	8.4	7.2
MAGNESIUM HARDNESS (mg/L)	5.3	6.6	7.2	8.7	9.1
TOTAL HARDNESS (mg/L)	22.3	26.1	27.3	31.8	35.3
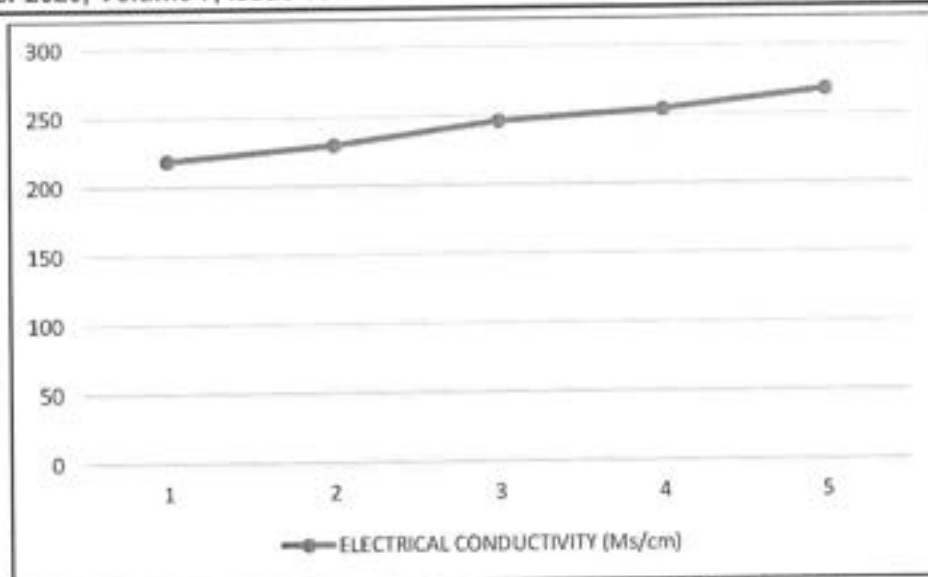
Figure1: ELECTICAL CONDUCTIVITY Vs SAMPLE
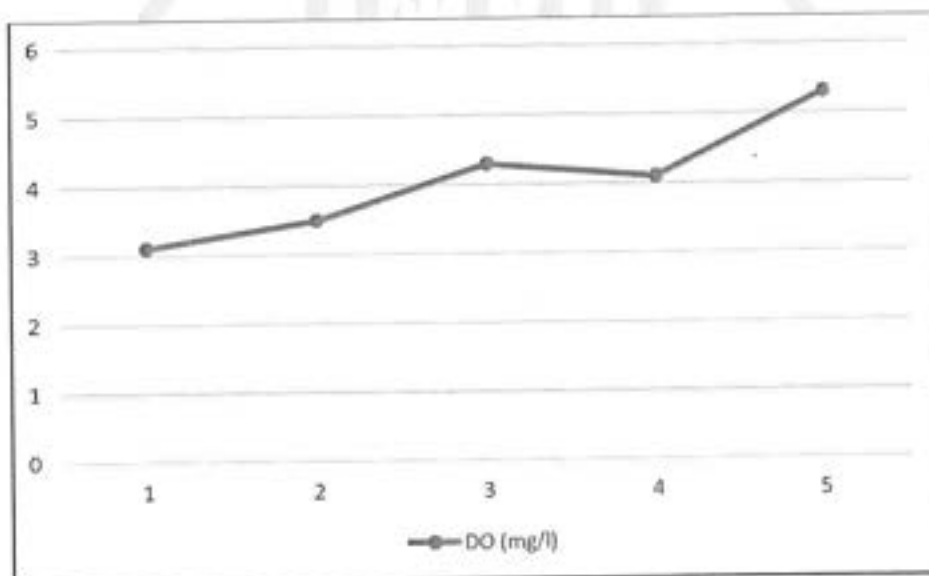
Figure2: DO Vs SAMPLE
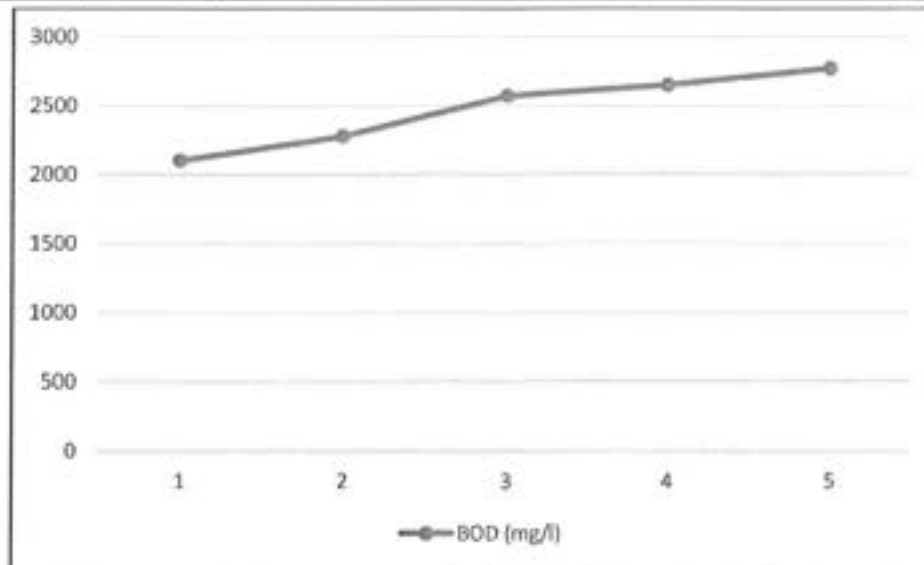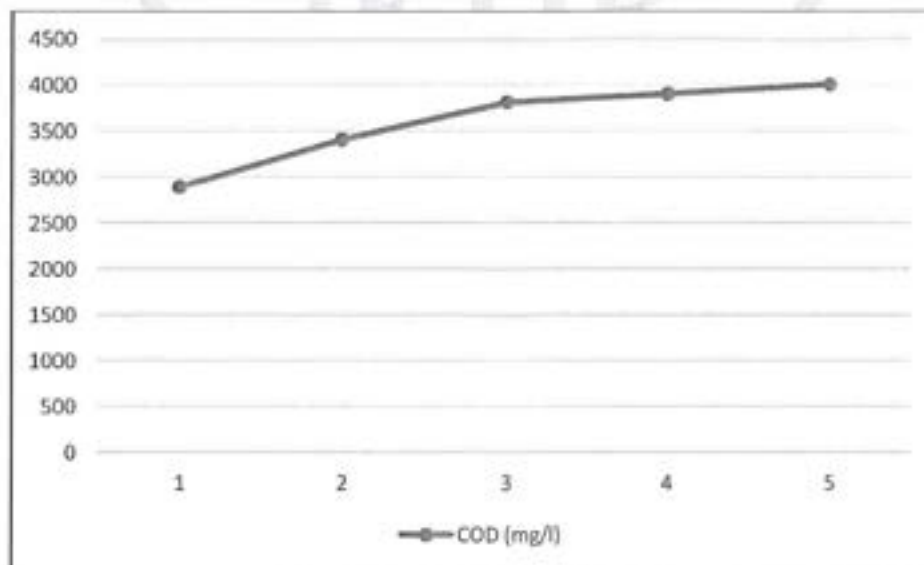
Figure3: BOD Vs SAMPLE

Figure4: COD Vs SAMPLE
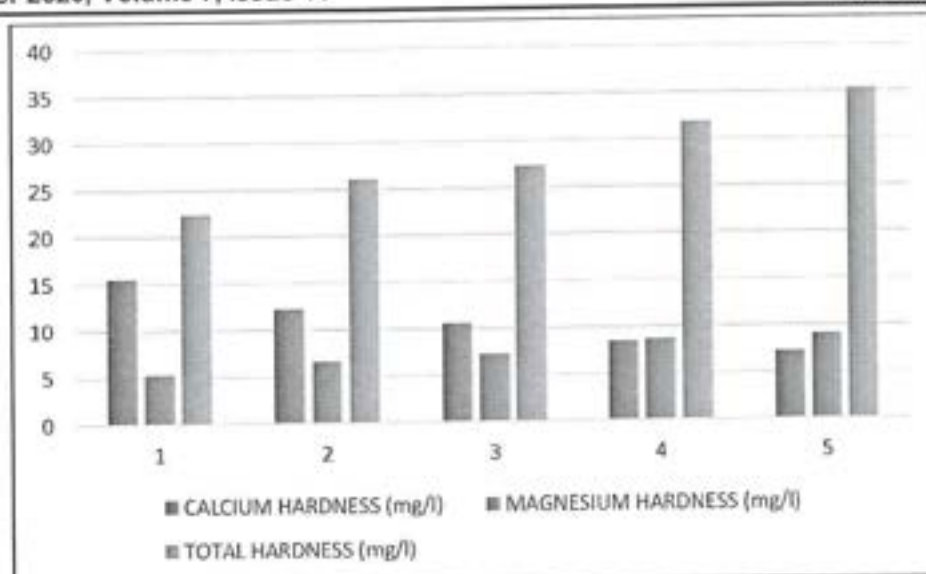
Figure5: HARDNESS Vs SAMPLE

VARIABLE PARAMETERS OF PURIFIED WATER USING GRAPHENE:

PARAMETERS	SAMPLE1	SAMPLE2	SAMPLE3	SAMPLE4	SAMPLE5
pH	7.4	7.2	8.0	8.3	10.1
ELECTRICAL CONDUCTIVITY (mS/cm)	150.2	162.8	168.0	179.2	193.0
DO (mg/L)	6.3	6.8	7.1	7.5	8.1
BOD (mg/L)	1750	1802	1882	1949	2005
COD (mg/L)	1734	2100	2312	2400	3210
CALCIUM HARDNESS (mg/L)	7.3	6.8	5.7	4.9	3.3
MAGNESIUM HARDNESS (mg/L)	1.8	2.3	3.4	4.8	5.2
TOTAL HARDNESS (mg/L)	9.3	8.7	7.4	6.5	5.1
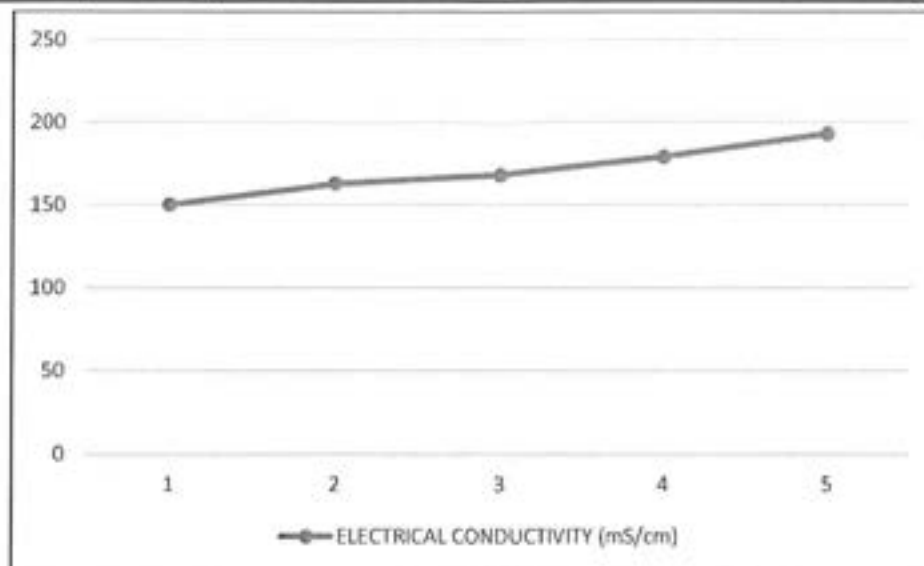
Figure6: ELECTRICAL CONDUCTIVITY Vs SAMPLE
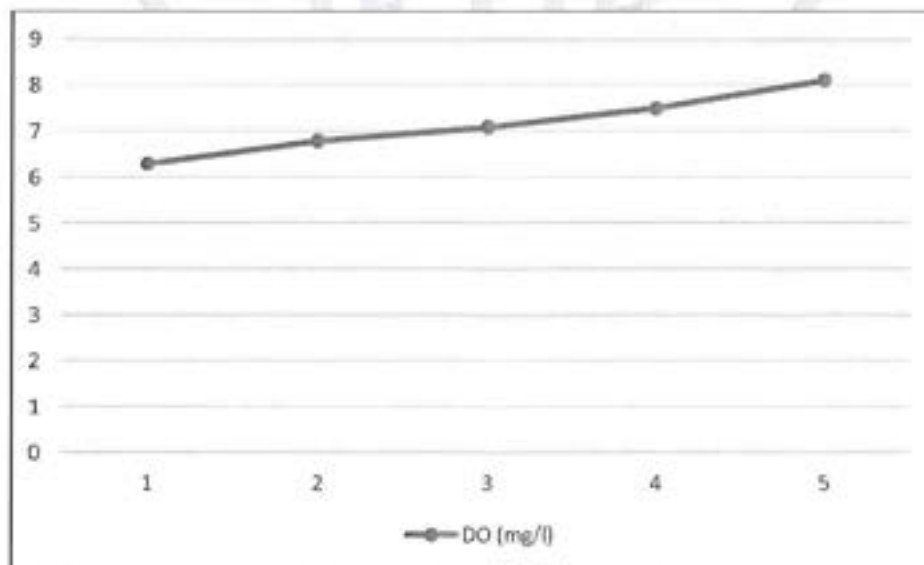
Figure7: DO Vs SAMPLE
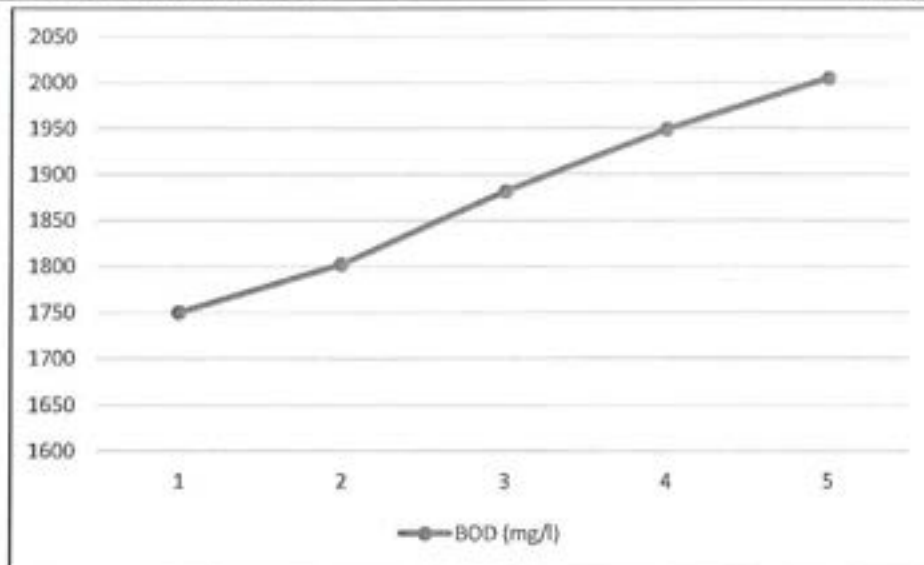
Figure8: BOD Vs SAMPLE
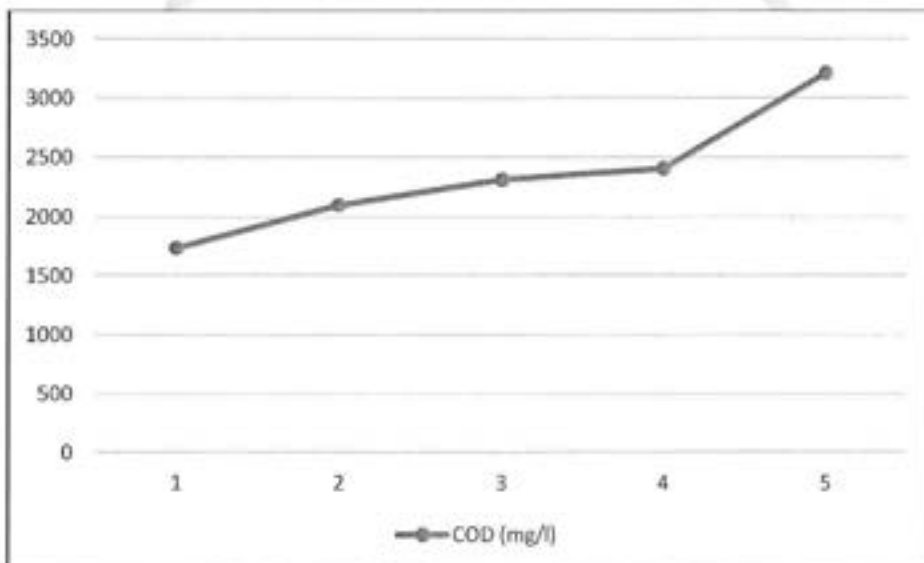
Figure9: COD Vs SAMPLE
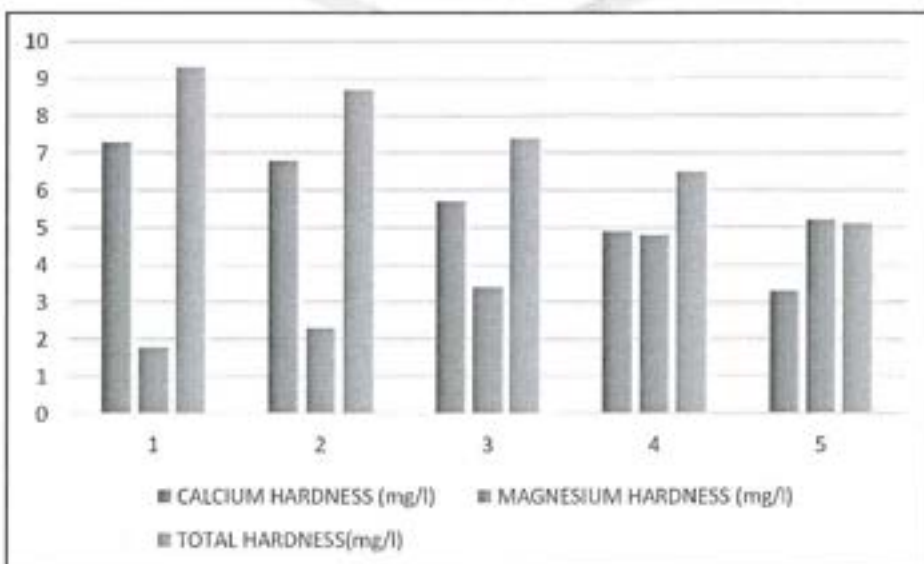
Figure10: HARDNESS Vs SAMPLE

From the above-mentioned data, we measured that the percentage of impurity in graphene based purified water is much lower than that of wastewater.

CONCLUSION

Water pollution and shortage of water is a major problem of the world. It is to be noted that 700 million people in the world do not have the access to clean water. The contaminated water that people were drinking gives rise to many diseases, which may lead to death. In this regard, Graphene has found to be a miracle in the field due to its peculiar structure of high permeable density. The studies discussed in this paper pointed out that Graphene-based water treatment process can be carried out in a much shorter time and at a much lower cost. These results are of importance for the environmental application of Graphene Oxide nanocomposites for the removal of inorganic and organic pollutants from larger volumes of aqueous solution and effluents. The presence of Oxygen- containing functional group and characterization peaks in XRD, AFM determined the preparation of Graphene Oxide sheets.

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Ethics in Research: Principles & Guidelines

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ABSTRACT

There are a number of ethical principles and guidelines that should be taken into account when performing undergraduate and master's level research. Research ethics educates and monitors scientists conducting research to ensure a high ethical standard. This article seeks to briefly review the various principles and guidelines of research ethics that exist on issues related to informed consent, confidentiality, providing incentives and various forms of research misconduct.

Keywords – Confidentiality, Consent, Ethics, Misconduct

1. INTRODUCTION

The ethics in research meaning that when a person or a research giving to start a research work from that time he/she should follow some rules and regulations to conduct the research work. The birth of modern research ethics start with a desire to protect human subjects involved in research projects. The first attempt to craft regulations during the Doctor's Trial of 1946-47 [1]-[3]. The following is a general summary of some ethical principles and guidelines.[4]-[6]

2. OBJECTIVE

This paper provides an outline of the main principles and guidelines that are the foundation for sound ethical practice in research.It is essential for researchers to gain an understanding of these principles and guidelines.

3. ETHICAL PRINCIPLES

Research ethics are based on three fundamental principles

1. Respect for Persons
This principle involve two elements that deal with respecting people in regard to research:

People should be treated as autonomous
The term autonomous means that a person can make his or her own decisions about what to do and what to agree to. Researchers must respect that individuals should make their own informed decisions about whether to participate in research. In order to treat people as autonomous, individuals must be provided with complete information about a study and decide on their own whether to enroll.

People with diminished autonomy should be protected

Some people in society may not have the capacity to make fully informed decisions about what they do or what happens to them. This could include young children, people who are very ill, or those with mental disabilities. In such cases, these people should be protected and only be included in research under specific circumstances, since they cannot make a true informed decision on their own.

2. Beneficence
The definition of beneficence is action that is done for the benefit of others. This principle states that research should:

Do no harm
The purpose of health research is to discover new information that would be helpful to society. The purpose of research should never be to hurt anyone or find out information at the expense of other people.

Maximize benefits for participants and minimize risks for participants

The purpose of much research involving humans is to show whether a drug is safe and effective. This means participants may be exposed to some harms or risks. Researchers are obligated to do their best to minimize those possible risks and to maximize the benefits for participants.

3. Justice

To This principle deals with the concept of fairness. Researchers designing trials should consider what is fair in terms of recruitment of participants and choice of location to conduct a trial. This encompasses issues related to who benefits from research and who bears the risks of research. It provides the framework for thinking about these decisions in ways that are fair and equitable. People who are included in research should not be included merely because they are a population that is easy to access, available, or perhaps vulnerable and less able to decline participating. An experimental strategy that is likely to be used by many types of people should be tested in the very populations of people who are likely to use it, to ensure that it is safe, effective, and acceptable for all of the potential users. For example, experimental treatments that are intended for use in the general population must be studied not only on men, but on enough women to ensure that they are also safe and effective for women. The principle of justice also indicates that questions being asked in trials should be of relevance to the communities participating in the study. People who are included in research should not be included merely because they are a population that is easy to access, available, or perhaps vulnerable and less able to decline participating. An experimental strategy that is likely to be used by many types of people should be tested in the very populations of people who are likely to use it, to ensure that it is safe, effective, and acceptable for all of the potential users. For example, experimental treatments that are intended for use in the general population must be studied not only on men, but on enough women to ensure that they are also safe and effective for women. The principle of justice also indicates that questions being asked in trials should be of relevance the communities participating in the study.

4. ETHICS GUIDELINE

Research ethics provide guidelines for the responsible conduct of the research. The 10 guidelines are as follows:

1. Research participants must voluntarily consent to research participation.
2. Research objects should contribute to the good of society.
3. Research must be based on sound theory and prior animal testing.
4. Research must avoid unnecessary physical and mental suffering.
5. No research projects can go forward where serious injury and/or death are potential outcomes.
6. The degree of risk taken with research participants cannot exceed anticipated benefits of results
7. Proper environment and protection for participants is compulsory.
8. Experiments can be conducted only by scientifically qualified persons.
9. Human subjects must be allowed to discontinue their participation at any time
10. Scientists must be prepared to terminate the experiment if there is cause to believe that continuation will be harmful or result in injury or death.

CONCLUSION

The recent increase in research activities has led to concerns regarding ethical and legal issues. Various principles and guidelines have been formulated by organizations and authorities, which serve as a guide to promote integrity, compliance and ethical standards in the conduct of research.

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ROLE OF FINANCIAL MARKET IN GLOBAL ECONOMY
(IN THE SPECIAL REFERENCE TO FOREIGN PORTFOLIO INFLOWS AND ECONOMIC GROWTH IN INDIA)

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ABSTRACT: This work paper aims to examine the effects of portfolio investments in India, which significantly impacting GDP and are being promoted in accordance with advanced financial markets. It is claimed that the key advantage of the FPI is that it gives rise to domestic stock prices. FPI and FDI will help to fill the investment gap in savings and provide the foreign exchange for growth and development. The change in Indian FPI policy led to a significant rise in international capital market investment. It revolutionized not just the country's capital market but its entire economy. The analysis focuses on FPI and FDI flows in India and the effect of FPI in particular on some economic indicators in India.

KEYWORDS: Foreign Portfolio Investment (FPI), Foreign Direct Investment (FDI), Gross Domestic Product (GDP), Economic Indicators, Financial Services, Foreign Market.

I. INTRODUCTION

Those who engage and trade on financial markets in any way affect economic and social life. The paper demonstrates how financial market existence and exchange can affect the money supply and conduct of individuals, corporations, and later on the entire economic and social life particular in FPI investment in India and its impact on our GDP. The author uses international financial data such as: Eurostat, central banks, international monetary fund, World Bank, BMI Analysis, domestic finance and/or economy website.

Investors are given the opportunity to specialization, diversification of risks or in particular, both in markets or services, on the financial markets, such as those which trade stocks or bonds, instruments (from bank CDs to future products and derivatives) and institutions (from insure companies to mutual funds or pension funds). As Demirgüç-Kunt and Levine have pointed out, together with the financial markets and financial institutions, the relative mix of the two does not appear to contribute to economic growth.

Financial markets help control the flow of savings and investment into the economy effectively in ways that promote capital accumulation and the production of goods and services. The combination of well-developed financial and capitalistic markets and a wide range of financial products and instruments meets the needs of lenders and therefore of the economy in general.

Big stock markets with a lot of business activity offer market players more liquidity than smaller markets with little securities and investors available and therefore fewer trading opportunities. The US financial system is widely known as the most advanced in the world. Daily transactions on the financial markets — both assets for a short period of one year or less and resources for a year or more — are massive. Many financial assets are liquid; others have secondary markets that permit the cost-effective transfer of existing assets.

Financial markets play a crucial role in raising capital and manufacturing goods and services. Credit prices and investment rates send a signal to producers and consumers — financial sector participants. These signals contribute to direct financing for clients, corporations, governments and investors (from savers, especially families and firms), who want to rent money by connecting those who value money most willingly (for instance, those who are willing to pay higher prices or interest rates). Similarly, the international flow of funds among countries is promoted by strong financial markets and institutions.

In addition, competitive capital markets and banks are aimed at minimizing search and transaction economic costs. A well-developed financial system offers customers a wide variety of financial products, with varying risks and prices and maturities, allowing borrowers and lenders to respond closely to their needs. Individuals, companies and governments needing funding can find out quickly which financial institutions or which capital markets are financing and what the borrower is paying for. This helps investors to balance their expected investment returns by selecting the most appropriate investment for their needs. This makes it possible to direct the credit allocation of financial markets across the economy and to promote the production of goods and services.

II. LITERATURE REVIEW

The link between financial market growth and competitiveness began to be one of the key issues as the development of financial markets is one of the global index of competitiveness. The effect of financial market development on economic growth is a good predictor of competition in most of the previous studies. The cornerstones of global competition are highly inspired by endogenous growth theories. The following two channels can also result in economic growth: technological advancement or improved quality of output; output growth factors. In general, economic growth was linked to a number of economic variables ranging from two levels: first, micro-level such as productivity of production factors and, second, macro-levels such as macroeconomic resource availability to development. This means that the recognition of sources of economic growth is the key to stimulating economic activity and to help it with structural changes (Wolde-Rufael, 2009).

As technological advancement and growth factors were seen, economic theory was not explicitly applicable to development on the financial markets (Christopoulos and Tsionas, 2004). The architecture of endogenous growth models has changed and shows that research and development investments, physical capital and human capital are the main determinants of economic growth (Beck, Demirgüç-Kunt & Levine, 2000). In other words, growth is a positive function of the investment ratio. It says that economic growth would rely on policy initiatives to foster transparency, competition and innovation in the long term (Aghion & Howitt, 1998).

Levine stressed to consider the importance for economic development of the financial sector. Hicks (1969) argues that England's financial system was essential to the industrial revolution. Schumpeter (1911) points out that an effective financial system promotes technical advances, which inevitably leads to economic development, by improving finance for entrepreneurs. Subsequent research support studies indicate the positive link between the stability of the financial system and current and potential economic growth, accumulation of physical resources and productivity. On the contrary, the explanations for that are Kuznets (1955), Friedman and Schwartz (2008), which is the financial system formed as a result of economic development.

Research shows that economic growth is catalyzed by local financial activities, Markets primarily by enhancing resident companies' access to and cost of capital (Levine & Renelt 1992; Asiedu 2002). For a global company, successful transactions, distribution and repatriation of financial capital are the key functions of the local financial system in terms of operational considerations. Only in well-functioning and effectively regulated capital markets can these functions be accomplished (Ito 1999; Lee & Chang 2009). Furthermore, due to the high risk of market failures, multinationals tend to reduce their offshore financial obligations in developing countries by adopting a variety of portfolio management policies, particularly with their host capital market listings (Froot & Stein 1991).

Research also shows that developed local financial markets can stimulate economic growth by improving the effective allocation of resources (Rousseau & Wachtel 2000). Healthy local financial markets in particular allow investors to easily and cheaply re-balance their portfolios (Bencivenga, Smith & Starr 1996). As the growth of the stock market mobilizes investment capital, portfolio risks are also minimized. In this regard, empirical evidence indicates that a financial market with its development threshold will catalyze home-grown entrepreneurial progress, stimulate innovation and attract foreign direct investment inflows, all of which lead to economic growth (Levine & Zervos 1998; Rajan & Zingales 2003; Antràs, Desai & Foley 2008).

Although a number (Naceur, Ghazouani & Omran 2007); advanced economics (Atje & Jovanovic 1993; Rajan & Zingales 2003) as also Africa (Alfaro et al.) has been investigated in relation to the role of the local financial market in economic growth in emerging economies.

2004, Adam & Tweneboah 2009; Adjasi, Abor, Osei & Nyavor-Foli 2009), which varies in methodology and emphasis from previous study. In particular, the recorded studies covering Africa have generally overlooked the effects of resource endowment and have either been country-specific or placed within a single region. Furthermore, none of the studies Geographical comparisons were included in their estimates. This analysis contains some reported academic deficiencies.

Levine (2004) shows that countries with stronger banks and financial markets are developing more rapidly and thus becoming competitive. Hartmann, Heider, Papaioannou, Duca, and Marco (2007) explain that there are a variety of ways of improving the financial market conditions in Europe to improve the financial system's contribution to innovation, efficiency, growth and thus competitiveness. Classens (2009) reviewed several

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earlier studies and concluded that new regulatory and competition policy problems arise as the Financial Services Sector evolves and as financial markets and goods become more competitive and global. Approaches to competitive challenges also need to be updated, as competition policy is frequently outdated in the financial sector. Wurgler (2000) clarified that developed financial markets have a greater capital distribution in comparison with poor financial markets, financially developed countries are rising and growing investments in emerging industries. Therefore, the key gain of financially developed countries is the increased distribution of capital to productive investment ventures beyond the higher investment levels.

Gray and Blejer (2006) show that in comparison with other Arab countries, the GCC countries have established financial markets as a function of a greater wealth, apart from policies for enhancing economic diversification and thus increasing competitiveness.

Trade openness is of importance to competition for Yokoi-Aria and Yoshino (2006), but such large financial market opening for foreign firms could result in the absolute domination of foreign companies, which could lead to a reverse response within the host nation. It is necessary to strike a balance between opening up markets and growing competition with a propensity towards capital markets.

While previous economists generally agreed that the relationship between economic and financial development was positive, other studies have a different perspective. The relationship between financial development and economic growth is very small after Favara's empirical study (2003). Giovannini, Iacopetta and Minetti (2013), on the other hand, reveal that, in developing countries, the static loss of GDP is a slow-moving development in addition to rapid absorption of overseas technologies. In addition, apparent capital market growth produces a more volatile economic environment and more serious financial crises effects. Arcand, Berkes and Panizza (2012) had a negative relationship between finance and growth under certain conditions. Ruiz (2018) found that financial development has a negative impact on economic growth if the financial development is below the threshold. This study thus analyses this relationship in the sense of competitiveness in developing and higher income countries.

III. FINANCIAL MARKET RECENT TRENDS

The liberalization of financial markets in the 1990s and 2000s has played a significant role in the global crisis of 2007/2008. However, we can ignore the significant contribution to economic growth of the financial markets. In developing countries, investment is expensive, including foreign direct investment (FDI). Well-developed capital markets can help finance these investments.

Financial markets need depth, access, efficiency and stability to do this (World Bank 2016c). "Depth" means ample scale for financial institutions and capital markets. 'Access' represents the extent to which financial services are used by economic agents. 'Quality' means that financial institutions are able to manage and promote transactions effectively. Finally, 'stability' refers to low uncertainty in the market and low financial fragility.

According to these requirements, financial markets in different countries have different levels of growth. Figure 1 shows the average rates of a composite measure to capture each country's financial system scope, access, efficiency and stability (Donaubauer et al. 2016a from Beck and Demirgüç-Kunt 2009 and World Bank database, Donaubauer et al. 2016).

Figure 1 Composite indicator of financial market development
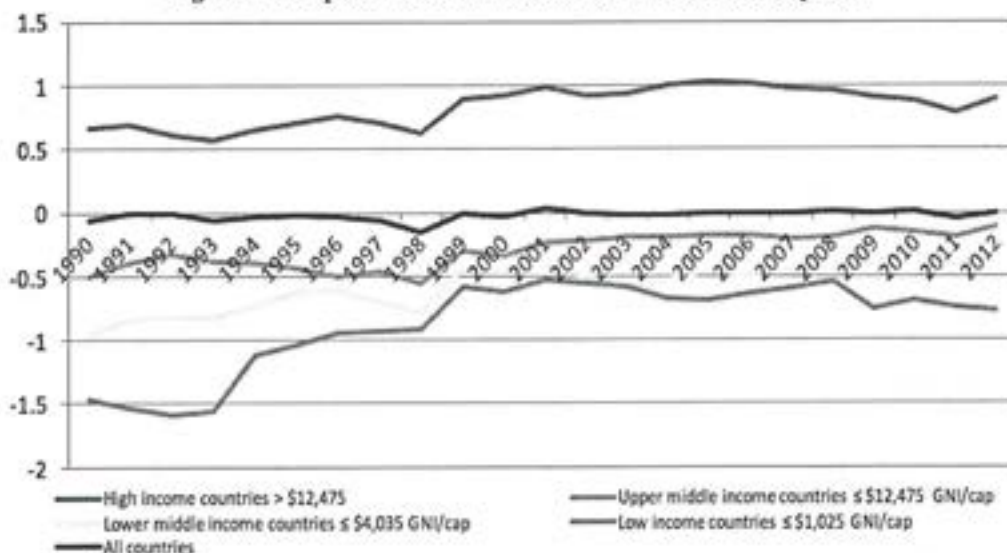
Note: countries Classifications according to World Bank (2016). Source: Donaubauer et al. (2016b).

Not unexpectedly, countries with high income have the most advanced financial structures. They changed on average until 2005 and then only marginally declined. The least established financial systems are applicable to low-income countries. Average financial market development for this community improved in the 1990s (which may represent a small number of observed countries during this period), but decreased after the financial crisis.

Economic prosperity relies on local finances, but not on the local financial system alone. Companies from one country may draw on another through FDI, through joint ventures or through complete foreign ownership. The financial markets of a parent's high-income country may in particular be abused by affiliates of multinationals (MNEs) in developing countries. In principle, MNE affiliates are less likely to be lending limited, use firms' internal funds more efficiently, make less use of external funds and are less dependent on local financial institutions (Görg and Kersting 2016). We would therefore expect improved financial development levels in the host country to enhance the use of finance from sources outside the business, particularly for domestic companies than for foreign companies.

Both effects have been shown by recent empirical studies: companies in developed countries have benefited from changes to domestic financial markets and MNE affiliates are less dependent on such changes. Görg and Kersting (2016) compare foreign-owned firms' activities in emerging and developed countries with the actions of the control group of local-owned firms through a tendency matching approach. Donaubauer et al. (2016b) analyses the effects of financial market changes on the gravitational distribution of FDI stocks. We understand that from these two studies:

• Promoting bilateral foreign direct investment through well-developed financial markets in either source or host countries (Gorg and Kersting 2016, Donaubauer et al. 2016b). Better access to foreign funds in the source country enables FDI financing. Well-developed financial markets in the host country may also contribute directly to FDI by currency risk clothing and indirectly by facilitating the financial interactions of the international business in the host country.

• Well-developed financial markets in source countries balance poorly developed financial structures by creating FDI flows in host countries. In comparison, the positive impact on the host country of a better developed financial market decreases, given that the host country already provides a favourable financial climate (Donaubauer et al. 2016b).

• MNE businesses are less hampered by lack of funding. They use bank loans less than solely domestic businesses. Companies newly integrated into the MNE slash bank loan funding in contrast with domestic financing (Görg and Kersting 2016).

• In principle, as the state of the local financial system improves, financing from sources external to businesses becomes more important than corporate finance. This change is more beneficial to domestic companies than to MNE affiliates that needed fewer outside support (Gortg and Kersting, 2016).

IV. RESEARCH METHODOLOGY

Indicators used in the Study and Analysis Result Some significant indicators have been selected to examine the effect of financial markets on economic life in countries. On the basis of the available data and the purpose of the study, it was also suggested that GDP was taken was taken into account (which only represent economic performance and changes to it after an economic trend or pattern has already been developed). The study used databases such as: Eurostat, central banks, IMF, World Bank, BMI Analysis, national finance and/or economy ministry websites. Analysis took into account countries all over the world, developed countries or their emerging economies. It aimed to show that financial markets are supporting economies, savings and economic development.

The Interdependence between Investments and Economic Growth

The above figures of this paper shows that the world's largest capital markets are in the most industrialized countries. Figures 1 showed the share of gross domestic product foreign investment and economic growth. The research has found that the volume of foreign direct investments is high for countries with active capital markets and an ancient history in the field (the United Kingdom, the USA, France and Germany). The study showed that, in recent years, investment volume has also increased in countries in which it is an active young financial market (such as india). On the other hand, in countries with underdeveloped and very young capital markets, both internationally and domestically, direct investment volumes are poor.
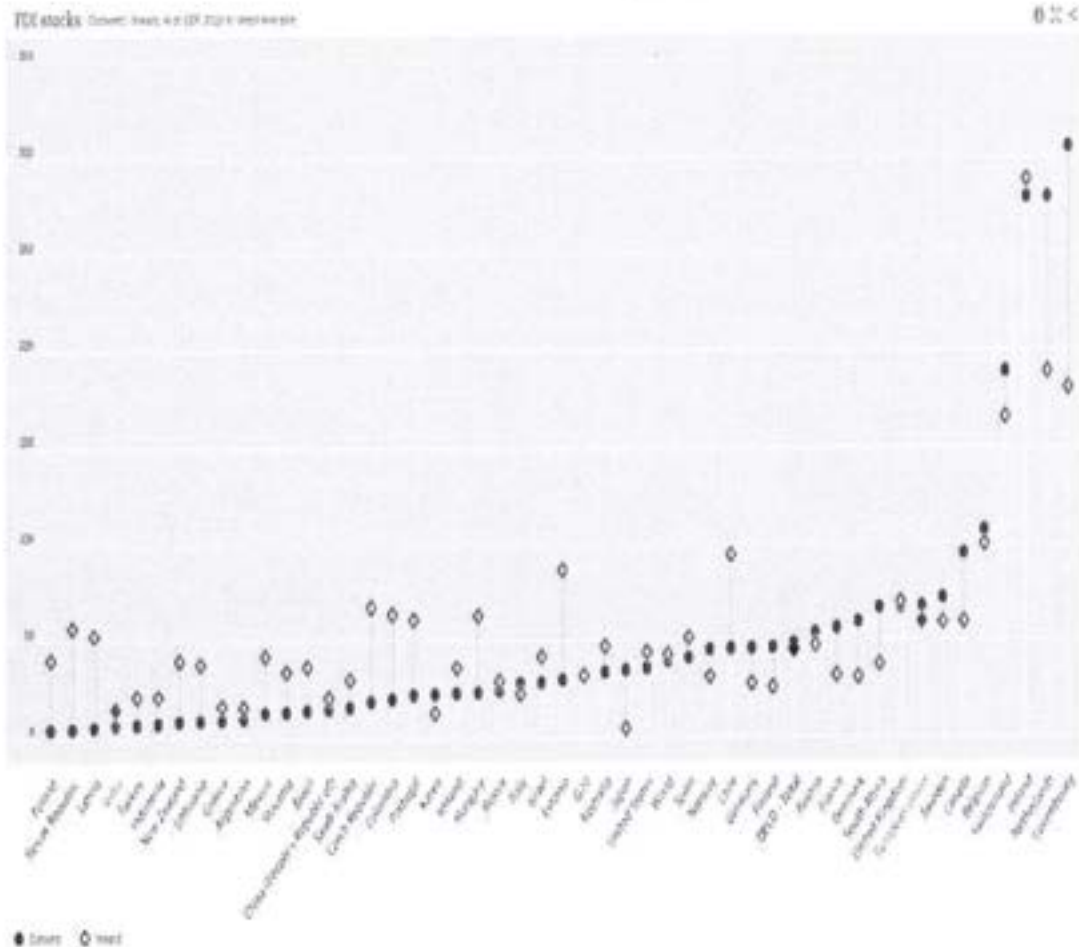
In foreign direct investment, it can be seen that most investments made in recent years have been made in developing countries with underdeveloped economies but economic potential. Bulgaria, Hungary, Poland and Spain are involved. With respect to equity assets, it can be assumed that they predominantly reflect investment in stocks and bonds. With respect to portfolio investment flows, which relate to the flow of debt protection and non-resident equity investment into the economy, it can be assumed that the biggest investments are made in the US, which in essence is the world's largest financial sector, NYSE.

Below have been given the data of FPI Net Investment (India) and its relation with GDP impact since 1992 to 2020 (up to Sept.)

FPI Net Investment (India)

Financial Year	INR crores				
	Equity	Debt	Debt-VRR	Hybrid	Total
1992-93	13	0	0	0	13
1993-94	5127	0	0	0	5127
1994-95	4796	0	0	0	4796
1995-96	6942	0	0	0	6942
1996-97	8546	29	0	0	8575
1997-98	5267	691	0	0	5958
1998-99	-717	-867	0	0	-1584
1999-00	9670	453	0	0	10122
2000-01	10207	-273	0	0	9933
2001-02	8072	690	0	0	8763
2002-03	2527	162	0	0	2689
2003-04	39960	5805	0	0	45765
2004-05	44123	1759	0	0	45881
2005-06	48801	-7334	0	0	41467
2006-07	25236	5605	0	0	30840

2007-08	53404	12775	0	0	66179
2008-09	-47706	1895	0	0	-45811
2009-10	110221	32438	0	0	142658
2010-11	110121	36317	0	0	146438
2011-12	43738	49988	0	0	93726
2012-13	140033	28334	0	0	168367
2013-14	79709	-28060	0	0	51649
2014-15	111333	166127	0	0	277461
2015-16	-14172	-4004	0	0	-18176
2016-17	55703	-7292	0	0	48411
2017-18	25635	119036	0	11	144682
2018-19	-88	-42357	0	3515	-38930
2019-20	6153	-48710	7331	7698	-27528
2020-21 **	83484	-42986	9718	8349	58565
Total	976138	280221	17049	19573	1292978

https://www.fpi.nsdl.co.in/web/Reports/Yearwise.aspx?RptType=5

Historically, since the early 1990s, there has been a sea of transition in India's approach to foreign investment. Pre-liberalization FDI was only permitted by international cooperation in particular high-tech sectors. There was a big change after 1991, which gradually eliminated constraints in low-tech regions. Reform action has gradually

gained traction in the last decade, as is apparent from the ever-increasing volumes of FDI inflows in India.

India GDP Growth Rate - Historical Data		
Year	GDP Growth (%)	Annual Change
2019	5.02%	-1.10%
2018	6.12%	-0.92%
2017	7.04%	-1.21%
2016	8.26%	0.26%
2015	8.00%	0.59%
2014	7.41%	1.02%
2013	6.39%	0.93%
2012	5.46%	0.22%
2011	5.24%	-3.26%
2010	8.50%	0.64%
2009	7.86%	4.78%
2008	3.09%	-4.57%
2007	7.66%	-0.40%
2006	8.06%	0.14%

2005	7.92%	0.00%
2004	7.92%	0.06%
2003	7.86%	4.06%
2002	3.80%	-1.02%
2001	4.82%	0.98%
2000	3.84%	-5.00%
1999	8.85%	2.66%
1998	6.18%	2.13%
1997	4.05%	-3.50%
1996	7.55%	-0.02%
1995	7.57%	0.92%
1994	6.66%	1.91%
1993	4.75%	-0.73%
1992	5.48%	4.43%

https://www.macrotrends.net/countries/IND/india/gdp-growth-rate

V. CONCLUSION

The step by India toward FPI, which forms part of liberalization, is mainly a drive towards economic development. Whatever the expectations and fears of the FPI, FPI has remained in the Indian economy. Especially in the age of liberalization, a return is neither necessary nor feasible. Similarly, regulatory interventions alone cannot guard against FPI volatility. The country can do so by focusing on export trade activities to combat possible and possibly large-scale withdrawals of FPIs. Above all, it is also important to grow the economy and thus make foreign Portfolio investment attractive for the market and enable it to stick to the Indian economy.

The research has concluded that there is also financial and fiscal stability in countries where an active and established financial market exists with a huge volume of transactions. Unemployment is lower and investors' trust is higher. A very active financial market can also enable governments to maintain sustainable payments and/or to speed up production capacity growth and to increase and sustain a degree of social stability

Economic development calls for balanced growth, which simultaneously implies growth in all sectors. The primary, secondary and tertiary sectors are in need of sufficient growth funds. The national financial system has been structured by the authorities to allocate the funds available to all sectors to ensure balance of development in manufacturing, agriculture and service sectors.

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Research Article

EFFECT OF ORGANIC PRODUCTS (ORGANIC FERTILIZERS, PESTICIDES AND GROWTH PROMOTERS) ON FERTILITY, YIELD AND QUALITY OF CICERARIENTINUM L (CHICKPEA)

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ABSTRACT

In the current scenario, sustainability of agriculture has become a major issue of global concern as the intensive use of chemical inputs show adverse impact on the environment, soil fertility and human health. The productivity of a plant sustainably can be enhanced by adoption of different crop production strategies such as by growing leguminous crops in rotation, intercropping, mixed cropping or use of biofertilizers e.g. *Rhizobium* and organic fertilizers. The current study aims to study the effect of organic products and chemical fertilizers on yield and quality of Chickpea (*Cicer arientinum* L.). The present study was carried out during 2019-2020, in the botanical garden of our college where the *Cicer arientinum* L. seeds were sown under different organic and chemical fertilizer treatment. The chickpea plants were examined for their growth parameters, nodule formation, yield and nutrient quality (Protein) after every 30, 60, 90 and 120 days after sowing in the laboratory.

The results showed that maximum attribute in growth parameters, nodule formation, yield and chemical analysis was recorded in chickpea treated with vermicompost+FS Super rather than any other treatment and was least in control. The results significantly proved the importance of organic farming practices in increasing plant productivity sustainably.

INTRODUCTION

Chickpea (*Cicer arientinum* L.) belonging to Leguminoceae family is commonly known as Bengal gram or chana, is an annual rabi crop and is the third most important pulse crop after dry beans and dry peas. It's per unit productivity can be enhanced by adoption of different crop production strategies such as by growing leguminous crops in rotation, intercropping, mixed cropping, use of biofertilizers like *Rhizobium* which can go a long way for sustainable crop production (Verma *et al*, 2013). In the current scenario, sustainability of agriculture has become a major issue of global concern as the intensive use of chemical inputs show adverse impact on the environment and the soil fertility (Laranjo *et al*, 2014). The ripened seeds of chickpea are consumed in the form of processed foods which are boiled, roasted, fried, steamed, and sprouted. It is also used as a dal or as flour. It is used in preparing snacks, sweets and condiments. Fresh green seeds are also consumed as green vegetable. It is an excellent source of protein (18-22%), carbohydrates (52-70%), fat (4-10%), minerals (calcium, phosphorus, iron etc.) and vitamins (Prasad,

2012). Leguminous crops are capable of fixing atmospheric nitrogen with the help of *Rhizobium* bacteria residing in the root nodules. Under favorable conditions, the symbiotic N_2 fixation can be as high as 176 kg N/ha and meets up to 85% of N requirements in legumes (Das *et al*, 2013) which leads to better root development and improves nutrient availability and significantly increases the plant height, pods/plant and grain yield, leghaemoglobin and chlorophyll content (Moinuddin *et al*, 2014). As fertilizers are expensive inputs, so determination of an appropriate dosage of organic fertilizer application, which would be both economical and appropriate to enhance productivity and consequently profit of the grower under given situation, needs an intensive study. Keeping the above facts in mind, the present research study was undertaken with the objectives to assess the comparative effect of different organic and inorganic fertilizers on growth and yield of chickpea. The comparative result in all the growth stages under the experimental conditions were studied and computed by correlation analysis.

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MATERIALS AND METHODS

The experiment was conducted from October 2019 to March 2020 in the botanical garden of Kanoria P. G.Mahila Mahavidyalaya, Jaipur, Rajasthan by sowing 50 *Cicer* seeds in specific plot rows so that the other soil flora or fauna do not hinder or disturb the experiment. The experiment set up consisted of control (without any organic or inorganic input), organic experimental unit (cow dung+*Trichoderma*, vermicompost+FS Super, Natural Sustainable Decomposing Liquid (NS-DL)+FS Power) and the third experimental unit with chemical fertilizer - urea. FS Power, FS Super, NSDL and *Trichoderma* are all organic products of Morarka Foundation. The five treatments namely C0 (control); C1, C2 and C3 (organic fertilizers) and C4 (chemical fertilizer) were applied. The control, C0 was grown in natural condition without any organic or chemical fertilizer application. The organic C1 involved treating the chickpea with cow dung and *Trichoderma*, the organic C2 involved treating the chickpea with NS-DL and FS Power and the organic C3 involved treating the chickpea with vermicompost and FS Super. The chemical unit C4 involved the application of commercial chemical fertilizers - urea. The chickpea plants were watered properly and weed control was also done manually from time to time. The chickpea seedlings and plants in all the three experimental units were measured for growth parameters (plant height, number of branches, root length, number of leaves, fresh weight, dry weight, number of nodules), yield parameters (number of pods and grain) and bio-chemical analysis of chlorophyll and protein after 30, 60, 90 and 120 DAS (Days After Sowing). Five representative plants from each plot were selected randomly for measurement of growth, yield and quality parameters and then the average was calculated on per plant basis. The chlorophyll content was estimated by the method given by Witham *et al*, 1971 and protein content was quantified by Lowry's method (Lowry *et al*, 1951). Finally, the comparative result in all the growth stages under the various experimental conditions was studied and computed by statistical analysis of coefficient of correlation.

RESULTS AND DISCUSSION

Growth parameters

Shoot length/plant

The periodic plant height was found to be accelerated maximum with the application of cow dung+*Trichoderma* followed by NS-DL+FS Power, vermicompost+FS Super, urea and least in control at 30 DAS. The application of urea increased plant height by 30.9%, from 30 DAS as compared to other organic treatments (at 60 DAS). These results are in line with the findings of Amany, 2007 and Caliskan *et al.*, 2008.

While, the growth was steady and exponential in all the treatments (cowdung+*Trichoderma*, NS-DL+FS Power and vermicompost+FS Super) and control till 120 DAS, after which it was stabilized and no more further growth was observed. The maximum plant height was measured in chickpea treated with cowdung+*Trichoderma*, followed by NS-DL+FS Power, vermicompost+FS Super, urea and least in control at 30, 60, 90 and 120 DAS (Figure-1). These results are in also in agreement with the findings of other researchers (Vadiraj *et al.*, 1992; Jat

and Ahlawat, 2002; Gajalakshmi and Abbasi, 2002; Sundharaiya *et al.*, 2003 and Sinha *et al.*, 2010).

Figure-1: Shoot length/plant

Figure-2: Root length/plant
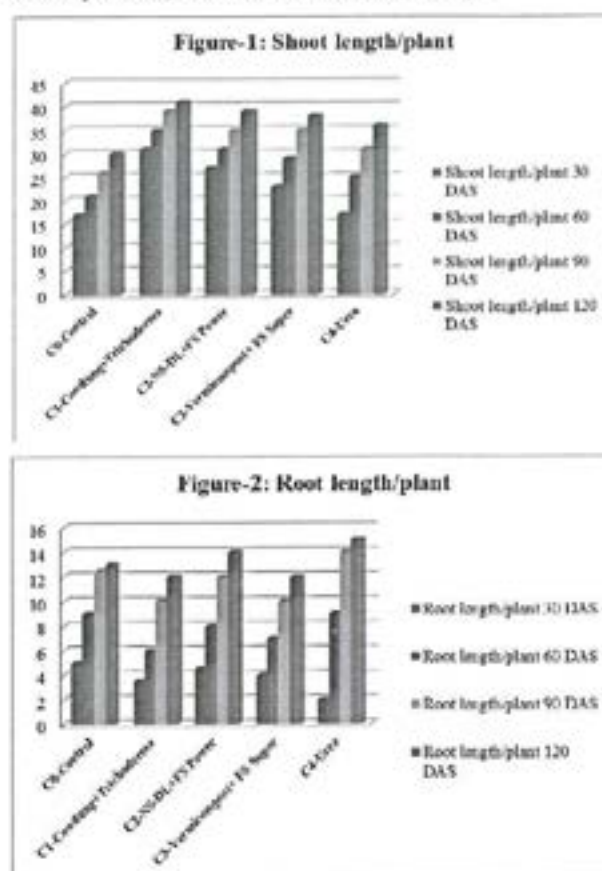
Effect on root length/plant of chickpea

The periodic root length was the maximum in control, followed by the application of NS-DL+FS Power, vermicompost+FS Super, cowdung+*Trichoderma* and least in urea at 30 DAS. The application of urea increased root length more than 50% from 30 DAS as compared to other organic treatments (at 60 DAS). These results are in line with the findings of Amany, 2007 and Caliskan*et al*, 2008. While, the growth was steady and exponential in all the treatments (NS-DL+FS Power, cowdung+*Trichoderma*, vermicompost+FS Super) and control till 120 DAS, after which it was stabilized and no more further growth was observed. At 60 DAS the maximum root length was measured in chickpea treated with urea and control. At 90 DAS the maximum root length was measured in chickpea treated with urea. At 120 DAS the maximum root length was measured in chickpea treated with urea, followed by NS-DL+FS Power, control and least in both vermicompost+FS Super and cowdung+*Trichoderma* (Figure-2). The roots showed an increase in the secondary branches as have been observed in both cowdung and vermicompost treated plants of chickpea. Such dense secondary branches are absent in the plants treated with NS-DL+FS Power, urea and the control. The increase in secondary branches show a much higher number of *Rhizobium sp.* root nodules than any other applications. These results are in agreement with the findings of other researchers (Mckenzie and Hill, 1995; Yasari and Patwardhan, 2006; Ali *et al*, 2010; Namvar *et al*, 2011).

Number of branches/plant

At all the periods of observations, application of urea and vermicompost+FS Super recorded significantly higher number of branches/plant than the application of NS-DL+FS Power and cowdung+*Trichoderma* and least in unfertilized control (Figure-3). For organic fertilizer application the results are in agreement with the work of Vadiraj *et al*, 1992; Jat and Ahlawat, 2002;Gajalakshmi and Abbasi, 2002; Sundharaiya *et al*, 2003; Sinha *et al*, 2010. These results are in agreement with those of Das *et al*, 2013; Amany, 2007 and Caliskan *et al*, 2008 in chickpea and soyabean.

Number of leaves/plant

Number of leaves/plant is also an essential parameter. As the number of leaves increases, the amount of chlorophyll would also be more, which leads to a higher rate of photosynthesis and hence the growth of the plant would be more. It was observed that at all the periods of observations (30, 60, 90, 120 DAS) application of vermicompost+FS Super recorded significantly higher number of leaves/plant followed by the application of urea, cowdung+*Trichoderma* and NS-DL+FS Power and least in unfertilized control (Figure-4). These results are in agreement with those of Amany, 2007; Caliskan *et al*, 2008; Namvar *et al*, 2011; Das *et al*, 2013 in chickpea. The vermicompost application results were similar to those of Vadiraj *et al*, 1992; Gajalakshmi and Abbasi, 2002; Jat and Ahlawat, 2002; Sundharaiya *et al*, 2003) andSinha *et al*, 2010.

Figure-3: Branches/plant
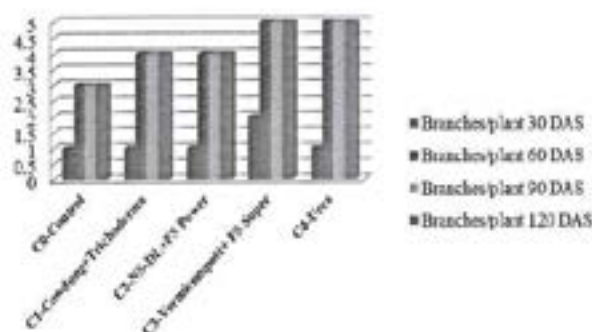
Figure-4: Number of leaves/plant
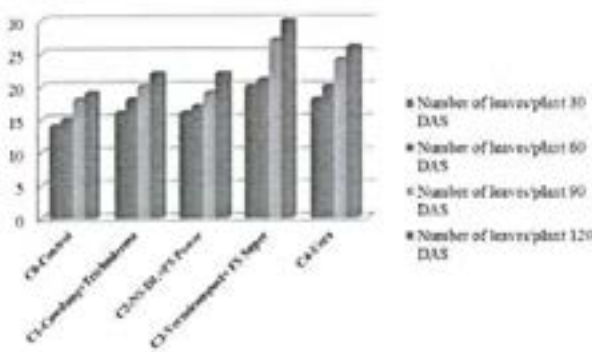
Fresh weight/plant

At 30 DAS, the maximum fresh weight was of NS-DL+FS Power treatment followed by cowdung+*Trichoderma*, vermicompost+FS Super, control and least in urea treatment. While, in the later growth stages at 60, 90 and 120 DAS

vermicompost+FS Super treatment showed the maximum fresh weight which was found to be significantly higher than the treatments of NS-DL+FS Power followed by cowdung+*Trichoderma*, urea and least in the control (Figure-5). Higher plant height (Figure-1), number of branches (Figure-3) and number of leaves (Figure-4) were also observed in these treatments which may also be the possible reason for increased fresh weight. These results are in correlation with the findings of Namvar *et al*, 2011 in chickpea; Gajalakshmi and Abbasi, 2002; Sundharaiya *et al*, 2003 and Eifediyi and Remison, 2010.

Dry weight/plant

Increase in the dry matter has been observed with growing age of the crop, with substantial increase between the period of 60 and 90 DAS. At 30 DAS the maximum dry matter was of NS-DL+FS Power treatment followed by cowdung+*Trichoderma*, vermicompost+FS Super, urea and least in control. While, in the later growth stages 60, 90 and 120 DAS vermicompost+FS Super treatment showed the maximum dry matter which was found to be significantly higher than the treatments of NS-DL+FS Power followed by cowdung+*Trichoderma*, urea and least in the control (Figure-6). The dry weight was also influenced by the plant height (Figure-1), number of branches (Figure-3), number of leaves (Figure-4) and the fresh weight (Figure-5). The similar results were reported by Mckenzie and Hill, 1995; Yasari, Patwardhan, 2006; Caliskan *et al*, 2008; Albayrak *et al*, 2006; Namvar *et al*, 2011) on different crops dry matter production. The similar results were reported for cowdung and vermicompost application by Gajalakshmi and Abbasi, 2002); Sundharaiya *et al*, 2003; Eifediyi and Remison, 2010.

Figure-5: Fresh weight/plant
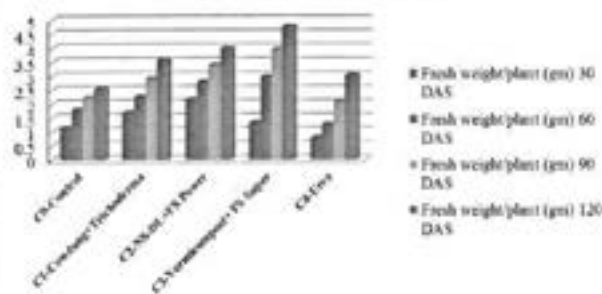
Figure-6: Dry weight/plant
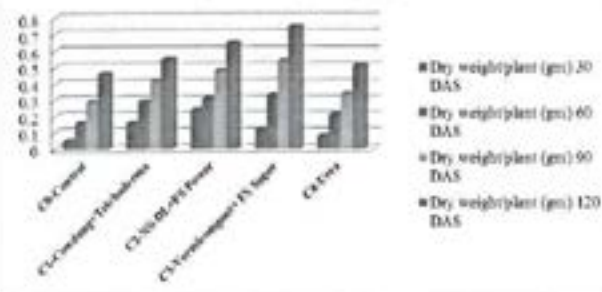
Number of nodules/plant

The increment in number of nodules was evident at 90 DAS as compared to 60 DAS (Figure-7). The number of nodules/plant increased till mid-flowering and afterwards it declined due to degradation of nodular tissue. The maximum number of nodules/plant were obtained with vermicompost+FS Super

followed by cowdung+*Trichoderma*, NS-DL+FS Power, urea and least in control during 60 and 90 DAS. Similar results have been reported by Sultan, 1997; Sinha *et al*, 2010.While a decline in number of nodules/plant was observed 120 DAS, which is mainly due to decay of nodular tissues at pod formation. Such result was also reported by Tagore *et al*, 2013.

Figure-7: Number of nodules/plant

Figure-8: Chlorophyll content
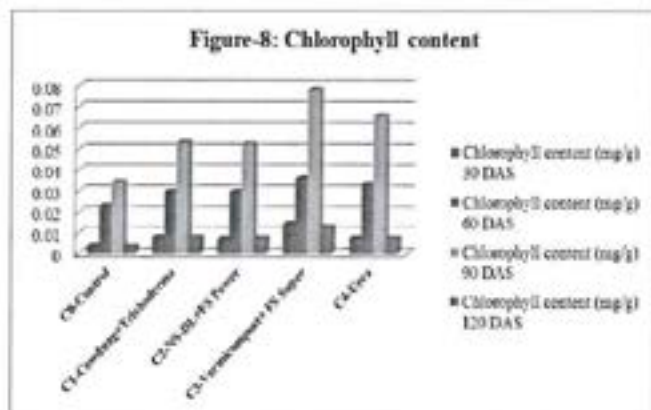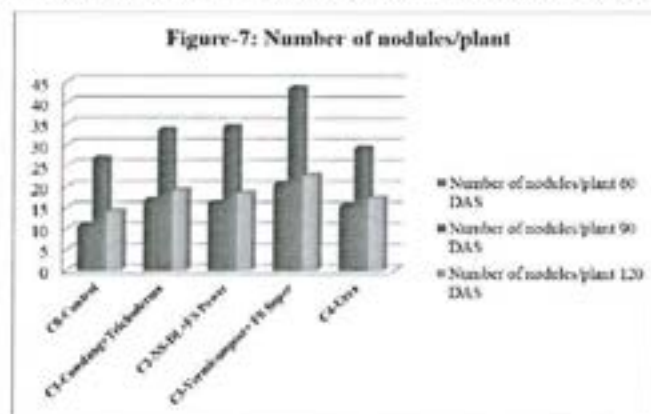
Quality parameters

Chlorophyll content

Chlorophyll content is a vital component for photosynthesis and indicates the amount of photosynthates in plants which helps in regulation of photosynthesis. The application of vermicompost+FS Super reported maximum amount of chlorophyll content followed by cowdung+*Trichoderma*, NS-DL+FS Power, urea and least in control at 30 DAS. The similar trend was obtained in chlorophyll content at 60 and 90 DAS. While, at 120 DAS the amount of chlorophyll was found to decline in all the applications (Figure-8).N deficiency causes a reduction in growth rate, general chlorosis, often accompanied by early senescence of older leaves, and reduced yield (Caliskan *et al*, 2008).

Elkoca *et al*, 2008 revealed that chlorophyll content is an indication of plant N content and N_2 fixation and it is higher in the bacterial inoculated treatments as compared to uninoculated control. These results are in line with the findings of Singh *et al*, 2015 in *kabuli* chickpea. Lower chlorophyll content at 120 DAS than at 90 DAS may be attributed to starting of yellowing of leaves after grains started to fill. The results are similar to the findings of Golchin *et al*, 2006); Berova and Karanatsidis, 2008; Pant *et al*, 2009; Hosseinzadeh *et al*, 2016.

Protein content in grain

The amount of protein in chickpea leaves was calculated to be significantly more in the chickpea treated with vermicompost+FS Super followed by urea, cowdung+*Trichoderma*, NS-DL+FS Power and least in control. The same results were obtained for the protein content in leaves at 30, 60 and 90 DAS. At harvest the protein content in chickpea seeds were calculated to be the highest in chickpea treated with vermicompost+FS Super followed by urea, cowdung+*Trichoderma*, NS-DL+FS Power and least in control (Figure-9). The supply of N to the plant will influence the amount of protein, amino acids, protoplasm and chlorophyll formed. The high nitrogen content in the soil and hence in the plant due to the application of urea and more number of root nodules due to *Rhizobium* association in vermicompost treated chickpea leads to a higher amount of protein in the plant and the seeds, which is more in the vermicompost and urea treated chickpea. The results are similar to those of Ali *et al*, 2010, Namvar *et al*, 2011, Amany, 2007 and Caliskan *et al*, 2008 in case of urea application. While, in case of vermicompost application, similar results were obtained by Jat and Ahlawat, 2002, Ramesh *et al*, 2010; Sinha *et al*, 2010 and Hosseinzadeh *et al*. 2016.

Figure-9: Protein content

Figure-10: Pods/plant
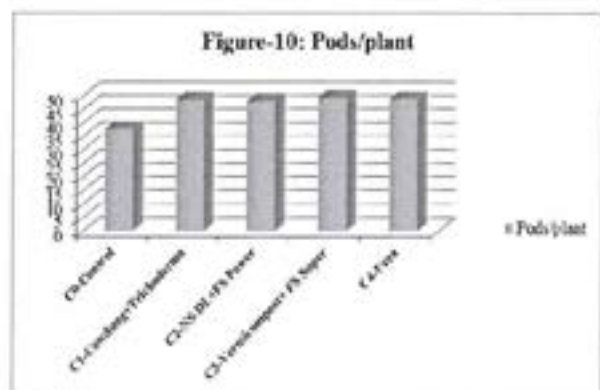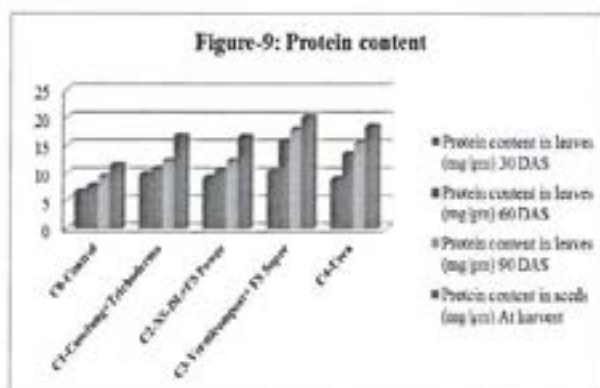
Yield parameters

Number of pods/plant

The maximum number of pods/plant at harvest was observed in the chickpea treated with vermicompost+FS Super, followed by urea, cowdung+*Trichoderma*, NS-DL+FS Power and least in unfertilized control. The similar results were observed by Singh *et al*, 2015 in chickpea. This can be attributed to higher plant growth, more number of leaves, branches, biomass and number of root nodules (Figure-10). While, in case of vermicompost

application, similar results were obtained byJat and Ahlawat, 2002; Ramesh *et al*, 2010 andSinha *et al*, 2010.

Correlation analysis

Correlation analysis was done using SPSS and Microsoft Excel 2010

Correlation among grain yield and growth parameters

A positive and significant correlation of the growth parameters with the grain yield was found. The correlation coefficient of pods/plant was found to be 0.9 with plant height, 0.8 with number of branches/plant, 0.69 for number of leaves/plant, 0.7 for fresh weight/plant and 0.6 for dry weight/plant.

Correlation among yield and number of nodules

The symbiotic parameters are the function of association between the host plant and rhizobia and the amount of nitrogen fixed. The correlation coefficient between number of nodules and pods/plant was found to be 0.8. Correlation coefficient between yield (number of pods) and symbiotic parameters *viz.* number of nodules was highly positive; means with increase in these symbiotic parameters increase in pods/plant is observed which might be due to improved nitrogen nutrition through biological nitrogen fixation by legume-rhizobia symbiosis.

Correlation among yield and quality parameters

Highly positive and significant correlation between the chlorophyll content and protein content with grain yield was observed. The correlation coefficient of pods/plant was found to be 0.8 with chlorophyll content and 0.9 with protein content. The pods/plant and grains/pod also showed positive coefficient of correlation, 0.9 with each other. The protein content of grain were highly correlated with the grain yield, that means more the nitrogen uptake more will be the protein content since N is an important constituent of protein.

Correlation among growth parameters, chlorophyll and protein content

A positive and significant correlation of the growth parameters and chlorophyll content with the protein was found. The correlation coefficient of protein content was found to be 0.7 with plant height, 0.96 with number of branches/plant, 0.9 for number of leaves/plant, 0.76 for fresh weight/plant, 0.7 for dry weight/plant, 0.87 for number of nodules/plant and 0.9 for chlorophyll content. Further, highly significant and positive correlation coefficient values between number of leaves/plant, fresh weight/plant and chlorophyll content was obtained. The correlation coefficient of chlorophyll content was found to be 0.9 with number of leaves/plant and 0.9 with the fresh weight/plant. This means more the fresh weight more will be the chlorophyll content and hence more will be the protein content which can be correlated with the improvement in nitrogen rich nutrient uptake by roots resulting in better plant growth and development.

CONCLUSION

The study of the effect of organic and inorganic nitrogen on growth indices and yield components of chickpea (*Cicer arietinum* L.) showed that the application organic and inorganic N and *Rhizobium* inoculation continued to have positive effect on growth, yield and quality parameters of chickpea. The findings of this study indicate that for obtaining high productivity of chickpea integrated use of Vermicompost along with FS Super is found to be more efficient, followed by the application of urea, cowdung+*Trichoderma* and NS-DL+FS Power and least in control.Lower levels of nitrogen application and less-inoculated plants (control) showed low growth indices including plant height, root length, number of branches/plant, fresh weight/plant, dry weight/plant, number of leaves/plant, number of nodules/plant, chlorophyll content/plant, protein content/plant, number of pods/plant and the number of grains/pod while the highest values of these indices were observed in case of Vermicompost + FS Super with more root nodules followed by application of urea. The results pointed out that natural N fertilization with Vermicompost + FS Super with more *Rhizobium* roots nodules can be beneficial in improving growth, development and total yield of chickpea. Biofertilizer are environmental friendly and it increases the nitrogen fixation from the atmosphere due to which the required chemical dose can be reduced. It is high time we promote sustainable agriculture which can supply to the need of ever increasing population without compromising the assets of future generation to meet their needs. Uses of organic manures like vermicompost combined with biofertilizer will not only benefit the crop but will also improve the soil and human health.

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An Off-diagonal Feed Elliptical Patch Antenna with Ring Shaped Slot in Ground Plane for Microwave Imaging of Breast

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Being planar and having many applications of microstrip patch antennas, nowadays these also have applications in biomedical field (for detection of cancer). As EM radiations are hazardous so direct experiments on human body and EM radiation are impossible. So this paper is focused on a breast model to detect the presence of tumor inside it along with antenna structure as a radiation source. HFSS simulation software is used for designing and simulation part. Antenna is resonating at 2.46 GHz in frequency range 2.41-2.5 GHz of ISM band suitable for medical purpose. Two models, one of which has microstrip patch antennas along with breast model without tumor and the other with tumor, are designed and simulated, and their radiation properties are compared. For cancer detection near E-field results are important, so near E-field plots for both models are shown in this paper. The differences in these results of two models can be used to diagnose tumor.

Keywords: MIS, Diagnostic of Breast Tumor, Patch antenna.

1. INTRODUCTION

Breast cancer is the most threatening disease occurring in the lives of women, also leads to a large number of deaths. But it can be cured if it is diagnosed early. The screening of breast cancer is a key to successful cure. Modern methods used for the diagnosis and treatment of breast diseases are based on the action on the tissue from radiation of various types: laser, ultrasonic waves, high-frequency current, and others, and include x-ray mammography, MRI, ultrasound, etc. [1-3]. X-ray mammography is commonly used for early breast cancer diagnosis but has many errors. A number of published reports deliberate that it gives direct exposure of radiation to patient; and false results are also very common in this technique [4-6]. During recent scenario microwave imaging is finding place as one of the most promising techniques in diagnosis as well as screening of breast cancer. It has many advantages like the use of non-ionizing radiation, non-invasive, sensitive to tumors, and low in cost. The principle behind the diagnosis of tumor in microwave imaging system consists in differences in electrical properties (conductivity, permittivity or dielectric parameters) of healthy and cancerous tissues at microwave range [7, 8].

In microwave breast imaging (MBI), low power and low frequency signals (compared to X-ray mammography) are used to obtain for ordered breast scanning. In the imaging systems based on microwave, an antenna is a significant element to irradiate the body under test with microwaves which travel through the body and then are detected by the other antenna working as a receiver. The receiver antenna contains the reflected information from tumors which are recorded and analyzed using suitable signal processing technique to get three-dimensional images of body under test. Microstrip antenna is one of the suitable types of antennas for use in Microwave Imaging System (MIS) as they are compact, conformal, low cost, light, easily designed and ease to fabricate. Several research groups from all over the world are working in this field. The performance of double layer and single layer patch antennas is checked, and it is proved that single layer patch structure is better candidate to be used in microwave imaging of breast return loss [9]. The inset fed antenna structure as a rectangular microstrip patch antenna is used, and a simple 3D breast structure is modelled for better understanding of cancer detection model [10]. A novel Multi-Ring Slots Ultra-Wide-Band (MRS-UWB) patch antenna that can be used for breast tumor detection is presented [11]. For radar based microwave imaging wide slot double sided microstrip antenna with fork feed has been presented [12]. A review on various geometries of microstrip patch antenna using FR-4 substrate resonating at various frequencies for MIS is also discussed [13].

2. EXPERIMENTAL DETAILS

It is a big challenge for researchers to design a compact size, low profile broadband antenna which can be efficiently used for imaging human body. In this paper, an off-diagonal microstrip line fed elliptical shaped microstrip antenna is proposed for microwave imaging system and for further check of its performance in active imaging system. A simple 3D breast structure with and without tumor is also modelled to diagnose cancerous tissue. HFSS simulator is employed for simulations. Antenna is designed for ISM band allotted for biomedical application. The designed antenna is resonating at 2.46 GHz in free space which is kept below breast model, and simulated maximum volume current density and maximum electric field results have been analyzed for cancer diagnosis. Step by step discussion

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Fig. 5 respectively. The maximum volume current density of the breast with tumor increases as compared to that without tumor from 160.14 A/m² to 276.49 A/m² respectively. Also the maximum electric field is also measured for both cases. The results for maximum electric field and volume current density for both cases are mentioned in Table 2.

From Table 2 it is clear that the maximum volume current density and maximum electric field for the breast with tumor are more in comparison to without tumor. In both cases the near electric (E) field of 2D pattern for azimuth plane is shown in Fig. 6.

It was found that at all angles near E-field for breast with tumor is more than that for breast without tumor. Thus, radiation properties of both models differ a lot and give a clue to detect the presence of tumor inside breast.
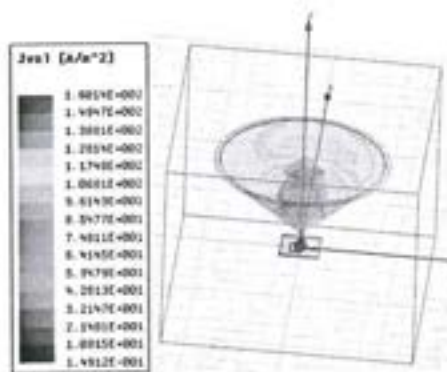
Fig. 4 – Volume current density distribution in breast without tumor
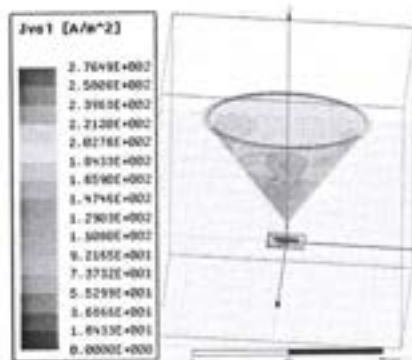
Fig. 5 – Volume current density distribution in breast with tumor

Table 2 – Comparison of electric properties for designed cancer diagnosis model with and without tumor

Model	Resonating frequency, GHz	Maximum electric field, V/m	Maximum volume current density, A/m²
Antenna with breast model without tumor	2.4667	202.63	160.14
Antenna with breast model having tumor	2.4733	264.25	276.49

It is important to measure the Specific Absorption Rate (SAR) value, which was calculated using the simulation software and is shown in Fig. 7. The maximum SAR value for this antenna is 0.843 W/kg at 2.46 GHz frequency which is below the desired range of allowed SAR value (1.6 W/kg).
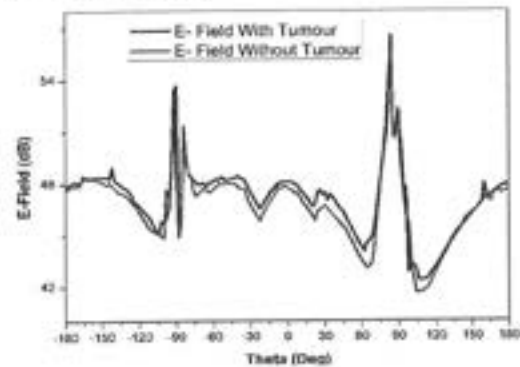
Fig. 6 – Near E-field variation with theta at phi = 0 for the two models
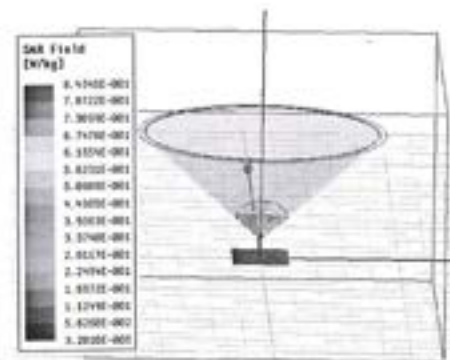
Fig. 7 – Simulated SAR value for the proposed antenna at 2.46 GHz when it exposed breast model

4. CONCLUSIONS

In this study we have designed a cancer diagnosis model of tumor present in breast by using HFSS simulator. The simulated results explain that in spite of having small more variation in resonating frequency, the maximum volume current density and maximum electric field for breast model with tumor are more than breast model without tumor. It is also shown that for all values of theta the near E-field result for tumor breast is more than that for tumor free breast. These results have a good approach to the detection of tumor inside the breast. Also, the SAR value is well below the allowed range. So, from these results we can say that the designed antenna structure can be used as a suitable candidate for active microwave imaging system as a transceiver as well as a receiver. But in spite of having good simulation results, it is very difficult to test the antenna performance practically as we have to make human phantom with three different dielectric layers (breast skin, normal tissues and cancerous tissue), and human phantoms are generally in the form of jell or liquid. So, more studies have to be planned to obtain the measured results for this cancer diagnosis model.

is presented in this article. Section 3 explains basic antenna design with breast model with and without tumor, simulation and results of cancer diagnosis model and section 4 presents conclusions.

3. RESULTS AND DISCUSSION

3.1 Antenna Geometry

Off-diagonal feed elliptical patch antenna with defected ground plane structure is shown in Fig. 1 and Fig. 2 (top and bottom views). Microstrip feed line is applied for excitation of this antenna. Epoxy FR4 substrate of relative permittivity $\varepsilon_r = 4.4$, substrate thickness $h = 1.6$ mm and loss tangent of 0.025 is used to design antenna structure. The operating frequency of the antenna with complete ground is 2.9 GHz, a square shaped slot is cut on ground plane to shift operating frequency from 2.9 GHz to 2.46 GHz in Industrial Scientific Medical (ISM) band for medical applications. The performance of this elliptical patch antenna is simulated in free space by using HFSS simulator.

The dielectric properties of biological tissues are greatly influenced by change in the frequency spectrum because different tissues will absorb different quantities of microwaves [14, 15].
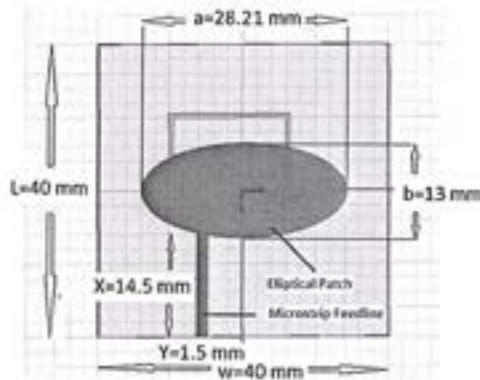
Fig. 1 – Elliptical patch with off-diagonal feeding (top view)
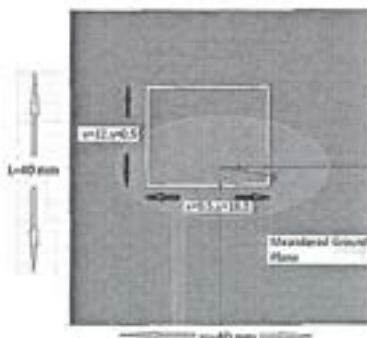
Fig. 2 – Geometry of meandered ground (bottom view)

Such electrical properties such as the electric conductivity (σ) and relative permittivity constant (ε) are also different for different tissues. Table 1 gives the dielectric properties of breast structure and tumor [16].

The dependency of permittivity and conductivity on frequency can be calculated by using following formulas [17]:

$$\varepsilon_r = 1.71.f^{-1.13} + 4 + \frac{\varepsilon_s - 4}{1 + \left(\frac{f}{25}\right)^2}, \qquad (3.1)$$

$$\sigma = 1.35.f^{0.13}.\sigma_{0.1} + \frac{0.0222.(\varepsilon_s - 4).f^2}{1 + \left(\frac{f}{25}\right)^2}. \qquad (3.2)$$

Table 1 – Dielectric and conductivity values of breast tissue at 2.45 GHz frequency

Tissue type	Permittivity	Conductivity, S/m
Normal breast tissue	9	0.4
Breast skin	36	1.46
Cancerous breast tissue	50	2.1

3.2 Diagnose Models

Using the above mentioned dielectric properties we have designed breast model implemented in HFSS simulator. Breast model is designed in the form of conical shape having two cones. Outer cone is designed taking lower radius 0 mm, upper radius 90 mm and height 70 mm which acts as breast skin. Inner cone is designed taking lower radius 0 mm, upper radius 85 mm and height 70 mm which acts as normal breast tissues without tumor which is placed at 11.67 mm distant from microstrip antenna. In order to diagnose tumor we have modelled breast structures with tumor. To design tumor we have embedded a sphere of radius 5 mm with the same dielectric properties as tumor (relative permittivity 50 and conductivity 2.1).

In this section the effect of radiation on breast model is discussed. We have simulated the complete model with and without tumor at a frequency of 2.46 GHz. The reflection coefficient of the microstrip antenna without breast model, with breast model having tumor and without tumor is shown in Fig. 3. It can be clearly observed that there is no change in operating frequency, it is almost the same in all three cases, but the reflection coefficient decreases from − 41 dB to − 17.46 dB which is considerable.

Volume current density for breast in the absence of tumor and with tumor in breast is shown in Fig. 4 and
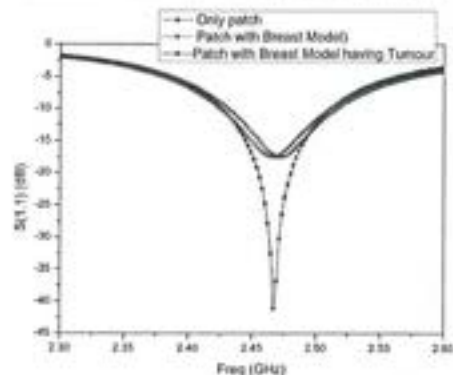
Fig. 3 – Variation of reflection coefficient with frequency

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Вертикальна еліптична смугова недіагональна антена з кільцевим отвором для мікрохвильового зображення молочної залози

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На сьогоднішній день мікросмугові антени також мають застосування в біомедичній галузі (для виявлення раку). Оскільки електромагнітне випромінювання небезпечне, то прямі експерименти на людському тілі неможливі. Таким чином, ця стаття зосереджена на моделі молочної залози, щоб виявити наявність пухлини всередині неї, разом зі структурою антени як джерела випромінювання. Програмне забезпечення HFSS використовується для проектування та моделювання. Антена резонує на частоті 2,46 ГГц у діапазоні частот 2,41-2,5 ГГц , що підходить для медичних цілей. Дві моделі, одна з яких має мікросмугові накладні антени разом із моделлю молочної залози без пухлини, а інша з пухлиною, розроблені та моделюються, і порівняно їх радіаційні властивості. Для виявлення раку є важливими результати поблизу електричного поля, тому в роботі показані графіки поблизу електричного поля для обох моделей. Відмінності в цих результатах двох моделей можуть бути використані для діагностики пухлини.

Ключові слова: MIS, Діагностика пухлин молочної залози, Смугова антена.

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Thermodynamics from field equations for charged radiating rotating black hole near horizon

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It is well known that near horizon black hole space–times show a resemblance to thermodynamic systems, it is easy to associate the thermodynamic parameters like temperature and entropy with them. In this paper, we study the connection between gravitational dynamics of the horizon and thermodynamics for the case of charged radiating rotating axially symmetric black holes. It is shown that Einstein field equation near apparent horizon can be interpreted in the form of thermodynamic law, i.e. $TdS = dM(v) - \Omega_H dJ - \Phi dQ(v)$.

1. Introduction

The connection among the thermodynamics and gravity[1–12] is known since the discovery of the laws of black holes thermodynamics from the classical Einstein's equation. It was first proposed in Refs. 13 and 14 with the idea that a black hole behaves like black body, emitting thermal radiation. It was shown earlier that the Einstein equation at the horizon gives rise to the first law of thermodynamics for a general

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static spherically symmetric and stationary axisymmetric space-times,[15-25] later in Lanczos–Lovelock gravity;[26] as well as for $f(R)$-gravity.[27] Further, the Friedmann equation can be regarded as a thermodynamic identity at the apparent horizon (AH),[28] for gravity with Gauss–Bonnet term, the Lovelock theory of gravity.[29] It is discussed for many cases including for the BTZ black hole.[31-37] It would be interesting to further consider the generalization of these analyses for the radiating black holes. The purpose of this paper is to show that differential form of the on-horizon Einstein equation for the case of charged radiating rotating black hole can be interpreted as virtual displacement of the horizon, and is, in fact, equivalent to the first law of thermodynamics, i.e. $TdS = dM(v) - \Omega_H \, dJ - \Phi \, dQ(v)$.

The metric signature used in this paper are as $(-, +, +, +)$ and all the fundamental constants have been set to unity ($G = \hbar = c = 1$).

2. Metric of Charged Radiating Rotating Black Hole

The metric of the charged radiating rotating black hole has the form

$$ds^2 = \frac{f(v,r)}{\Sigma}(dv - a\sin^2\theta \, d\phi)^2 - \frac{\sin^2\theta}{\Sigma}\left[adv - (r^2 + a^2)d\phi\right]^2 + 2dv \, dr - 2a\sin^2\theta \, dr \, d\phi - \Sigma \, d\theta^2, \tag{1}$$

where

$$\Sigma = r^2 + a^2\cos^2\theta, \quad f(v,r) = r^2 + a^2 - 2M(v)r + Q^2(v). \tag{2}$$

Here $0 \leq r \leq \infty$ is the radial coordinate, $-\infty \leq v \leq \infty$ is advanced time coordinate ($v \cong t + r$), $0 \leq \theta \leq 2\pi$ is the angular coordinate. The electromagnetic potential related to metric (1) is

$$A_a = \frac{Q(v)r}{\Sigma}\left[1, 0, 0, -a\sin^2\theta\right]. \tag{3}$$

Here $M(v)$ is the mass and $Q(v)$ is the charge of the black hole space–time as a function of retarded time v, and a is the angular momentum per unit mass. Thus, we have a kind of charged radiating rotating metric defined by (1). The usual stationary Kerr–Newman black hole[49] in (t, r, θ, ϕ) can be obtained by applying local coordinate transformation and replacing $M(v)$ and $Q(v)$ by constants M and Q. Thus, the metric (1) bears the same relation to Kerr–Newman as does Vaidya metric to Schwarzschild metric. Also for $Q = 0$, the metric (1) is radiating Kerr space–time and for $a \to 0$ the metric (1) is Bonnor–Vaidya space–time which has zero angular momentum.

The Einstein field equations for the metric (1)

$$R_{ab} - \frac{1}{2}Rg_{ab} = \frac{8\pi G}{c^4}T_{ab}, \tag{4}$$

with T_{ab} as the energy–momentum tensor of a null fluid[44,45]

$$T_{ab} = \psi\beta_a\beta_a + (\rho + P)(\beta_a l_b + \beta_b l_a) + Pg_{ab}, \tag{5}$$

and ψ is the nonzero energy density of the null fluid. The null vectors β_a and l_a are defined by

$$\beta_a = -\delta_a^v, \quad l_a = -\frac{1}{2} f(v,r) \delta_a^v + \delta_a^r. \tag{6}$$

The part of the energy–momentum tensor, $\psi \beta_a \beta_a$, can be considered as the component of the matter field that moves along the hypersurface $v = $ const. The metric of the radiating rotating solution has the form (1) with electromagnetic potential given by (3).

3. Thermodynamic Interpretation

To discuss the thermodynamical nature of charged radiating rotating black hole, we begin with introducing its kinematical parameters. Assuming $v = $ const to be an in-going null surface with future-directed null tangent vector β^a. Following Refs. 47, 48, 52–56, the null-tetrad of the metric (1) is of the form

$$l_a = [1, 0, 0, -a \sin^2 \theta],$$

$$n_a = \left[\frac{f(v,r)}{2\Sigma}, 1, 0, \frac{f(v,r)}{2\Sigma} a \sin^2 \theta \right],$$

$$m_a = \frac{1}{\sqrt{2}\rho} \left[ia \sin \theta, 0, \Sigma, -i(r^2 + a^2) \sin \theta \right],$$

$$\bar{m}_a = \frac{1}{\sqrt{2}\bar{\rho}} \left[-ia \sin \theta, 0, \Sigma, i(r^2 + a^2) \sin \theta \right],$$

where

$$\rho = r + ia \cos \theta,$$

and $\bar{\rho}$ is the complex conjugate of ρ. The null tetrad obeys null, orthogonal and metric conditions

$$l_a l^a = n_a n^a = m_a m^a = 0, \quad l_a n^a = 1,$$

$$l_a m^a = n_a m^a = 0, \quad m_a \bar{m}^a = -1,$$

$$g_{ab} = l_a n_b + l_b n_a - m_a \bar{m}_b - m_b \bar{m}_a,$$

$$g^{ab} = l^a n^b + l^b n^a - m^a \bar{m}^b - m^b \bar{m}^a. \tag{7}$$

The null-vector decomposition[47,48] of the metric (1) is of the form

$$g_{ab} = -n_a l_b - l_a n_b + \gamma_{ab}, \tag{8}$$

where

$$\gamma_{ab} = r^2 \delta_a^\theta \delta_b^\theta + r^2 \sin^2(\theta) \delta_a^\varphi \delta_b^\varphi. \tag{9}$$

To examine the horizon structure we use the null vectors β^a and l^a with vanishing angular components and normalization $\beta_a l^a = -1$. It is known that for an outgoing null geodesic near $r = r_{\text{TLS}}$ one has

$$\frac{dr}{dv} = \frac{1}{2} f(v, r). \tag{10}$$

Differentiating (10) with respect to v, near $r = r_{\text{TLS}}$, we obtain

$$\frac{d^2 r}{dv^2} = \frac{1}{2} \frac{\partial f}{\partial v} + \frac{1}{2} \frac{\partial f}{\partial r} \frac{dr}{dv}. \tag{11}$$

Applying the condition $dr/dv = 0$ at TLS and therefore $d^2 r/dv^2 \geq 0$ for $\partial f/\partial v > 0$, which is also required for $\psi(v, r) > 0$. Thus the photons will escape from $r = r_{\text{TLS}}$ and reach arbitrarily large distances. Therefore, this surface is not an event horizon but it is an apparent horizon. The optical behavior of null geodesic congruence is governed by the Raychaudhuri equation

$$\frac{d\Theta}{dv} = \kappa \Theta - R_{ab} l^a l^b - \frac{1}{2} \Theta^2 - \sigma_{ab} \sigma^{ab} + \omega_{ab} \omega^{ab}, \tag{12}$$

with expansion Θ, twist ω, shear σ, and surface gravity κ.

The expansion rate Θ of the null geodesic congruence is given by

$$\Theta = \Theta_a^a = \gamma^{ab} \nabla_a l_b. \tag{13}$$

It then follows that

$$\nabla_a l^a = \frac{\partial l_a}{\partial x^a} + \Gamma_{ac}^a l^c = \kappa + \Theta, \tag{14}$$

and clearly in flat space–time Θ vanishes. We rewrite (14) as

$$\Theta = \nabla_a l^a - \kappa, \tag{15}$$

where ∇ denotes the covariant derivative and κ is the surface gravity expressed as:

$$\kappa = -\beta^a l^b \nabla_b l_a. \tag{16}$$

Since the structure and dynamics of the apparent horizon is only dependent on Θ, therefore, it must satisfy the requirement $\Theta \simeq 0$ to order of $\mathcal{O}(L)$, where $L = -\partial m/\partial v < 1$ is measured in the region where d/dv is timelike.[48] The expansion of the null rays parametrized by v is obtained by using Eq. (15)

$$\Theta = \frac{f(v, r)}{r}. $$

Recall at TLS we also have

$$\Theta = 0, \tag{17}$$

thus the apparent horizon and TLS coincide.

Evaluating the surface gravity using Eq. (16), and substituting the condition of the horizon leads to

$$\kappa = \frac{1}{2} \frac{\partial f(v, r_H)}{\partial r}, \tag{18}$$

which gives

$$\kappa = \frac{r_H - M(v)}{(r_H^2 + a^2 \cos^2 \theta)}. \tag{19}$$

Thus the expansion Θ is given by

$$\Theta = \nabla_a l^a - \kappa = -r_H \frac{f(v, r_H)}{\left(r_H^2 + a^2 \cos^2 \theta\right)^2}.$$

Now using the equation for surface gravity (19), and substituting the condition of the horizon, we obtain the Hawking temperature of black hole via $T = \kappa/(2\pi)$, which leads to

$$T = \frac{f'(v, r_H)}{4\pi(r_H^2 + a^2)}.$$

Entropy is one of the important parameter which is related to area of the horizon as

$$S = \frac{A}{4} = \pi \left(r_H^2 + a^2\right).$$

Thus we have defined all thermodynamic parameters. Now, to obtain a thermodynamical identity from the Einstein field equations for a charged radiating rotating black hole space–time following Ref. 25, we evaluate the field equations for the metric (1) using Eq. (4), and it is found that the components G_v^v and G_r^r of the Einstein tensor are equal and is given by

$$G_r^r = \frac{r^2 - r f'(v, r) + f(v, r) - a^2}{(r^2 + a^2 \cos^2 \theta)^2}. \tag{20}$$

Now at horizon we know $\Theta = 0$ which implies $f(v, r)|_{r=r_H} = 0$, in (r, r) component. Therefore

$$G_r^r|_{r=r_H} = \frac{r_H^2 - r_H f'(v, r_H) - a^2}{\left(r_H^2 + a^2 \cos^2 \theta\right)^2}. \tag{21}$$

Using it the (r, r) component of Einstein's equation can be written as

$$G_r^r\big|_{r=r_H} = 8\pi T_r^r\big|_{r=r_H}. \tag{22}$$

Thus we obtain

$$\frac{r_H^2 - r_H f'(v, r_H) - a^2}{\left(r_H^2 + a^2 \cos^2 \theta\right)^2} = 8\pi T_r^r, \tag{23}$$

where T_r^r is the (r, r) component of the energy–momentum tensor at the horizon, given by

$$T_r^r = -\frac{Q^2(v)}{8\pi \left(r_H^2 + a^2 \cos^2 \theta\right)}. \tag{24}$$

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Substituting T_r^r and multiplying Eq. (23) on both sides by dr_H we get

$$\left(\frac{r_H^2 - a^2}{r_H^2 + a^2}\right)dr_H - \frac{r_H}{r_H^2 + a^2}f'(v, r_H)dr_H = -\frac{Q^2(v)}{(r_H^2 + a^2)}dr_H,$$

which can be arranged as

$$\left(\frac{r_H^2 - a^2}{2(r_H^2 + a^2)}\right)dr_H - \frac{f'(v, r_H)}{4\pi(r_H^2 + a^2)}d\left(\pi(r_H^2 + a^2)\right) = -\frac{Q^2(v)}{2(r_H^2 + a^2)}dr_H. \quad (25)$$

Now for this case we know that $a = J/M(v)$, where J is the angular momentum of the black hole. We considered a particular variation in r_H, for which $dJ = a\,dM(v)$ for simplification. In order to interpret the other terms we use the horizon which is $r_H = M(v) + \sqrt{M(v)^2 - a^2 - Q^2(v)}$. Using this relation we obtain

$$TdS = dM(v) - \frac{a}{r_H^2 + a^2}dJ - \frac{r_H Q(v)}{r_H^2 + a^2}dQ(v), \quad (26)$$

where $a/(r_H^2 + a^2) = \Omega_H$ and $r_H Q(v)/(r_H^2 + a^2) = \Phi$. Thus, Eq. (26) can be written as

$$TdS = dM(v) - \Omega_H\,dJ - \Phi\,dQ(v). \quad (27)$$

It can be seen that the above expression is identical to the first law of thermodynamics.

4. Conclusion

The study of black hole thermodynamics shows a deep resemblance between gravity theory and the laws of thermodynamics. It has been demonstrated earlier that the field equations can be written as the first law of thermodynamics at the horizon for spherically symmetric static black holes, In this paper, we have generalized the treatment to charged radiating rotating black holes and it is found that the Einstein field equations describing charged radiating rotating black holes at the apparent horizon can be written in the form $TdS = dM(v) - \Omega_H\,dJ - \Phi\,dQ(v)$ which describes the first law of thermodynamics where M, T, S, Φ, H and V are defined as mass, temperature, entropy, pressure and volume, respectively. All the quantities are defined in terms of null vectors using the definition suggested by York.[48] This indicates that the thermodynamical interpretation is generic in nature which points to a deep connection between gravity and thermodynamics. It may also be of interest to associate these results with holographic properties of gravity which will be the subject of future projects.

Acknowledgments

Appendix A. Detail Thermodynamic Interpretation of Einstein Equation

Beginning from Eq. (25),

$$\frac{r_H^2 - a^2}{2(r_H^2 + a^2)}dr_H - TdS = \frac{-Q^2}{2(r_H^2 + a^2)}dr_H,$$

$$TdS = \frac{r_H^2 - a^2 + Q^2}{2(r_H^2 + a^2)}dr_H,$$

$$r_H = M(v) + \sqrt{M^2(v) - a^2 - Q^2(v)},$$ (A.1)

$$dr_H = dM(v) + \frac{2M(v)dM(v) - 2Q(v)dQ(v)}{2\sqrt{M^2(v) - a^2 - Q^2(v)}}.$$

Multiplying both side by $\frac{r_H\sqrt{M^2(v) - a^2 - Q^2(v)}}{2M(v)r - Q^2(v)}$

$$\frac{r_H\sqrt{M^2(v) - a^2 - Q^2(v)}}{2M(v)r_H - Q^2(v)}dr_H$$

$$= \frac{r_H\sqrt{M^2(v) - a^2 - Q^2(v)}}{2M(v)r_H - Q^2(v)}dM(v) + \frac{M(v)r_H}{2M(v)r_H - Q^2(v)}dM(v)$$

$$- \frac{r_H Q(v)dQ(v)}{2M(v)r_H - Q^2(v)}.$$ (A.2)

Solving the right-hand side of above equation

$$\frac{r_H\sqrt{M^2(v) - a^2 - Q^2(v)}}{r_H^2 + a^2}dM(v) + \frac{M(v)r_H}{r_H^2 + a^2}dM(v) - \frac{r_H Q(v)dQ(v)}{r_H^2 + a^2}.$$

Adding and subtracting $dM(v)$, we get

$$\left[\frac{r_H(r_H - M(v))}{r_H^2 + a^2} + \frac{M(v)r_H}{r_H^2 + a^2} - 1\right]dM(v) - \phi\, dQ(v) + dM(v),$$

$$\left[\frac{r_H^2 - r_H M(v)}{r_H^2 + a^2} + \frac{M(v)r_H}{r_H^2 + a^2} - 1\right]dM(v)$$

$$- \phi\, dQ(v)\frac{r_H^2 - r_H^2 - a^2}{r_H^2 + a^2}dM(v) - \phi\, dQ(v) + dM(v).$$

Therefore, Eq. (A.2), can be written as

$$\frac{r_H\sqrt{M^2(v) - a^2 - Q^2(v)}}{2M(v)r_H - Q^2(v)}dr_H = -\frac{a^2}{r_H^2 + a^2}dM(v) - \phi\, dQ(v) + dM(v).$$

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We know, $J = M(v)a$, thus using $dM(v) = \frac{dJ}{a}$, we obtain

$$\frac{r_H \sqrt{M^2(v) - a^2 - Q^2(v)}}{2M(v)r_H - Q^2(v)} dr_H = \frac{-a}{r_H^2 + a^2} dJ - \phi \, dQ(v) + dM(v). \qquad (A.3)$$

Comparing Eqs. (A.1) and (A.3), we get

$$TdS = dM(v) - \Omega \, dJ - \phi \, dQ(v),$$

which is the first law of thermodynamics, where Ω and ϕ are defined earlier in Sec. 3.

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केंद्रीय हिंदी संस्थान, आगरा

अनुक्रम

अनुसंधान एवं भाषा विकास विभाग

मानस का चित्रकूट प्रसंग : एक विराट सांस्कृतिक बिंब

शीताम शर्मा

हिंदी साहित्य आकाश के चंद्रमा तुलसी कविता करके स्वयं इतने प्रसिद्ध नहीं हुए, जितने उनकी कविता प्रसिद्ध हुई। तुलसी की प्रबंध कल्पना से उनका युगबोध स्पष्ट परिलक्षित होता है। जब वैयक्तिक भावानुभूति गहन हो, तो मुक्तक की रचना होती है तथा जब कवि के सम्मुख कोई बड़ा सामाजिक संकट हो तब वह विकल्प के रूप में प्रबंध रचना द्वारा समाज का व्यापक बिंब प्रस्तुत करता है। भक्तिकाल में कबीर, सूर और मीरा तीनों में वैयक्तिक अनुभूति की गहनता है, वहीं तुलसी व जायसी में सामाजिक अनुभूति की तीव्रता।

'मानस' की प्रबंध कल्पना की पृष्ठभूमि में तत्कालीन परिस्थितियों की मुख्य भूमिका रही है। तुलसी के सम्मुख उस समय दो संकट थे; प्रथम तो बाहरी आक्रमण से हिंदू संस्कृति की रक्षा का संकट और दूसरे हिंदू संस्कृति के आंतरिक विखंडन को रोकना। इन दोनों का निस्तार एक युग द्रष्टा कवि ने प्रबंध कल्पना में देखा। तद्युगीन राजनीतिक उठा-पटक के वातावरण में हतदर्प व भ्रमित भारतीय जन के उद्धार का मार्ग तुलसी ने रामकथा में देखा, इसीलिए उनका नायक, रामायण के महामानव 'राम' से परमब्रहम 'राम' हो गया। वह 'शील-शक्ति-सौंदर्य' से युक्त है। वह मर्यादा पुरुषोत्तम है। तुलसी की इस कथा का आधार उनकी भक्ति है, जो कि नितांत वैयक्तिक भाव है और इस वैयक्तिक अनुभूति के साथ ही उन्होंने वृहत्तर सामाजिक, सांस्कृतिक एवं धार्मिक मूल्यों का बोध प्रस्तुत किया है, तथापि अपने इस काव्य को स्वांत: सुखाय कहना, तुलसीदास जी की विनम्रता व महानता का सूचक है, "इस महानायक की प्रसिद्ध प्रबंध रचना 'रामचरितमानस' भारतीय संस्कृति का बिम्ब है तो इसके अयोध्याकांड का चित्रकूट प्रसंग, विराट सांस्कृतिक बिंब।"

उत्तर प्रदेश एवं मध्य प्रदेश की सीमा पर अवस्थित चित्रकूट, त्रेतायुगीन भगवान श्रीराम की पावन लीलास्थली रही है। रामचंद्र जी ने, जनक नंदिनी एवं अनुज लक्ष्मण के साथ अपने वनवासी जीवन के आरंभिक' साढ़े ग्यारह वर्ष यहीं पर व्यतीत किये थे। दशरथ के देहावसानोपरांत, भरत,

गवेषणा

सौमित्र एवं शत्रुघ्न, प्रमुख नागरिकों के साथ यहाँ आये थे और इसी अवसर पर भरत के साथ आये हुए संपूर्ण अयोध्यावासी एवं प्रमुख गणमान्य व्यक्तियों के साथ तीनों माताओं, गुरुजनों, ऋषि-मुनियों तथा राम, लक्ष्मण एवं सीता के मध्य एक सभा आयोजित की गयी थी जिसका अभिप्राय, श्रीराम को भरत द्वारा मनाकर अयोध्या लेकर जाना था।

चित्रकूट की वनस्थली में राम, लक्ष्मण सीता और अयोध्या से आगत राज समाज के पारस्परिक मिलन के कवि ने अनेक भावुक चित्र खींचे हैं। भरत अपने पिता द्वारा प्रदत्त राज्य का त्याग कर, भाई राम के राज्याभिषेक के लिए विभिन्न तीर्थों का पवित्र जल तथा अन्य अभिषेक सामग्री लेकर चित्रकूट गये थे। अयोध्या से भरत यह सोचकर चले थे कि चित्रकूट में राम का राज्याभिषेक हो सकता है और वे अयोध्या लौटकर आ गये, किंतु वहाँ पहुँचने पर उन्हें स्पष्ट हो गया कि राम अयोध्या नहीं लौटेंगे क्योंकि वे केवल भरत के भाई राम ही नहीं थे अपितु विशिष्ट अद्वैती भक्त, परम ब्रह्म से भी अधिक, एक युगद्रष्टा कवि के 'नायक' थे।

भावुक भरत राम को साथ ले जाना चाहते हैं किंतु विवेक और शील के समुद्र राम को कर्तव्यच्युत करने की बात वे सोच ही नहीं पाते, धर्म के सम्मुख सभी नत हो जाते हैं। दोनों पक्षों में भावुक वार्तालाप होता है। योगी-यति भी भावुकता के आवेग में बह जाते हैं, किंतु 'रघुकुल रीत सदा चली आई। प्राण जाए पर बचन न जाई' जैसी नीति का पालन करने वाले राम, अयोध्यावासियों को नीति विमुख होने से बचा लेते हैं। अंत में राम, पिता आज्ञा का पालन करेंगे एवं भरत श्री राम की चरण-पादुका के साथ अयोध्या का राज-भार संभालेंगे, यह निर्णय समस्त सभासदों को कलेजे पर पत्थर रखकर स्वीकारना पड़ता है।

इसी प्रसंग को लेकर तुलसीदास जी ने अयोध्या-कांड में चित्रकूट सभा का अभूतपूर्व वर्णन किया है। यह सभा आध्यात्मिक, सांस्कृतिक, सामाजिक, धार्मिक एवं पारिवारिक आदर्शों की दृष्टि से अत्यधिक महत्वपूर्ण बन पड़ी है। इस समाज में विनय, शील, त्याग, कर्तव्य आदि के संघर्ष से उत्पन्न, जो धर्म ज्योति प्रस्फुटित हुई, उससे समस्त चित्रकूट प्रकाशमान हो उठा। आचार्य शुक्ल के शब्दों में – "यदि भारतीय शिष्टता और सभ्यता का चित्र देखना है तो इस राज समाज में देखिए।"

चित्रकूट सभा एक आध्यात्मिक घटना है – धर्म के इतने स्वरूपों की एक साथ योजना, हृदय की इतनी उदात्त वृत्तियों की एक साथ उद्भावना, तुलसी के विशाल मानस में ही संभव थी। यह संभावना भिन्न वर्गों के समावेश द्वारा संघटित की गयी है। राजा-प्रजा, गुरु-शिष्य, भाई-भाई, माता-पिता व संतान, श्वसुर, जमात, सास-बहू, क्षत्रिय-ब्राह्मण, ब्राह्मण-शूद्र, सभ्य-सभ्य के परस्पर व्यवहारों के उपस्थित प्रसंगों में गांभीर्य के समावेश द्वारा, संस्कृति का मनोरम रूप प्रस्फुटित हुआ है।

डॉ. गौरी शंकर मिश्र ने इसी प्रसंग के आधार पर मानस को 'आदर्श मानवीय संबंधों का महाकाव्य' कहा है। तुलसीदास जी ने इसमें राजा और प्रजा का संबंध, भ्रातृ-भ्रातृ का संबंध, नागरिक तथा ग्रामीणों का संबंध तथा ऋषि और तिरस्कृत वर्गों के परस्पर मानवीय संबंधों को विस्तारपूर्वक चित्रित किया है। इन संबंधों का चित्रण एक ऐसे धरातल पर किया है जिसमें 'बहुजन हिताय-बहुजन सुखाय' की ध्वनि झंकृत होती है।

तत्कालीन विश्रृंखलित भारतीय संस्कृति का पुनः सृजन चित्रकूट प्रसंग के निम्न संबंधों के उत्कर्ष द्वारा देखा जा सकता है।

राजा और प्रजा का संबंध : जहाँ प्रजा, राजाओं से त्रस्त थी, वहीं अयोध्या की समस्त प्रजा अपना काम-धंधा तजकर, भरत के पीछे उन्हीं के समान मगन चली जा रही है-

"नगर लोग सब सजि-सजि जाना। चित्रकूट कह कीन्ह पयाना॥"

समस्त प्रजा में राम दर्शन की उत्कट लालसा है। उनकी विरह व्यथा और दर्शन की व्यग्रता तीव्र है। सभी जन राम दर्शन की लालसा लिए, मार्ग में आये सभी कष्टों को सहते हुए बढ़े चले जा रहे हैं-

'राम दरस बस सब नर नारी। जनु करि करिण चले तमि बारी॥'

प्रजा का वश नहीं चलता, नहीं तो वह चौदह वर्ष श्रीराम के साथ ही व्यतीत करे, किंतु तुलसी के नायक की ध्येयनिष्ठा, कर्मठता तथा कर्तव्यपरायणता के सम्मुख सभी नत-मस्तक हो जाते हैं-

"सीता राम संग बनवासु। कोटि अमरपुर सरिस सुपासु।
परिहरि रामु लखन बैदेही, जेहि घर भाव वाम विधि तेहि॥"

यह स्नेह जितना प्रजा का राजा के प्रति है, उतना ही राम का भी प्रजा के प्रति है। राम सभी से प्रेमपूर्वक भेंट करते हैं, क्योंकि तत्कालीन राजा और बादशाह तक प्रजा की पहुँच नहीं थी और न ही उसके सुख-दुःख से शासकों का सरोकार था, इसीलिए इस प्रसंग में रामराज्य का आदर्श प्रस्तुत किया है-

"सानुज मिलि पल मैह सब काहू। कीन्ह दूरि दुख दारुण दाहू।"

तुलसी के युग में सत्ता लोभ वश जहाँ भाई, भाई की हत्या कर रहा था वहीं चित्रकूट में भरत और राम की सत्ता निर्लिप्तता व अगाध स्नेह व्यक्त हुआ है। भ्रातृ भाव से भरे भरत नंगे पांव श्री राम को

प्रवाने जा रहे हैं। मार्ग में जहाँ सुनते हैं कि यहाँ पर राम, लक्ष्मण व सीता ने विश्राम किया, उस स्थल को देखकर भाव विभोर हो उठते हैं-

"राम वासथल विटप विलोके। उर अनुराग रहति नहिं रोके॥"

भरत मार्ग में पूछते जाते हैं कि राम किस वन में हैं? मार्ग में जो कोई उन्हें उनकी कुशलता से अवगत कराता है, वह व्यक्ति उन्हें राम-लक्ष्मण सम प्रिय लगता है? भरत के नेत्रों से प्रवाहित अश्रु-सलिल का प्रवाह रोके नहीं रुक पाता है। ऐसा प्रतीत होता है कि भरत का चरित्र तुलसी का प्रिय चरित्र है, जहाँ-जहाँ भरत पर लेखनी चली है कविता भावमयी हो गयी है। तुलसी, राम द्वारा शपथ पूर्वक लक्ष्मण की शुचिता प्रमाणित करवाते हैं -

'लखन तुम्हार सपथ पितु आना। सुचि सुबंधु नहिं भरत समाना॥'

आचार्य रामचंद्र शुक्ल ने इस भ्रातृ मिलन के वैशिष्ट्य को इस प्रकार उद्घाटित किया है- "चित्रकूट में राम और भरत का जो मिलन हुआ है वह शील और शील का, स्नेह और स्नेह का, नीति और नीति का मिलन है। उस मिलन से प्रस्फुटित उत्कर्ष की प्रभा देखने योग्य है।"

भरत पर श्रीराम का विश्वास दृढ़ है, जब लक्ष्मण अपने अग्रज के प्रेम के वशीभूत भरत पर शंका करते हैं, तो राम उन्हें समझाते हैं -

"भरतहि होई न राजमदु। विधि-हरि-हरपद पाई॥"

इधर भरत का भी भ्रातृ-प्रेम देख, राम अधीर हो उठते हैं, तो भरत राम के दर्शन होते ही लकुट की नई धरा पर गिर पड़ते हैं। यह स्नेह प्रगाढ़ता भारतीय पारिवारिक संस्कृति का आधार है। क्या ऐसी संस्कृति को त्यागकर कोई उस संस्कृति को ग्रहण सकता है, जिसमें निजी स्वार्थों के लिए सगे भाइयों तक का कत्लेआम किया जा रहा था-

"ठठे राम अति प्रेम अधीरा। कहुं निषंग कहुं धनु तीरा॥"

इसी प्रकार राम और लक्ष्मण का संबंध चित्रित हुआ है, सत्ता-मोह से विमुक्त लक्ष्मण, राम को इच्छ के विरुद्ध, उनके साथ वन जाते हैं -

"मोरे सबई एक तुम स्वामी, दीन बंधु उर अंतरजामी।"

लक्ष्मण, राम को जितना प्रेम करते हैं, राम भी उन्हें पुत्रवत मानते हैं। वन में अनुज का मन लगा रहे इसके लिए राम उन्हें समय-समय पर कहानियाँ सुनाते रहते हैं-

"कहहिं पुरातन कथा कहानी। सुनहि लखन, सिय अति सुखमानी॥"

देवर भाभी के संबंध को भी बड़े ही सुंदर ढंग से व्यक्त किया है। लक्ष्मण सीता का बहुत सम्मान करते हैं और सीता भी अपने देवर को छोटे भाई सा स्नेह देती हैं, उसकी सार संभाल करती हैं।

शासक-मनीषी संबंध : प्रजा जिस प्रकार अपने शासकों के प्रति आश्वस्त है, उसी शासक भी अपने गुरु व मनीषियों का उतना ही सम्मान करते हैं। राम राजा हैं तथापि विनम्रता के साथ सभी छोटे-बड़े का पूरा ध्यान रखते हैं। मर्यादा में रहकर बात करते हैं। सदैव उनके रुझान को देखकर अपनी बात कहते हैं और बात से पूर्व चरण वंदना करते हैं; चित्रकूट प्रसंग का यह दृश्य, तत्कालीन भारतीय समाज में गिरते नैतिक मूल्यों के पुन:सृजन की सायास आयोजना है –

"गए नहाई गुर पहिं रघुराई। वंदि चरन बोले रुख पाई ॥"

इसी प्रकार भरत व लक्ष्मण भी अपने गुरुओं की वंदना करते हैं। भरत को गुरु वशिष्ठ पर इतना अधिक विश्वास है कि उन्हें वे माता-पिता से भी बढ़कर हितैषी जान पड़ते हैं–

"कुल गुरु सम हित माय न बापू॥"

राम और भरत गुरुओं के सम्मुख अपना मत प्रकट करते हुए सकुचाते हैं कि वंदनीय गुरुओं को उनके व्यवहार में राज प्रगल्भता का भान न हो जाए। इस सभा में जितना सम्मान शिष्य, गुरुओं को देते हैं, गुरु भी अपना स्नेह, आशीष शिष्यों को प्रदान करते हैं।

जहाँ आज के युग में संबंधों में मानवीय शिथिलता व तनाव है वहीं तत्कालीन समय में जमाई-श्वसुर के संबंध कलुषित हो अपना मूल्य खो रहे थे; ऐसी विषम परिस्थितियों में तुलसी ने इन संबंधों को प्रगाढ़ता प्रदान की है। राम-भरत भी जनक को विशेष सम्मान देते हैं। इस संबंध की मधुरता देखिए –

"तात तुम्हारि मोरि परिजन की। चिंता गुरहिं नृपहिं घर बन की।
माथे पर गुरु मुनि मिथिलेसु। हमहिं तुम्हहिं सपने हूँ न कलेसु॥"

पिता-पुत्री संबंध को जनक व सीता के माध्यम से समझाया है। अपनी पुत्री द्वारा तपस्वी वेश धारण किया देखकर, जनक प्रसन्न होते हैं तथा पुत्री के पति अनुगामिनी होने पर गर्व अनुभव कर सम्मुख व्यक्त भी करते हैं; यह अभिव्यक्ति अपने युग से संसक्त कविबोध की मनोवैज्ञानिक अभिव्यक्ति है–

"तापस वेष जनक सिय देखी। भए प्रेम परितोष विसेषी।
पुत्री ! पवित्र किए मुल दोऊ। सुयस धवल जग कह सब कोऊ॥"

कैकेयी के गले लगते हैं क्योंकि वे जानते हैं कि कैकेयी की ग्लानि उनके द्वारा ही दूर की जा सकती थी, जिसे उन्होंने बड़े सहज स्वभाव से कर दिखाया— ...य वात्सल्य के साथ चित्रित किया है। राम सर्वप्रथम

"प्रथम राम मिलहि कैकेई। सरल स्वभाव भक्तिमति भई।"

श्री राम ने कैकेयी के चरण पकड़कर सकल दोष विधाता पर मढ़ दिया— यह प्रसंग स्वयं को दोषी मान रही नारी की पीड़ा का तुलसी के नायक द्वारा किया गया मनोवैज्ञानिक उपचार है —

"मेरी रघुवर मातु सब, करि प्रबोध परितोष।
अंब ईस आधीन जग काहु न देइय दोष॥"

माताओं से मिलने का क्रम भी इस प्रसंग की महत्ता है। दोनों भाइयों द्वारा सर्वप्रथम जनक तत्पश्चात कैकेयी तदोपरांत माता अरुन्धती (गुरु पत्नी) के चरणों की वंदना, तत्पश्चात सुमित्रा की तथा अंत में माता कौशल्या की चरण वंदना करते हुए, शिथिल अंग होकर माता के चरणों में गिर पड़ते हैं, माता ने भी बड़े स्नेह से उन्हें उठाया और अपने प्रेमाश्रु जल से उन्हें मानो स्नात कर दिया। ऐसे स्नेहपूरित भाव विह्वल कर देने वाले प्रसंगों ने ही मानस को लोक का काव्य बना दिया। यही तुलसी की युग दृष्टि थी —

"गंग गौरि सम सब सनमानी। देहि असीस मुदित मृदु बानी।
गहि पद लगे सुमित्रा अंका। जनुभेटी संपति अति रंका।
पुनि जननी चरननि दोउ भ्राता। परे प्रेम व्याकुल सब माता॥"

दांपत्य प्रेम उत्कर्ष दांपत्य की दृष्टि से भी यह प्रसंग अनुपम बन पड़ा है। वनवास की शर्त केवल श्रीराम के लिए थी, किंतु जब पति का उद्देश्य लोक कल्याणकारी हो तो उसकी अनुगामिनी बन जाने में ही पत्नी की कर्तव्य निष्ठता होती है। भारतीय नारी के इसी गुण को कवि पुन: नारी में देखना चाहता है। सीता भी सर्वस्व राजसी भोग–विलास त्यागकर साध्वी रूप में प्रसन्न मन से वन के लिए प्रस्थान करती है—

"रामसंग सिय रहत सुखारी। पुर परिजन गृह सुरति बिसारी।
छिनु–छिनु प्रिय बिधु वदनु निहारी। प्रमुदित मनहुं चकोर कुमारी॥"

तद्युगीन समाज में व्याप्त वर्ग तथा वर्ण वैषम्य की खाइयों को पाटने का प्रयास भी चित्रकूट प्रसंग की विशिष्टता है। जहाँ कबीर इन्हें ध्वस्त कर देना चाहते हैं तुलसी इनमें समन्वय की चेष्टा करते हुए, टूटते भारतीय समाज की मरम्मत करते प्रतीत होते हैं। केवट द्वारा दूर से ऋषि को प्रणाम करने

और ऋषि को उसे आलिंगन करने में उभय पक्ष का व्यवहार अति सुष्ठ बन पड़ा है। शूद्रों को अपनी मर्यादाओं में रहना चाहिए और उच्च वर्ण उदार हृदय हो किंतु अंतर बराबर बना रहे। निषाद व अन्य वशिष्ठ के ऐसे हृदयंगम मिलन को देखकर देवता भी पुष्प वर्षा करने लगते हैं –

"प्रेम पुलकि केवट कहि नामा कीन्ह दूर ते दण्ड प्रणामा।
राम सखा रिषि बरबस भेंटा। जहि महि लुटत सनेह समेटा॥"

सभ्य-असभ्य संबंध : वन की आदिवासी जातियों के प्रति सभासदों के सहृदयता पूर्ण, मृदुल व विनम्र व्यवहार को देखकर कोई भी अभिभूत हो उठेगा। हर्षित आदिवासी, टोकरों में कंद-मूल-फल राम के लिए लाते हैं। राम का प्रेम पूरित नेत्रों से उन्हें देखना माने नयनों का नयनों से संभाषण है। राम भीलों के वचन इस प्रकार सुनते हैं जैसे एक पिता अपने बालक को सुनता है।

श्रीराम राजत्व को त्यागकर, प्रसन्न मन से उन्हें सुनते हुए उनकी वस्तुओं का अधिक से अधिक मूल्य देते हैं किंतु आदिवासी रामचंद्र की दुहाई देते हुए मूल्य लौटा देते हैं-

"सबहि देहि करि विनय प्रनामा। कहि-कहि भेद स्वाद गुन नामा।
देहि लगे बहुमोल न लेहिं। फेरत दान दोहाई देहीं॥"

भावुक हुए वनवासी प्रेम से पूरित स्वयं की आजीविका व जीवन के बारे में जानकारी देने लगते हैं-

"हम जड़-जीव जीव-गन घाती। कुटिल कुचाल कुमति कुजाती।
पाप करत निसि बासर जाहीं। नहि पट कटि नहिं पेट अघाही।
जब ते प्रभु पद पदुम पधारे। मिटे दुसह दुख दोस हमारे॥"

अयोध्यावासी जब राम को भीलों के प्रति स्नेह करते देखते हैं तो वे भी स्वयं को रोक नहीं पाते और हृदय के भाव मुख पर झलक आते हैं। वनवासियों के ऐसे प्रेमपूर्ण वचन सुनकर स्वयं अयोध्यावासी मुग्ध होकर उनकी निश्छलता, सरलता से अभिभूत हो उठते हैं -

"वचन सुनत पुरजन अनुराग तिनके भाग सराहन लगे।"

यह नागरिक व ग्राम्यजन (सभ्य-असभ्य) के मध्य समन्वय की चेष्टा है, क्योंकि तत्कालीन समाज में हिंदू शूद्रों द्वारा धर्म परिवर्तन तथा उच्च वर्ण द्वारा उनकी उपेक्षा व शोषण, राष्ट्र को राजनीतिक रूप से दुर्बल कर रहा था। यहाँ तुलसी यह समझाना चाहते हैं कि यदि बड़े संकट (रावण) का सामना करना है तो शासकों को बंदर सेना (जंगली आदिवासी) अर्थात अछूत असभ्य जनों को भी साथ लेकर चलना होगा।

Influence of Light on the Germination of Seeds and Growth of Plantlets: An Experimental Study

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ABSTRACT: Light is a very important factor in a plant's life. Plant uses different colors which are present in visible light to perform different aspects of their growth. Plant development is strongly influenced by light quality which refers to the colors or wavelengths reaching a plant's surface. Due to the advancement of technology, lighting systems play an important role in the commercial greenhouse productions. The aim of this study was to investigate the effect of red, blue, green, yellow and natural light on the plant growth of *Vigna radiata* and *Trigonella foenum-graecum*. The effects of blue, red, green and yellow light were performed as a pot experiments under controlled conditions, repeated three times. The characters studies include seed germination percentage, seedling growth, shoot length and root length. Both negative and positive values were recorded as a result of light treatment. The results showed that application of different lights affects the morphological characters, as compared to the plants grown under sunlight. Compare to the control sample, the maximum seedling length was recorded in both the plants under blue light. The presence of lighting systems is very important for expanding and increasing the plant quality. The results indicate the possibilities of better yield through proper selection and the improved commercial production will help farmers to achieve maximum production.

Keywords: *Trigonella, Vigna,* light quality, seedling growth, germination percentage.

I. INTRODUCTION

Pulses belong to the family Fabaceae. They are commonly known as legumes; they have high protein content and are easily digestible [1]. Pulses are said to be the poor's man meat and are grown worldwide for consumption due to their high nutrition and low-cost aiding in overcome protein malnutrition in developing countries like India [2]. They are rich in carbohydrates, vitamins and minerals. They have capability to restore soil fertility and climate change through their N_2 fixation properties. India is the largest producer, consumer and importer of pulses in the world.

Trigonella foenum-graecum and *Vigna radiata* is an annual herb which comes under leguminous crops. *Trigonella foenum-graecum,* commonly known as methi/fenugreek, is mostly found in India, Africa, North America and Australia. Among them India is a leading producer of *Trigonella foenum-graecum* in the world. It is famous spices in human food. The seeds and green leaves of *Trigonella foenum-graecum* are used in food as well as in medicinal application that is the old practice of human history, hence it is called "an old-world crop for the new world" [3-4]. It is an important medicinal plant use in certain women health disorders and hepatotoxicity as traditional remedy [5-6].

Among pulses, *Vigna radiata* is known as mung bean/green gram. It is cultivated in India, China, Thailand, Indonesia, Burma, South Europe and US [7]. It is rich in carbohydrate, protein, minerals, vitamins and fat. *Vigna radiate* seeds are invaluable source of digestible protein for vegetarians. It plays key role in various cropping systems and sustainable agriculture production due to N_2 fixation ability and low water requirement [8-9].

The growth of a plant might see like a simple and straight forward process. The plant needs to be watered, the soil needs to have certain nutrients and it needs to be in an environment where it receives light for a certain period of time. A crucial component in the growth of a plant besides water and oxygen is sunlight. Light is such an important environmental parameter, plants have evolved numerous biochemical and developmental responses to light that help to optimize photosynthesis and growth, plant development, flowering and usage of water. Experiments by Hoover [10] on photosynthesis efficiency curves over the light spectrum served as the foundation for the relative quantum efficiency. Curves established by McCree [11] are cited in most current research related to photobiology and light quality. Managing light is

obviously critical to the production of crop grown in controlled environments [12-14]. Several processes such as photosynthesis, germination, flowering, and biomass accumulation can be controlled and optimized via adjusting light wavelengths [15-17]. A specific light quality can be used to improve the nutritional quality of vegetables and yields in commercial production [18-19]. Plant responses are different based on the lighting environment, season, genotype, cultivation practices and many others [20]. Light contain the entire colors visible light spectrum from red to violet. Each color has a different wavelength. Red has the longest wavelength and violet has the shortest wavelength. When all the waves have seen together, they make white light. Light is essential in a plant's life. Without light a plant can't grow, reproduce and photosynthesize. Plants utilize the different colors found in visible light to control different aspects of their growth. The nature and wavelength of the light has different influence on the different physiological plant processes depending on the species and their development stage or studied organ [21]. To increase the production capacity, controlled growing systems using artificial lighting have been taken into consideration by Darko et al., [22]. A closed system for plant production with artificial light is an innovative method of plant cultivation [23]. Joshi et al., [24] also reported that LED-interlighting products most commonly consist of blue- and red- LED chip combinations, specifically targeted for excitation of the chlorophyll pigments and thus for enhancing photosynthetic activity. The aim of this study was to investigate the effects of red, blue, green, yellow and natural light on the seedling growth of T. foenumgraecum and V. radiata.

II. MATERIALS AND METHODS

Plant material: the seeds of V. radiate and T. foenumgraecum were procured from local market in Jaipur, Rajasthan. The experiment was conducted in laboratory conditions. Seeds were air dried and stored in room temperature. Stored seeds were surface sterilized and sown in pots.

Light treatment: four color, (red, blue, green and yellow), cellophanes were taken. Tape two layers of the desired color of cellophane on four pots. One pot was without any cellophane and used as control. Place all the pots in light and observe them for one week.

Plant growth measurement: main measured quantities in this study were germination percentage, seedling length, root length, shoot length and seedling vigor index. Environmental conditions for all treatments were controlled to maintain the same temperature and relative humidity.

III. RESULT AND DISCUSSION

The effects of light quality treatments on Trigonella foenum-graecum and Vigna radiata were monitored by measuring changes in germination percentage, seedling length, root length and shoot length at 10 days of germination. Table 1 and 2 presents all the measured components of growth parameters. The present study examined the effects of different lightening conditions on growth parameters. Plants showed distinct growth responses to different light quality treatments. Results from Table 1 and 2 showed that light quality influenced the growth of seedlings.

In Vigna radiata germination % varied from 85-100% and in Trigonella foenum-graecum it was ranged from 90-100%. Among all four different color filtrations blue, green and red light showed 95-100% germination, respectively. In each experiment, plants grow in red light have used less water than other plants. The values showed that V. radiata grew more rapidly in the presence of yellow light than the natural light (Table 1 & Fig 1). Selective filtration of the yellow light increased the seedling length. Seedling length was also increased by blue light filtration in both the plants. Same results were given by Surducan et al., [25]. Randall and Lopez [26] investigated that the application of red and blue light improves the growth of plant. The blue light increased the height of basil medicinal plant [27]. Nguayen et al., [28] also reported that the plant height, leaf number, leaf area, photosynthetic capacity and productivity of Spinach changed due to the different light intensities. In Trigonella foenum-graecum red and green light also showed better growth than the natural light (Table 2 & Fig 2). Kim [29] suggested that green supplemented light could also offer benefits, since green light can better penetrate the plant canopy and potentially increase plant growth.

Root length of both the plants was significantly shorter under red, blue, green and yellow lightening environments. Different light quality treatments inhibited the elongation of roots. This agrees with the reports of Guo et al., [30] and Nhut et al., [31] and Chen et al., [32]. Liu et al., [33] reported that a different red to blue ratio affected root morphology. Shoot length was not significantly different among all lightening environments in Trigonella foenum-graecum. In Vigna radiata different light quality treatments affected the growth of shoot length and red light likely inhibited the elongation of shoot. Glowacka [34], found tomato cultivars placed under blue light showed shorter height compared to those kept in day natural light. In roses and poinsettia blue light was known to reduce stem elongation [35-36]. In Petunia blue light promotes stem elongation on the contrary red light suppresses plant height [37]. Ajdanian et al., [38], reported that blue and red light had considerable effects on the vegetative traits compared to the control treatment and presence of blue and red wavelengths are necessary for a better growth of the plant.

A growth retarding effect might be caused by an insufficient quality of light. The seedling health index was greatest under blue light. The higher health index under the blue light environment contributed to the

shorter shoot height and larger stem diameter which can provide a higher loading resistance potential. Blue LED light was an effective light source for plant growth and development and light spectra, intensities and duration can easily be controlled by growers in artificial growing environment [30, 32]. Lighting system play an important role in the commercial greenhouse productions.

IV. CONCLUSION

Light is the original source of energy for plant photosynthesis and growth. A wide range of signals and information for morphogenesis and many other physiological processes is triggered by light. Different characteristics of light such as spectral composition (wavelengths), intensity, duration and direction can influence plant growth and development. From the findings of present study, it was concluded that different colors of light or different wavelengths affects the germination percentage and seed growth. Plants react differently to different colors of light. Different color light helps plants achieve different goals. Many plant functions can be enhanced and promoted just by knowing what light color they react and respond. All the above-mentioned parameters of *Vigna radiata* and *Trigonella foenum-graecum* were influenced by different lights. The results indicate the possibilities of better yield through proper selection. It is hoped that the different light treatments, induce variability, may have further scope in *Vigna radiata* and *Trigonella foenum-graecum* improvement through its incorporation in breeding programs.

Table 1: Values for *V. radiate*.

S.No.	Characters	Control	Red light	Blue light	Green light	Yellow light
1.	Germination %	100	90	90	87	85
2.	Seedling length (cms)	3.08	2.04	3.84	2.63	3.23
3.	Root length (cms)	3.52	1.43	2.00	2.34	2.43
4.	Shoot length (cms)	0.50	0	0.40	0.16	0.14
5.	SVI	3.08	1.84	3.46	2.29	2.75

Table 2: Values for *T. foenum graecum*.

S.No	Characters	Control	Red light	Blue light	Green light	Yellow light
1.	Germination %	90	100	95	95	90
2.	Seedling length (cms)	9.60	10.60	11.61	10.21	8.84
3.	Root length (crns)	5.69	4.52	3.87	4.69	3.48
4.	Shoot length (cms)	5.55	6.08	6.87	5.34	5.36
5.	SVI	8.64	10.60	11.03	9.70	7.96
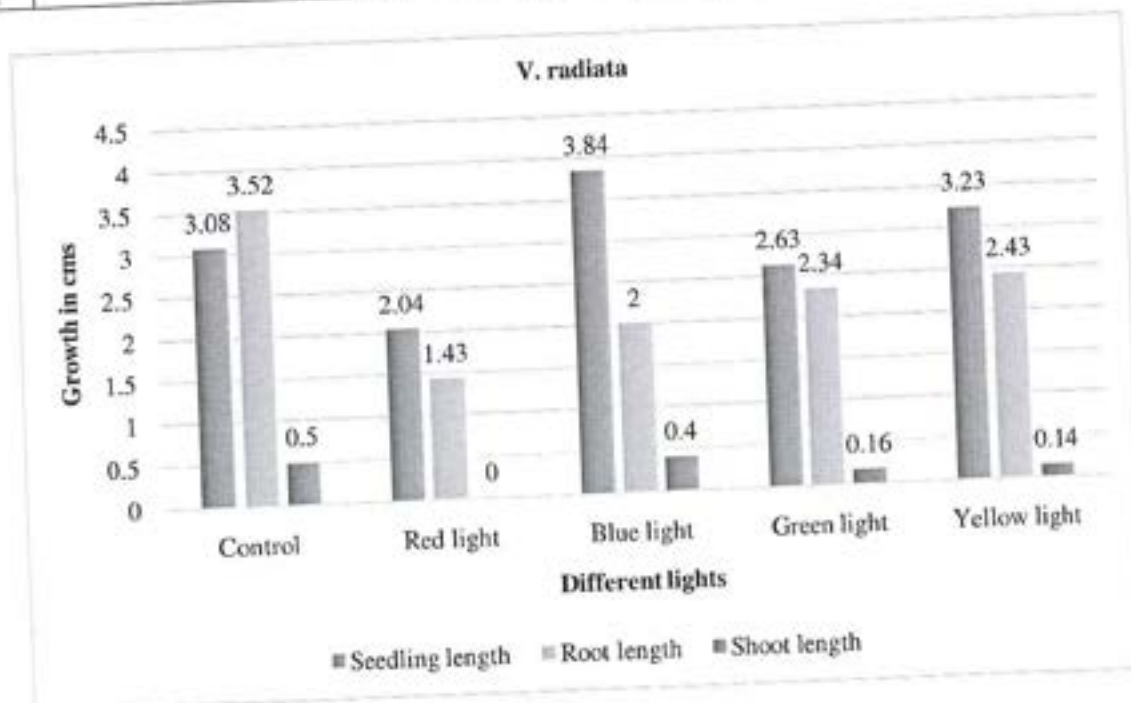
Fig. 1. Values of *V. radiate*.
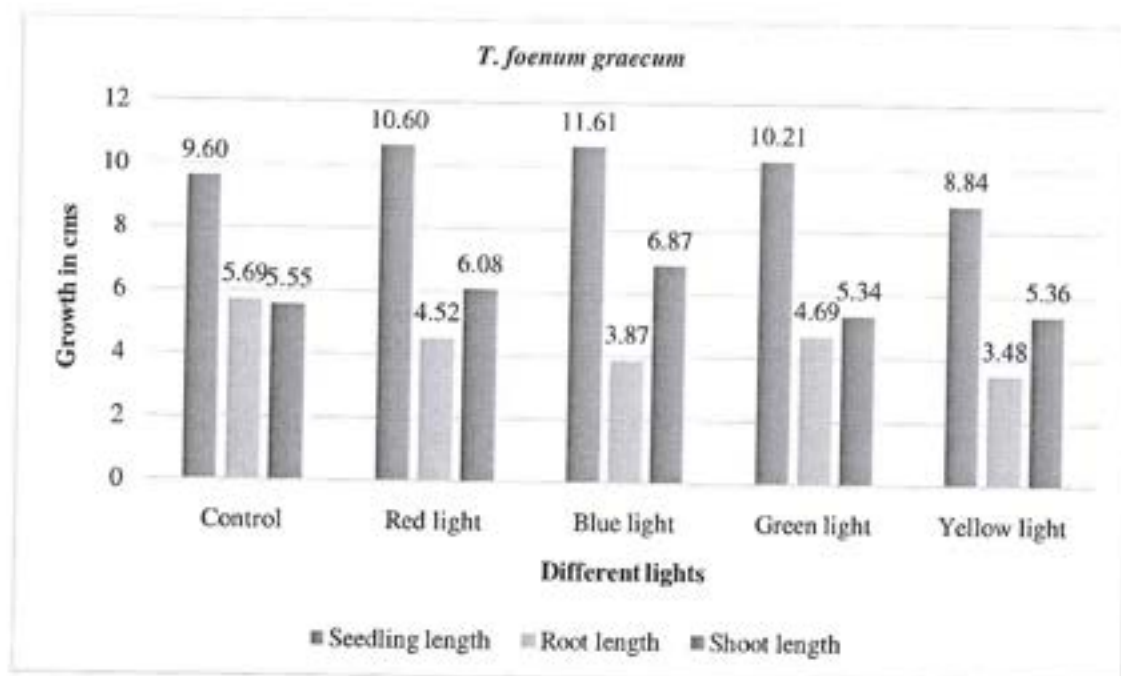
Fig. 2. Values of *T. foenum graecum.*

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! is only with the heart that one can see rightly; — what is essential is invisible to the eye.

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10

A Hermeneutical Analysis

Reading Kavita Kane's *Sita's Sister*

Swatti Dhanwni

The word hermeneutics refers to interpretation of texts that were written in another time or in context very different from the present one. It refers to how we read, understand and respond to ancient, canonical, sacred and theological texts. Originally, hermeneutics was understood as science of deciphering ambiguous passages in sacred texts however, over the time the scope of hermeneutics broadened. Hermeneutics develops a sympathetic understanding of the views, ideas and arguments that previously seemed to be alien. Thus, hermeneutics contributes to bridge the opposing viewpoints and accepting diversity at the level of meaning. Epics like *Mahabharata* and *Ramayana* have always been interpreted and understood from the traditional point of view. They are stories of good versus evil, Rama versus Ravana and Kauravas versus Pandavas. For most of us, these stories have heroes like Rama, Hanuman and Arjun. Women characters like Sita, Urmila, Draupadi, Mandodhari, Surpanaka have been largely ignored. Kavita Kane's novel *Sita's Sister* twists the popular version of Rama's exile and return to Ayodhya. The novel is the story of Sita's childhood, marriage, exile and return to Ayodhya from the perspective of her sister Urmila who was married to Lakshman. Through the protagonist Urmila, the paper aims to analyse the response of women characters to Rama's exile along with Sita her sister and her husband Lakshman which separated her not only from her sister but her husband too.

For the present study, I take up Kavita Kane's novel *Sita's Sister* which draws upon Valmiki's *Ramayana*. Kavita Kane is a former journalist, columnist who now works as a full-time novelist. She is the author of *Menaka's Choice, Lanka's Princess, The Fisher Queen's Dynasty* and the bestseller *Karna's Wife: The Outcast Queen*. Her latest work is *Ahalya's*

Awakening. Her novel *Sita's Sister* is the tale of four sisters – Sita, Urmila, Mandavi and Shrutakirti narrated by Urmila, one of the characters that has been largely overlooked. Urmila is the daughter of King Seeradhwaj Janak and his wife Sunaina. The king and the queen found a beautiful baby while ploughing the fields as a part of the *yagya*, a year prior to the birth of Urmila. They adopted the daughter and named her Sita-the child of *bhumi*. She was showered with titles like Janaki, Vaidehi and Mithila. Urmila never resented the favours showered upon Sita rather the two shared an intense bond of being sisters and friends. Sita, Urmila and her two cousins Mandavi and Shrutakirti were married to the four brothers Ram, Lakshman, Bharata and Shatrughana respectively.

Hermenutics does not encourage a tight closed system which refuse modification, rather heremenutical inquiry moves towards fresh interpretations. Creative dimension of hermeneutics is the receptivity of the hearer or the listener and to appreciate what we understand with sensitivity over the traditional method of scrutinizing the text (Thiselton 2009, 19). Thus we see that Valmiki's *Ramayana* is the oldest version of *Ramayana*. Though, it is not the only version of *Ramayana*. Many vastly different versions of *Ramayana* exist. A.K. Ramanujan in his famous essay Three Hundred Ramayanas: Five Examples and Three Thoughts on Translation, discusses about hundred versions of the epic. Some of the versions that deviate from the epic in terms of plot and character are *Adbhut Ramayana, Dasaratha Jataka, Paunachariya, Gond Ramayani, Ramakirti* and *Ramakien*. It has been adapted into various other regional versions like Kannada version in Karnataka, *Adhyatama Ramayana* in Kerala written by Thunchaththu Ezhuthachan in 16th century and *Kambarmayanam*, a Tamil version of *Ramayana* written by poet Kamban in 12th century also exists. To understand them one must understand the historical context that is when they were written and why they were written.

The traditional approach to Valmiki *Ramayana* has been male centred. i.e. to see Ram as the victim going to exile for fourteen years abiding by the promise his father King Dashratha made to Kaikeyi. In her work 'Feminist Criticism in the Wilderness' Elaine Showalter (2000) explains that one mode of feminist criticism is concerned with feminist as reader, providing feminist readings of texts which present stereotypical image of women in literature. One mode of feminist criticism was feminist as 'reader', offering feminist readings of texts. The second mode of criticism is woman as 'writers'. Thus re-writing the classical texts by women gives an opportunity to bring forth the female experience. Showalter is of the opinion that today the dominant mode of feminist criticism is the study of woman as writer which includes writing by women. She believes that feminist criticism has gradually evolved from

revisionary readings or critique of male-authored texts to an analysis of literature by women (309–10). *Sita's Sister* provides an opportunity to look and understand the ancient text from the perspective of the female characters. The novel is narrated by Urmila taking into account the sufferings of the women characters.

As soon as Sita mentions about accompanying her husband to the forest, Urmila is concerned about her safety as she would be exposing herself to unknown dangers. Lakshman too chooses Ram over Urmila. Thus, Urmila is rejected both by her husband and sister. She feels betrayed and left out.

'Both Lakshman and Sita had made their intention clear: they would be accompanying Ram and there was no room for any argument. Lakshman has forsaken her and Sita was going to leave the palace with Ram. The two persons whom she loved most had left her, without a moment's hesitation' (SS 142).

It is Sita who identifies Urmila's pain before she leaves for exile:

I bow to you, sister, for your vanvaas, your exile here in the palace shall be way harder than mine in the forest. Give me your strength and I know I shall succeed too (SS 153).

Urmila is deeply hurt and upset by Lakshman who refuses to take her with them, leaving her to take care of his old parents and family. Sita makes her understand that Lakshman has been able to take this decision only because he has faith in his wife. He knows that Urmila is a strong woman. Even before her marriage Urmila as a princess had been a scholar and a painter. She was the one who united all the four sisters.

On the demise of King Dasharatha and absence of any heir on the throne, Urmila plays the role of a wise daughter-in-law and takes charge of the kingdom. She is aware of the possibility of an attack from enemy kingdom and hence prepares the army for war. She not only has to look at the affairs of the palace but political concerns as well. She is the narrator of the novel and at this point she emerges as a strong character. The women characters in the epics have been presented as ideal women. However, the contemporary writers read in between the lines and bring out certain details which have been overlooked. The ancient literature has been now looked at from the perspective of women characters. The legend goes that Urmila remained asleep for the entire fourteen years when Lakshman, Ram and Sita were exiled. Kavita Kane interprets the sleep as a metaphor of loneliness and loss.

When Bharat on his return to Ayodhya is ready to join his brothers in exile, Urmila steps in to convince him not to leave Mandavi the way Lakshman left her. One should not overlook the plight of Urmila who is

separated from Sita and Lakshman but also the pain of Kaushalya and Sumitra who were separated from their sons. Urmila becomes the representative voice of the women who all were left behind to go through another form of exile.

Patrocinio P. Schweickart in the essay 'Reading Ourselves: Towards a Feminist Theory of Reading' (2000) explains that the study of male-authored classics has been largely androcentric or where women readers seem to accept masculine/patriarchal experience as the generalisation of human experience (433). Judith Fetterley, a scholar known for her work in feminism and women's studies stresses that a particular text affects a female reader and a male reader differently. She with the concept of resistant reading in 'The Resistant Reading: A Feminist Approach to American Fiction' (1978) argues that as readers women are taught to think as men and to accept as normal and legitimate a male system of values. She stresses that the reality is not the emasculation (deprive a man of his male strength) of men by women but the immasculation (perfectly clean or having no flaw or error) of women by men hence, excluding women's perspective and experience completely (qtd. in Schweickart 430). Thus, women characters in epics and ancient literature were regarded as ideal women. Women characters like Urmila, Mandodari, Srupanakha, Menaka have been largely ignored. The ancient literature has not been looked through the lens of woman's experience. The author in an interview says that she believes that while writing she is revisiting the story in a different way. She admits that all her protagonists are coomen about whom people do not know much. They play different roles and are intricate and complex characters.

When Bharat decides to stay in the forest until Ram's exile Urmila argues about his duty towards his wife. She in fact battles for the rights of Mandavi. She declares:

Today in this room we have talked about all sorts of dharma-of the father and the sons, of the king and the princes, of the Brahmin and the Kshatriyas, even of the wife for her husband. But is there no dharma of the husband for his wife? No dharma of the son for his mother? Is it always about the about father, sons and brother? (SS 219)

She questions yet again:

I ask again and again-does the man have no duties toward his wife and his mother? Why are the queens made to suffer the grief of parting from their sons? (SS 221)

Minor characters sometimes give us fresh interpretation to well-known plots. Thus, the author through the character of Urmila articulates the perspective of a woman to the decision of exile taken by Ram.

Feminist criticism steps into the process of reading with the view that the literary canon is androcentric and has damaged women readers. Elaine Showalter calls for feminist criticism that is women-centred, independent and intellectually coherent rather than looking up to critical theories based entirely on male experience put forward as universal. She coins the term gynocriticism to describe literary criticism based on the female perspective (311). Today, the emphasis on gynocriticism has made us develop a feminist criticism that is truly centred on women's experience. Urmila as the protagonist of the novel gives voice to the passions and sufferings of women who have to follow the decision taken by men whether it is Sita who chooses to go to with Ram, Urmila who is separated from Ram and Sita and Kaushalya and Sumitra who are separated from their sons Ram and Lakshman

Feminist readings of female texts are motivated by the need to connect and revitalize women writers, women readers and critics and to large community of readers. Thus, a gynocentric interpretation facilitates to open up space for discussion and strengthen the women's writing. Feminist criticism is situated in the larger struggle of patriarchy. Schweickart believes that the task of feminist critics has been 'recovering, articulating, and elaborating positive expressions of women's point of view, of celebrating the survival of this point of view in spite of the formidable forces that have been ranged against it' (439). The lives of the female characters seem to be governed by the men of the family. They are the victim of a promise that a husband made to his wife. Lakshman rightly raises the question of Dashratha's duty as a king, as a father and as a husband. Lakshman considered it his dharma to follow the footsteps of his brother. Urmila bravely and dutifully stands by his decision considering it as her dharma. Although, Sita, Lakshman and Urmila call their decisions as dharma yet one must not ignore that they are a part of the tradition where one must go by his words even if one loses his life. When Urmila, Bharat, Shatrugana and Kaikeyi reach out to the forest to bring them back Lakshman clearly says that Ram will never break the promise made to his father. Thus, there is no possibility of bringing Sita and Lakshman back.

Feminist critics have worked to disrupt the process of immasculation and disclosing the androcentricity which has been considered as universal experience. Therefore, feminist reading of male texts is important as the androcentric canon leads to androcentric interpretive strategies thus marginalizing gynocentric interpretation. Response and perspective of characters like Sita and Urmila are important in order to comprehend them fully. Hence, re-reading male-authored texts and rewriting such texts which take into account only male experience is essential.

Grant Osborne (qtd. in Thiselton) There uses the term hermeneutic spiral which denotes an upward and constructive process of moving from pre-understanding to fuller understanding and then returning back to review and need for correction or change in preliminary understanding. This pre-understanding and new understanding merges together to develop understanding of the whole picture. Hans Georg Gadamer argues that it is not possible to relocate the original meaning of a text. He is of the view that in order to understand one must understand the perspective of the text and of the author. He speaks of being open and listening to the text (qtd. in Thiselton 19).

The phase in which women turned writers demanded a rewriting of the canon of literature to include the voices of women who have been excluded from the canon. The perspective of the author Kavita Kane has been to look at the legendary plot from the perspective of Urmila who has been largely ignored though she has been one of the major characters and who if not more but atleast equally was suffering exile like Sita. The study of hermeneutics provides different perspectives to look at the text. Also, it helps us to read text without any assumptions or approaching it with certain expectations. As heremeneutics brings together different approaches and interrelated factors to understand the text. Hermeneutics is about plurality of interpretations. This helps us in forming sympathetic understanding of diverse arguments and views. Critics like Emilio Betti are of the view that heremeneutics fosters open-mindedness and receptiveness. It nurtures tolerance and mutual respect for disparate opinions (Thiselton 14). I conclude by saying that none of the interpretations of sacred texts can be called as more useful or less useful, feminist reading of this text can be one way of understanding the female perspective.

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CONTENTS

Health Care System: A Changing Scenario in Rajasthan

*Vijay Laxmi Gupta

Abstract

Development is a crucial issue for developing countries. Government are adopting various strategies to provide necessities of life to the people. Investment in social and physical infrastructure is a way towards development. Physical infrastructures include transportation, water supply, electricity, sanitation etc. This form of development has direct effects, and the changes can be visualized in short time. Investment in social infrastructure has indirect and long run effects. This include education, health, social change, art, and culture etc. Rajasthan is a state with huge population, illiteracy, several health care problems, social issues, and poor infrastructure. This paper focus on health conditions in Rajasthan which is an important sector of development. This paper also explains about the basic living conditions in the state. This aspect of health is having indirect and important impact on the development. The health conditions in state are analyzed with the help of some health parameters like birth rate, death rate, total fertility rate, concentration of health workers, maternal mortality rate, public expenditure on health sector and subnational human development index for the state and country. Findings states that there is positive relation between health and economic development. Implementation of national and state level schemes are also an effective factor through them health of people and entire health system has been improved.

Introduction

A better health status of population can be maintained not only by a good healthcare system, but it also needs improved basic conditions of life. The fundamental requirements for a healthy life include proper water supply and quality monitoring, sanitation system, cleanliness in surrounding, primary health education, food supply and nutrition, clean cooking fuel etc. Here government efforts are needed to aware people for basic hygiene and health. But the state is having worse condition of these necessities. State has adopted water policy in 2010 and several schemes are running to provide clean and regular supply of water. According to the NSSO (76 round), access to the principal source of drinking water of household within dwelling is 36.4% for Rajasthan and 37.3% for India and outside dwelling but within premises it is 26.6% for Rajasthan and 28.6% for India. When it comes to quality,

access to treated drinking water is 50.1% for rural and 59.6% for urban area in Rajasthan. It means in rural area around 49.9% and in urban area 40.4% of population is not getting quality and treated drinking water. On the other hand, at India level, 27.2% of rural and 49.1% of urban population is having access to treated water. From sanitation point of view, access to bathroom by the household in rural area is 65.3% in Rajasthan and 56.6% in India. For urban area it is 94.1% and 91.2% for Rajasthan and India respectively. So still around 27% population in Rajasthan and 31.5% population in India do not have bathroom. Access to latrine by household in rural area is 65.8% and in urban area is 95.5% in Rajasthan while it is 71.3% in rural and 96.2% in urban area in India. So, condition in urban area is quite better and for Rajasthan it is almost equal to the national level. Household who do not have access to latrine is 26.3% in Rajasthan and 20.2% in India. Household who is having access to both bathroom and latrine in Rajasthan is only 66.5% and 61% in India. In the case of fuel used in cooking, only 48.1% household use LPG in Rajasthan and 61.4% use LPG in India. Around 50.3% and 36.8% household use firewood, drunk cake and other material in Rajasthan and India respectively.

This analysis provides us an idea about the living conditions in state and nation. There is definitely a link between health and quality of life and surrounded environment that include water, sanitation, cleanliness, cooking fuels, air etc. A large Population is not having access to basic needs like clean water, clear air, sanitation facilities, non-polluted cooking fuels etc. Apart from these necessities, in modern time blind development is also creating health problems. There is need of basic safeguards before establishing industries and plants, industrial areas, and economic zones, developing residential areas and institutions on forest land and for any kind of developing or industrial activity. Manufacturing sector is the backbone for economy, but environmental considerations are must. Avoiding all these factors have an important role for a healthy life and without them they may create several health problems and a heavy burden on health services. This environmental health is indeed a need for healthy life.

Mental health is also an important aspect of health system. Mental illness and other mental health related diseases are greater in developing nations. The required infrastructure for treating mental health problems is very poor. Practically in many cases due to prevalent superstitions it is not considered as disease itself. Central government has introduced National Mental Health Program (NMHP)) in 1982 to face this huge burden of mental illness and expert health workers. District Mental Health Program was added in 1996 and the whole program was restructured in 2003 to modernize the mental hospitals and improve the condition of psychiatric departments in hospitals.

A sound health system is needed for the good working of society and for the development of state. According to the WHO "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". A healthy person has high working efficiency, long working capacity, high productivity for the society and less burden on state resources. Since Rajasthan is having huge population and mass poverty, an efficient health system is needed to provide good and required services to its people. Rajasthan is one among the highly focused state for the national rural health mission. The health policy primarily focuses on the weaker and needy

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section of society. There are several initiatives and programmes have been started by the government to provide assistance to people. Some of the major schemes in recent past are Mukhya Mantri Nishulk Dava Yojna (2011), Mukhya Mantri Nishulk Janch Yojna(2013), Rajasthan Janni shishu Suraksha Yojna (2011), Rastriya Bal Swasthya Karykram (2013), Dhanvantari 108 Toll free Ambulance Yojna (2008), Bhamashah Swasthya Bima Yojna (2015), Ayushman Bharat-Mahatma Gandhi Rajasthan Swasthya Bima Yojana (2019) Janta Clinic (2019), Nirogi Rajasthan abhiyan(2019) etc. These recent changes played a very prominent role to enhance the health services not only in urban but also in rural and remote areas of the state. make the healthcare system more focused, efficient and reachable.

Both public and private sector have an important role in developing and providing health services to the people. Public sector hospitals definitely play most important role as they provide cost effective treatment and work on no profit motive. Their main aim is to provide healthcare to all the people in equal manner. The public healthcare system is a three structured system that include a network of Sub-centers and Primary Health Centers (PHC) at the primary level, Community Health Centers (CHC), sub-district hospitals and district hospitals at the secondary level, and teaching hospitals and healthcare institutions at the tertiary level. The hospitalization cases in government hospitals are 50.8% (rural) and 49.7% (urban) while for private hospitals, cases are 48% for rural and 48.5% for urban areas. Government also run all the programs, schemes, relief plans effectively through them. Public and private sectors are also working together in PPP (public private partnership) mode to make health services affordable, easy to reach. State government first started to operate PHC in PPP mode in June 2015. Initially around 90 PHC were given to run. After that, control of 30 PHCs and 153 Subcenters from 12 districts were given to the Wadhwani Initiative for Sustainable Healthcare (WISH) Foundation. The role of government in the partnership is to provide basic infrastructure, medicines, tools and surgical equipment and financing the cost of operating the clinic. Private sector arranges the doctors and other staff and regulate the clinic. They mainly provide radiological and diagnostic services, supply of medicines, laundry etc.

Objective

1. To study the current status of health indicators in Rajasthan.

2. To analyze the medical and health sector public expenditure.

3. To compare the concentration of health workers in different states.

4. To study the relation between health and development.

Methodology

This study is based on secondary data sources such as NSS surveys, working paper series, journals and different reports of state and central government etc. Related articles and research papers also helped in framing the concrete views regarding the topic.

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Table-1
Public Expenditure in Rajasthan

Year	Provision for Medical and Health Sector (Including Ayurveda)
2011-12	Rs. 663.53 Cr
2012-13	Rs. 1008.24 Cr
2013-14	Rs. 1780.35 Cr
2014-15	NA
2015-16	Rs. 6063.04 Cr
2016-17	Rs. 6047.42 Cr
2017-18	Rs. 5843.20 Cr
2018-19	Rs. 7816.53 Cr
2019-20	Rs. 8445 Cr#
2020-21	Rs. 8769.51 Cr

Source: Budget at a Glance, Rajasthan. Directorate of Economics and Statistics. (various issues)

#: Rajasthan Patrika

Table-2
Maternal Mortality Rate

Year	Rajasthan	India
2001-03	445	301
2004-06	388	254
2007-09	318	212
2010-12	255	178
2011-13	244	167
2014-16	199	130
2015-17	186	122

Source: NITI Aayog (www.niti.gov.in)

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Table-3
Health Indicators

Year	Total Fertility Rate (TFR)		Crude Death Rate (CDR)*		Crude Birth Rate (CBR)*		Infant Mortality Rate (IMR)	
	Raj	India	Raj	India	Raj	India	Raj	India
2005	3.7	2.9	7.6	8	30.3	24.3	67	57
2006	3.5	2.8	7	7.6	28.6	26.8	65	55
2007	3.4	2.7	6.9	7.5	28.3	23.5	63	53
2008	3.3	2.6	6.8	7.4	27.9	23.1	59	50
2009	3.3	2.6	6.8	7.4	27.5	22.8	55	47
2010	-	-	6.7	7.2	26.7	22.1	52	44
2011	3.0	2.4	6.7	7.1	26.2	21.8	49	42
2012	2.9	2.4	6.6	7	25.9	21.6	47	40
2013	2.8	2.3	6.5	7	25.6	21.4	46	39
2014	2.8	2.3	6.4	6.7	25	21	43	37
2015	2.7	2.3	6.3	6.7	24.8	20.8	41	34

Source: NITI Aayog (www.niti.gov.in)
*Rajasthan at a glance (SIHFW)

Table-4
Concentration of Health Worker (% as Fraction of National Total)

State	Rajasthan	Gujarat	Karnataka	Madhya Pradesh
Population (Lakhs)	565.1	506.7	528.5	603.5
Population Share (%)	5.49	4.93	5.14	5.87
Allopathy Doctor	3.67	3.50	5.98	4.83
Ayurveda Doctor	6.27	6.82	4.56	6.57
Homeopathy Doctor	1.12	3.56	1.44	1.99
Unani Doctor	2.91	0.97	2.56	2.01
Dental Practitioner	4.75	4.49	8.24	2.69
Nurses and Midwifes	4.38	4.02	5.25	2.69
Pharmacists	6.24	6.71	2.90	5.87
Ancillary Health professional	1.74	3.59	6.53	5.11
Traditional and Faith Healer	5.84	13.86	1.16	1.04

Source: The Health Workforce in India,
Human Resources for Health Observation Series 16 (WHO)

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Table-5
Subnational Development Index

States	1990		2017	
	Index	Rank	Index	Rank
Kerala	0.54	2	0.77	1
Goa	0.55	1	0.75	2
Punjab	0.49	6	0.72	3
Rajasthan	0.40	22	0.62	20
Madhya Pradesh	0.40	21	0.60	23
Uttar Pradesh	0.39	24	0.59	24
Bihar	0.38	25	0.57	25
India	0.43	-	0.64	-

Source: SBI, Ecowrap, March 08, 2019

Analysis

Table 1 shows the trends in public expenditure in Rajasthan for the medical and health sector (including Ayurveda). The table shows the time period of 10 years from 2011-12 to 2020-21. There is continuous increase in the expenditure of medical sector in these years. Health is one among top priority for the government and so more spending on health facilities and to make them available to each and every citizen. During 2011-12 the public expenditure was Rs. 663.52 cr and during 2015-16 it was Rs. 6063.04 cr. This shows a tremendous rise of around RS. 6000 cr in the duration of only 5 years. For year 2020-21, it was 8769.51 cr. It was a hike of around 2700 cr from year 2015-16.

Table 2 points out about the maternal condition in Rajasthan and India between the time period from 2001 to 2016. Maternal Mortality Rate (MMR) shows number of maternal deaths per 100000 live births. During 2001-03, MMR was 445 for Rajasthan and 301 for India. This shows a wide gap between state and nation. Table shows continuous decline in MMR throughout the period. For 2011-12, it was 255 for Rajasthan and 178 for India. Still there is quite large difference in both the region. During the period 2015-17, MMR was 186 for state and 122 for nation. Across the country, Kerala have lowest MMR (42) followed by Maharashtra (55) for 2015-17. According to United Nation, globally MMR is targeted to reduce lower than 30 per lakh live birth up to 2030. But for India it is like impossible goal to achieve a lot more need to be done to reach near to this. There is a decreasing trend in MMR and the gap is also continuously reducing.

Table 3 presents a study of basic health indicators that include TFR, CBR, CDR, and IMR. These are the parameters through health status can be easily analyzed. The table shows measured value of the

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indicators for 10 years from 2005 to 2015. All of them show a decreasing trend which reflect improvement in health services, living conditions, basic health knowledge, awareness etc. The study points out that Rajasthan is having slightly higher measurement than national average. TFR in Rajasthan in 2017-18 is also 2.7 and it did not show any change from last year. According to NITI Aayog report, Rajasthan is still in the category of states having highest TFR.

Table 4 reveals the concentration of health workers in Rajasthan and few other states like Karnataka, Gujrat, and Madhya Pradesh. These states have approximate equal share of population, so it is convenient to compare them. Karnataka is having highest Percentage share of Allopathy doctors but lowest in Ayurveda doctors. Gujrat have highest share of Ayurveda doctors and then Rajasthan follow. So, for both these categories Rajasthan is in between among given states. In case of Homeopathy, Gujrat is on the top and Rajasthan is on lowest place, but both the other states are also nearly equal to Rajasthan. Unani doctors is the only category in which Rajasthan has highest share and Gujrat is having lowest. For dental practitioner, Rajasthan is on second position and Karnataka is having highest share and much higher than other states. In case of both Nurses &Midwifes and Ancillary health services, Gujrat is on the top. For Ancillary health service Rajasthan is at lowest position and this shows that state is having very poor diagnostic and support services to help health workers. For Pharma and Traditional Healers Rajasthan is in the middle and doing well yet there should be more focus on traditional ones.

Table 5 indicates the position of different states for subnational Human development Index in year 1990 and 2017. The Index is having education, health and standard of living as basic parameters. The table shows a hike in index for the states but it does not show much change in rank. Kerala and Goa are having top two positions in 2017 same as 1990. Punjab is showing an improvement this time from 6th rank to 3rd rank. Bihar and U.P. are having least Positions as before. For M.P. there is worse condition and for Rajasthan a slight upliftment but not satisfactory. Rajasthan is still one among lowest ranking states and even after more than 25 years, state is not in good position for human development.

Conclusion and Recommendations

The relation between health and development is the positive and prominent. Good health leads to high productivity, increased working efficiency, greater income, high demand etc. A healthy person is not only free from any kind of physical illness but he should be mentally fit. Rajasthan is working hard to improve its health care system. Expenditure on health in continuously rising and central government is also providing funds to state governments and related agencies. Both the governments have started different programs for neonatal, child, maternal and reproductive health, nutritional programs, programs for the prevention from communicable and non-communicable diseases and schemes to improve health structure and management.

Rajasthan has improved a lot in the field of health care system. There is gradual fall in DR, BR, TFR, MMR and IMR. Women health has shown a positiveness and government has focused to provide

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better hospital and health services to them. This reflects the improved health services for pregnant women, proper checkups and nutrition during pregnancy period, vaccination, identification of high-risk pregnancies, encouraging the child birth in hospitals etc. women and child health is the most important pillar of a state health scenario and the analysis shows that the health policies and schemes are definitely working in that direction. The availability of medical professionals and health workers is also showing a comparativeness with other states. State has lack of doctors, health workers, hospitals, number of beds, infrastructure, equipment and other required facilities and state is quite behind as per WHO norms and developed regions. The basic living conditions are also not favorable and there is a lot to change. According to UNDP's human development index ranking India was at 130th place among 189 countries. It's index has been increased from 0.427 to 0.640 but still country has poor indicators of life. The other health measures like sanitation, clean water, nutritious food, good living conditions, health education etc. are also having a projecting impact on the health and so on development. State has many schemes like Swachh Bharat Abhiyan for sanitation, AMRUT Mission for better living conditions, Mid-Day Meal and Akshaya Patra for food etc. But these efforts are not sufficient and need more attention.

Both state and central government need to work on improving basic health conditions. The rural areas need more emphasis as these areas are facing challenges at most. Maternal and child health should be primarily focused as it directly effects the future of economy. Rajasthan is having high mortality rate for both mother and child despite its long-time efforts and several launched schemes. Infant mortality rate in different age group is also a matter of concern. Apart from providing health services to the diseases, state should also create awareness, implementation of concrete master plan for better living conditions, spread of health education in the society, attracting the medical professionals in rural areas etc. Improving the basic health in the state is indeed a long-term need but in the current scenario where new kind of diseases are continuously coming on regular basis, the focus should be on research and development. More fund and attention should be for health and allied sectors.

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Fertility Lifetables of Glasshouse Whitefly *Trialeurodes vaporariorum* (Westwood) on French Bean cv. Contender at Different Temperatures

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Abstract

Fertility Life tables and characteristics of the *Trialeurodes vaporariorum* (Westwood) were assessed on French bean cv. Contender at different temperatures 15, 20, 25 and 30 °C. The life table analysis showed that the females lived for a maximum of 58 days at 15 °C. The trend of oviposition showed a peak on 32nd day at 25 °C as the highest number of eggs produced per female per day was 9.98. The true intrinsic rate of increase (r_m) values were 0.123 and 0.121 at 20 °C and 25 °C, respectively. The rate of natural increase (r_c) was 0.120 at 20 °C and 25 °C. The highest net reproductive rate (45.86) was obtained at 20 °C. The population doubling time (DT) was maximum (10.42 days) at 15 °C and minimum (5.64 days) at 20 °C. Generation time was 47.17 days at 15 °C which decreased to 24.82 days at 30 °C.

1. Introduction

Vegetables constitute an essential component of a balanced diet and play a vital role in the maintenance of good human health. Pest infestation and related diseases are major constraints in vegetable production. The warm temperature of spring and summer brings a flush of new foliage growth which attracts a wide variety of pestslike sap suckers foremost being whiteflies which can cause serious damage to crops worldwide (Peric, 1994).

The whiteflyis an important insect pest on a global scale, attacking a wide variety of agricultural commodities especially in vegetable and ornamental crops including citrus, squash, poinsettia, potato, cucumber, grape, tomato, hibiscus etc. (Van Lenteren and Martin, 2000). *Trialeurodes vaporariorum* (Westwood) commonly known as glasshouse whiteflyis a polyphagous pest. It was first described as *Aleurodes vaporariorum* (Westwood, 1856) from whiteflies collected from tomato in glasshouses throughout Europe (Quaintance, 1900). In India, it was reported at Thumantty (Nilgiris) infesting potatoes (David, 1971). The nymphs and adults suck the vital sap from the foliage which reduces photosynthetic activity of the plants (Yamada et al., 1979). The damage is inflicted by yellowing of leaves which later fade and dry away (Baker, 1922). The honeydew secreted by nymphs and adults of whitefly results in sooty mould which makes plants unsightly and valueless (Garman and Jewett, 1992; Johnson et al., 1992; Omar et al., 1992; Liu et al., 1993) and also reduces photosynthetic activity of the plants (Yamada et al., 1979; Tosh and Brogan, 2015).

Although whiteflies themselves can cause significant crop damage, *T. vaporariorum*-vectored viruses can cause losses that are much more economically damaging than those resulting from vector feeding alone (Byme et al., 1990). The viruses have been found to be transmitted by *Trialeurodes*, all within the genus Crinivirus (Wisler et al., 1998; Wisler and Duffus, 2001).

The whitefly species like *Bemisia tabaci* (Gannadius) and *T. vaporariorum* are serious pests of large cultivated crops throughout the world and in India, it poses potential threat to the cultivation of highly remunerative crops like tomatoes, beans and cucurbits. Since French bean is a short duration (85-90 days) crop, it fits as a component of intercropping and sequence cropping in many of the agro-climatic zones.In India, French bean is cultivated in 137.54 thousand hectare with production of 1370.21 thousand tones and productivity of 478 kg ha^{-1} (Saxena et al., 2015). The pests that attack French beans at different growth stages include white flies, pod borers and leaf miners (Lohr, 2006). Since, the construction of life

fertility tables is vital for determining the inherent capacity of an insect to increase in numbers and understanding population dynamics of a species (Phadke,1982). Hence, keeping in view the serious nature of the pest and potential threat it poses to the cultivation of highly remunerative crops like tomatoes, beans and cucurbits, an attempt was made in the present study to critically assess the reproductive potential of *T. vaporariorum* on French bean cv. Contender. The calculation of growth rate statistics is, therefore, a value for determining the growth potential of whitefly population under a given set of environmental conditions. The present study will enable us to know their potential in different temperature conditions.

2. Materials and Methods

All experiments were conducted at the Department of Entomology, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh in climatic chambers operating under controlled conditions (15, 20, 25 and 30 °C). The culture of whitefly was raised in the laboratory on French bean cv. Contender. The French bean seedlings were grown in disposable cups and after 6-7 days of emergence, transferred to rearing cages (40×30×40 cm³). The adults were released on the seedlings. The pots were taken out and leaves were observed under the microscope for egg laying activity of the insects.

After egg laying, the eggs were marked withpointed tip permanent Faber castle make markers,then the seedlings were taken out and covered with glass chimney (20×15 cm²). The top of the chimney was covered with muslin cloth. The effect of temperature on the development of whitefly was studied in BOD incubators maintained at four constant temperatures i.e.15, 20, 25, 30 °C. A photoperiod of 14:10 (L:D) and relative humidity of 70% maintained at all the temperatures and replicated ten times. Daily observations at all temperatures were taken. The age specific survival (l_x) and age specific fecundity (m_x) at each pivotal age (x) were worked out daily for entire reproductive period to prepare fertility table as per the details given by Andrewartha and Birch (1954) and Southwood (1978).

Life table was constructed using the following column of parameters:

X: the pivotal of individuals (days)

l_x: the number of surviving individuals at age X

m_x : the number of living females born per female in age interval X(fecundity rate)

The reproduction rate: GRR $= \Sigma\, m_x$

Net reproduction rate of increase: $R_0 = \Sigma\, l_x m_x$

Approximate generation time (in days) $T_c = \Sigma\, X\, l_x m_x / R_0$

True generation time (in days): $T = \log_e R_0 / r_c$

The innate capacity for increase: $r_c = \log_e R_0 / T_c$

True Intrinsic rate of increase: $r_m = \Sigma\, e^{-r_m x}\, X\, l_x m_x$

Finite rate of increase: $\lambda = $ antilog$_e r_m$

Population doubling time: DT $= \log_e 2 / r_m$

Weekly multiplication rate: WM $=$ antilog$_e r_m^7$

3. Results and Discussion

The age specific survival and age specific fecundity is illustrated graphically (Figure 1-4), the perusal of which revealed reproductive potential of *T. vaporariorum* at different temperatures. The whitefly had a maximumlife span of 58 days at 15 °C and pre-oviposition period was of 39 days. The oviposition started on 43rd day and maximum fecundity (6.80) was on 49th day (Figure 1). At 20 °C, lifespan was 42 days of which immature stage occupied 24 days. The oviposition started on 27th day and maximum age specific fecundity (9.66) was attained on 34th day, respectively (Figure 2).The fertility statistics at 25 °C revealed that oviposition lasted for 15 days and female contributed highest egg production (9.98) on 7th day of oviposition. The egg laying ceased on 41st day of pivotal age (Figure 3). At 30 °C, the total lifespan of *T. vaporariorum* was 32 days and immature stages lasted for 20 days. The oviposition started on 22nd day and lasted for 8 days, the maximum fecundity (4.35) was on 25th day (Figure 4). At all temperatures, the mortality mostly acts heavily on old individuals and was almost constant with time. Works done by

Figure 1: Daily age specific survival and age specific fecundity of *T. vaporariorum* on French beans cv. Contender at 15±1°C

Figure 2: Daily age specific survival and age specific fecundity of *T. vaporariorum* on French beans cv. Contender at 20±1°C
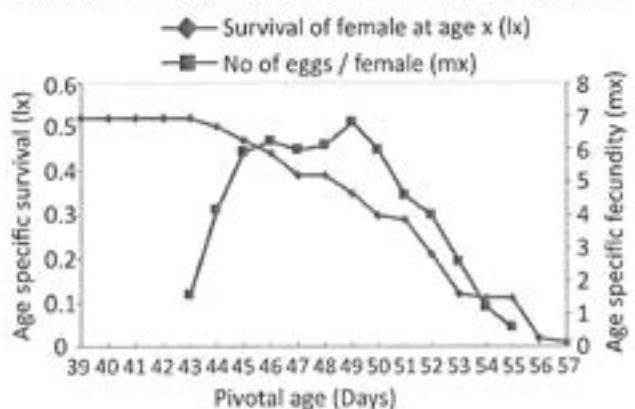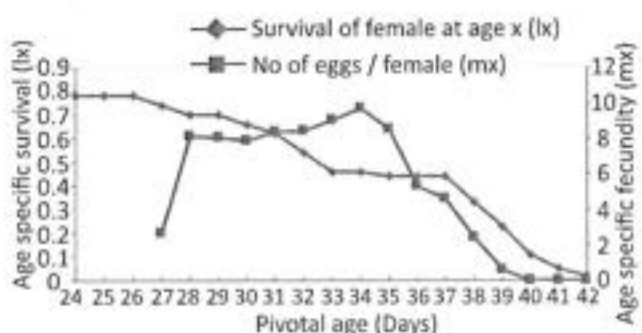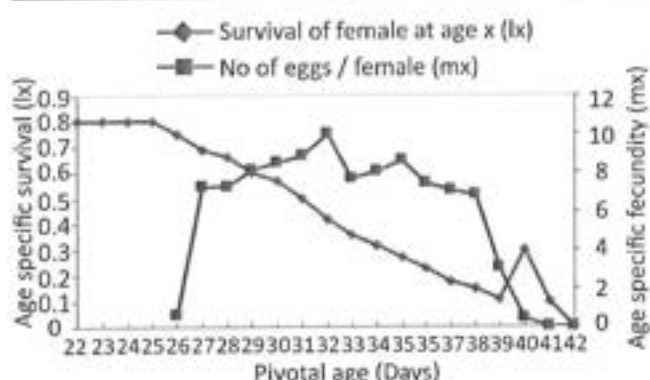
Figure 3: Daily age specific survival and age specific fecundity of T. vaporariorumon French beans cv. Contender at 25±1 °C
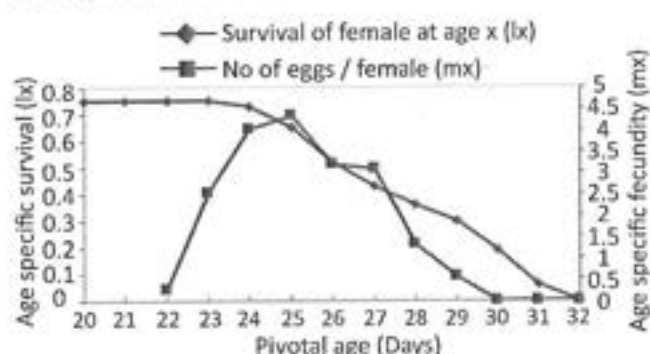

Figure 4: Daily age specific survival and age specific fecundity of T. vaporariorum on French beans cv. Contender at 30±1 °C

Verma et al. (1990) are in consonance with the present work.

Fertility table statistics of T. vaporariorum on French bean at different temperatures presented in Table 1 revealed that the higher net reproductive rate (R₀) was at 20 °C and 25 °C. The temperature below 20 °C and above 25 °C decreases the whitefly population. Rodriguez et al. (2005) made a generalization regarding climatic conditions that T.vaporariorum is absent in the area where RH is higher than 80% but other whitefly species like Bemisia tabaci (Gennadius)

biotype B are present on vegetable crops.

This observation is supported by findings of Burnett (1949) who reported the maximum fecundity between 18 and 21 °C and maximum female longevity at 15 °C with very short survival at 9°C and temperatures over 27 °C. These results are corroborated by the work done byVerma et al. who studied the life cycle of the whitefly and concluded that temperature ranges from 23 to 30 °C provided optimal conditions for development of T. vaporariorum .

The gross reproductive rate (GRR) of T. vaporariorum was 55.71, 87.69, 100.22 and 19.34 while net reproductive rate was 19.99, 45.86, 40.83 and 11.50 at 15, 20, 25 and 30 °C, respectively. The difference in gross and net reproductive rate may be attributed to mortality of the parent female before reaching the maximum reproductive age at the respective temperature. The whitefly completed one generation (T₂) in 34.78 days at 15 °C, 31.66 days at 20 °C, 31.03 days at 25 °C and 24.90 days at 30 °C. The temperature was inversely proportional to duration of development. Yano (1988) while working on survival rate of T. vaporariorum adults also found that at low temperatures the survival capacity of the fly reduced considerably.

The innate capacity of natural increase (r₂) gives the actual rate of a species with no overlapping of generation and is derived from survival rate and reproductive performance of a cohort of females. It was found that the r₂ was maximum (0.120) at 20 and 25 °C. This was attributed to the fact that the intrinsic rate of increase (rₘ) gives response of an organism to a particular set of environmental conditions and therefore, it gives a precise estimate of the reproductive capacity of a species (Birch, 1948; Bursell, 1964; Macfadyan, 1963 and Messanger, 1964). It was observed that maximum rₘ value (0.123) was at 20 °C and the nearly same value of rₘ (0.121) was at 25 °C. Calvitti and Buttarazzi (1995) also reported the similar rₘ value (0.121) of T. vaporariorum population on marrows.

The higher rate of finite increase (λ) was 1.13 per female per day at 20 and 25 °C. The population multiplied weekly 1.57,

Table 1: Fertility table statistics of T. vaporariorumon French beancv. Contender at different temperatures.

Tempera-ture (± °C)	Growth rate parameter								
	GRR	R₀	T₂	r₂	rₘ	T	λ	WM	DT
15	55.71	19.99	34.78	0.086	0.064	47.17	1.07	1.57	10.83
20	89.69	45.86	31.66	0.120	0.123	31.10	1.13	2.37	5.64
25	100.22	40.83	31.03	0.120	0.121	30.60	1.32	2.33	5.73
30	19.34	11.50	24.90	0.098	0.098	24.82	1.10	1.99	7.04

2.31, 2.33 and 1.99 times at 15, 20, 25 and 30 °C, respectively and doubling time was maximum at 15 °C (10.83) and minimum (5.64) at 20 °C. No such work appears to have been carried out at constant temperature. However, Yano(1989) studied the effect of two temperature regimes 24 and 30 °C during the day time and 10 and 25 °C during night on population growth of T. vaporariorum on tomato and concluded that

low temperature regimes decreased survival rate of eggs and larva and the higher temperature increase the intrinsic rate of natural increase. Yano (1988) also found that survival rate of T. vaporariorum adults reduced at low temperature. Recently, it was found that T. vaporariorum possesses less tolerance to higher temperatures than B. tabaci biotype B, probably linked to the expression of heat shock protein genes

(Wan et al., 2009).

4. Conclusion

This study provides important data for understanding the population dynamics of *T. vaporariorum*, for development of potential population dynamic models and pest forecasting. Further, the whitefly population growth model can be used to evaluate effects of intended changes in the cropping system, e.g., of changes in climate and crop species or cultivar on whitefly development. Result of this study indicated that optimum temperature for population growth of *T. vaporariorum* was between 20 to 25 °C, so early sowing of French bean can help the crop escape the onslaught of this pest.

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Contents

An Ecocritical Approach to Henry David Thoreau's *Walden*

Dr. Swatti Dhanwni*

Abstract

Ecocriticism is an interdisciplinary concept that studies environment through literature. The term ecocriticism was coined in 1978 by William Rueckert in his essay "Literature and Ecology: An Experiment in Ecocriticism" which investigates the critical writings that explore the interrelation between all forms of plant and animal life to humans. In the middle of the nineteenth century many American writers like Henry David Thoreau and Ralph Waldo Emerson talked about the threats posed by urbanization and industrialization to the environment. Henry David Thoreau the great American writer and environmentalist in his classic work *Walden* (1854) records his impressions as he rejects the city life, goes in the woods and builds a small hut near the Walden pond to live close to nature. Thoreau liberated himself from the trappings of city life to "live deep and suck the marrow out of life". He wanted to live life simply without "modern improvements". *Walden* records the aesthetic experience of nature which is lost when work dominates lives. This paper aims to bring forth Thoreau's critique of contemporary attitude of consumerism and materialistic approach of man towards nature.

Keywords: Ecocriticism, Nature, Anthropocentricism, Environment.

Nature has been represented in literature from the very beginning. Pastoral form of poetry inaugurated by the Greek Theocritus in the third century B.C depicted ideal rural life, beautiful landscapes, life of simplicity, harmony and peace which were lost in the urban society. The nature writing form with detailed description of environment was initiated in England with Gilbert white's *Natural History and Antiquities of Selbourne* (1789). This tradition was further carried by Romantic writers especially Wordsworth who viewed Nature as a teacher source of inspiration and worshipped nature. By the mid of the nineteenth century, writers like Thoreau called for attention to the depletion of natural resources and conserving the environment. Writers like John Muir and John Burroughs advocated

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for preserving American wilderness. It was under this climate of environment crisis ecocriticism was initiated.

Ecocriticism developed from the traditional approaches about the treatment of nature in literature such as nature writing practiced by American writers like Thoreau. The term ecocriticism was introduced in 1978 by William Rueckert in his essay "Literature and Ecology: An Experiment in Ecocriticism" which investigates the critical writings that explore the interrelation between all forms of plant and animal life to humans. Later in 1989 Glen A. Love called for "an ecological literary criticism" in his address to the Western American Literature Association. His inspiring words laid the foundation of Association for the Study of Literature and the Environment (ASLE). The association represents a movement where ecocritics re-examine not only the Eurpoean tradition of nature poetry and the nineteenth century American literature but they also re-examine literature written across the globe from environmental perspective. However, some critics also turn to texts that embody green values. Critics like Jonathan Bate refer to English Romantic poetry as containing environmental awareness. The focus area of ecocritics have not only been poetry and non-fiction writing but also epics, stories, dramas and sacred texts.

Henry David Thoreau (1817-62) is now regarded as a classic in American literature, an environmentalist and a conserver of nature. He was a resident of Concord which was also the centre for Transcendentalism. His journal *Walden* has received wide critical praise and appreciation. Thoreau was intellectual companion to Ralph Waldo Emerson another great literary figure of American Literature and a transcendentalist. Both went for long walks in forests for Thoreau loved being in woods, fishing and exploring the countryside around Concord. Thoreau's philosophy and his methods inspired Gandhi's Civil Disobedience movement.

Thoreau had no steady source of income but whenever he was in need of money he turned to odd jobs like carpentering, school teaching, gardening, pencil making, lecturing and surveying. E.B. White in "Concerning Henry Thoreau" observes: "Although he had the

curiosity of a naturalist and the drive of a reformer, Thoreau believed that the big thing was not to create a better mousetrap, or a better lead pencil, or even a better book, but a better man." (Thoreau xv).In 1840, Thoreau made up his mind to live alone in the woods, close to nature. In July 1845, he went to stay in the woods and stayed there until September 1847 and the result was *Walden* which he subtitled as 'Life in the Woods'. The time he spent in woods near Walden pond was an experiment in living that Thoreau conducted. The time of two years gave him ample opportunity to observe nature and his own soul, to read, write, work on field and live with nature. Later, he condensed the experience of two years to one year for artistic unity.Thoreau wanted to live simple life close to nature and away from society in which "the mass of men lead lives of quiet desperation." Thoreau clearly states his purpose of going to live in woods near Walden pond "was not to live cheaply nor to live dearly there, but to transact some private business with the fewest obstacles".(13) Further he adds, " I wanted to live deep and smuck out all the marrow of life." (66)*Walden* clearly shows that Thoreau lived in a perfect harmony with nature for two years. In the chapter, Economy which lays the foundation of the work, Thoreau suggests that we should look more closely at the way we manage our time and money, and the way we manage our lives. Thoreau believes that man has reduced himself to a machine and is more engaged in "factitious cares" and "coarse labours" and misses out to enjoy the fine things of life.

Arthur Compton Rickett in *A History of English Literatur* notes that the *Walden* episode represented the totality of Thoreau' life. He writes that Thoreau went to Walden not to escape life but t fit himself for ordinary life. Thoreau had touch of wildness in h nature which made simple life attractive to him and especially critic: of modern civilisation. Hence, life in woods came naturally to him. 1 any man luxuries and comfort mean so much but Thoreau remaine indifferent to them. Compton writes that "He saw even more clear than Emerson the futility and debilitating effect of extravagance at luxury- especially American Luxury" (640).

Thoreau believes that man is most concerned about three thin

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in his life- i Food ii. Clothing iii. Shelter and iv. fuel. Man works hard to obtain these necessities of life. He gives a list of things needed for survival like knife, axe, lamplight, stationery, books all obtained at a small cost. Man needs fuel only to prepare food. Fuel apart from cooking is then unnecessary. Yet some wise and rich need fuel to keep their body warm during winters. They work hard throughout their lives to finally die in their native land. Thoreau believes that the comforts of life for which man works hard or one may say spends his whole life to acquire are actually not indispensable but hindrance to what Thoreau calls " elevation of mankind". E. B White believes that in *Walden* Thoreau "took man's relation to Nature and man's dilemma in society and man's capacity for elevating his spirit and he bet all these matters together, in a wild free interval of self –justification and delight and produced an original omelette from which people can draw nourishment in a hungry day." (Thoreau viii) Thoreau considers that clothes should not be the criteria for judging a man. He himself never underestimates a man by the patch on his clothes. A man should not be eager to wear fashionable clothes rather it is more important for a man to have sound conscience. Thoreau in fact writes " I say, beware of all enterprises that require new clothes, and not rather a new wearer of clothes. If there is not a new man, how can the new clothes be made to fit?". He calls clothes only as "outmost circle" and "mortal coil" (16).

Richard J Schneider in *Thoreau's Sense of Place: Essays in American Environmental Writing* maintains that Thoreau falls in the category of writers who are defenders of nature and pursue people not to observe nature just as a commodity (4). Thoreau writes that we build houses by "robbing the nests and breasts of birds to prepare this shelter within a shelter" (9). We have advanced from the time when man lived in caves to man living under the roofs of palms, of barks to houses made of stones and tiles but man has forgotten to live in open air. He considers the plight of man who is harassed to death to pay rent for "luxurious box"(20). He considers shelter only as an external garment which only makes a man poorer. He argues that if civilization is advancement then the cost of comfortable dwelling

is life. Thoreau calls Nature as our common dwelling believing environment not only for humans but for the nonhuman world too. Lawrence Buell argues that Walden works through Eurocentric, homocentric and androcentric culture to finally arrive at an environmentally responsive vision (qtd in Newman 9).

Thoreau takes the case of farmers of Concord who are so poor that they work their entire life to own the land which they cultivate. Only handful of farmers in Concord have their own land. He believes that the wisest people have lived their lives in "involuntary poverty"Thoreau writes:"While civilization has been improving our houses it has not equally improved the men who are to inhabit them. It has created palaces but it was not so easy to create noblemen and kings." (24)Thoreau is sad to resign the pleasure of building his own house to carpenter and therefore takes the task of building the house. He gives the total expense of building the house which he finds lesser when compared to annual rent of a room paid by a student at Cambridge College on fourth floor. Thoreau calls the inventions only as "improved means to an unimproved end"(37) as they distract our attention from the serious things of life. Thoreau used little furniture in his cell like a bed, a table, a desk, three chairs and few utensils to cook which cost him nothing. From the experience of two years Thoreau believes that a man can survive and remain healthy if he abstains from eating meat. The chapter Higher Laws is a critique of hunting, fishing and meat eating. Thoreau writes:"No humane being past the thoughtless age of boyhood, will wantonly murder any creature, which holds its life by the same tenure that he does...I have found repeatedly, of late years, that I cannot fish without falling a little in self-respect... I believe that every man who has ever been earnest to preserve his higher or poetic faculties in the best condition has been particularly inclined to abstain from animal food, and from much food of any kind."(157)

Variety of food is needed only to please the palette and not for health. Thoreau sets an example for others by writing that for more than five years he lived only by his own labour and was able to meet all expenses. He wished to earn only ten or twelve dollars. For this, he planted the two and a half acres of land with potatoes, corn, peas

and turnips. He advises every citizen of New England to make his own bread and thus he will not be dependent on markets where fresh and sweet meal is rarely sold. Thus, a man could live easily if he were to live "simply and wisely"(51).

The chapter Ponds gives respectful and loving account of Walden Pond and the other ponds surrounding it. Thoreau believes that any natural object is the most innocent and encouraging to him. Cafaro believes that it is this personal and friendly connection with nature which helped him to sustain through his solitary days at pond. Thoreau went to the pond for self development and artistic achievement but wrote a work titled *Walden* and not something titled about himself with 'I'. In this way Thoreau was observing environmental virtue ethics where human and nature merge with each other (82-4)Cafaro contrasts the farmer Flint with Thoreau and observes that the farmer cannot see the rich green plants and animals inhabiting nearby. He is interested to see the pond and its inhabitants only as a resource. Therefore, he is unable to connect the pond and its history to his own life (85) Thus, Thoreau gives us a choice of how we relate to nature. By only looking at the resourcefulness of nature for consumption we miss out on the beauty and higher uses.

Some readers believe that Thoreau suggest the superiority of nature over humans or to withdraw from society, however, his return to village at the end of his stay at the pond strengthens the fact that it was only an experiment. (Cafaro 87)Jay Parini notes that ecocriticism " marks a return to activism and social responsibility; it also signals a dismissal of theory's more solipsistic tendencies. From a literary aspect, it marks a re-engagement with realism, with the actual universe of rocks, trees and rivers that lies behind the wilderness of signs" (qtd. in Newman 9). Thoreau's environmental ethics too demand for using natural resources wisely and preserving the wild. This is also validated in the conclusion of *Walden* as Thoreau concludes by seeking to preserve wild nature for their own as well as nature's sake. Thoreau sums up his argument in following words:"Our village life would stagnate if it were not for the unexplored forests and meadows which surround it. We need the tonic of wilderness,- to wade sometimes in marshes where the bitterns and the meadow -

hen lurk, and hear the booming of the snipe; to smell the whispering sedge where only some wilder and more solitary fowl builds her nest, and the mink crawls with its belly close to the ground…We need to witness our own limits transgressed, and some life pasturing freely where we never wander " (232).

Thus, the literary representation of nature has provoked critics to think ecocritically and to critique anthropocentric approaches to nature that is humans were born to dominate over nature which is rooted in the biblical account of creation. Glen Love argues that the major role of literature is to focus on the threatened natural environment. Thus ecocritics critique anthropocentric attitude, thinking humans to be dominating over nature or nature as passive. Thoreau inaugurated the tradition of American nature writing. Today ecocritics regard Thoreau as one of the first defenders of wilderness. (Newman 8). Hence, Thoreau's critique of anthropocentric attitude is clearly found in *Walden* where he gives an example of living, simply and harmoniously with nature without exploiting the resources.

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IMPACT OF COVID-19 PANDEMIC ON BUYING BEHAVIOR OF WOMEN IN JAIPUR
: A COMPARATIVE STUDY BETWEEN ONLINE AND OFFLINE BUYING

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Abstract

COVID-19 officially declared a Global pandemic by the World Health Organization will likely to be one of the defining events of 2020, whose effects will last into decades. With the wide spread of the disease and no vaccine found yet, the entire country is under lockdown. Government has ordered the closure of all nonessential businesses, and people are asked to remain in self quarantine and follow social distancing by avoiding public places to prevent the spread of the disease. Shopping of only essential items is allowed, that too by maintaining a distance of atleast 1 meter and with the mask on the face while going out. With the shutdown of shops and lockdown getting extended, as the pandemic continues to spread, the buying behavior and spending patterns are observed to be drastically changing. Consumers are trying to prepare for the uncertainties by stocking up food and utility supplies as safety stock. There's a huge demand for essential items, especially the household staples, baby products and health-related goods, such as hand sanitizer, face masks, and many more. Soon, both the brick-and-mortar and online stores were burdened with this increasing demand. This study has been conducted to find out if there has been a change in the buying behavior of Women in Jaipur during this pandemic and if they have been switching their modes of shopping from offline to online because of this pandemic. The conclusive statement will help us analyze whether this will lead to a permanent change in their behaviors or not.

Keywords: *COVID 19, Pandemic, Lockdown, Buying Behavior, Offline, Online.*

Introduction

On 24 March 2020, the Government of India under Prime Minister Narendra Modi ordered a nationwide lockdown for 21 days, limiting movement of the entire 1.3 billion population of India as a preventive measure against the COVID-19 pandemic in India. It was followed by a 14-hour voluntary public curfew on 22 March, after enforcing a series of regulations in the country's COVID-19 affected regions. Ever Since then, the corona virus positive cases are increasing at a rapid rate and hence the lockdown also got extended time and again till date.

Lockdown has come in 4 different phases so far:

Phase 1: 25 March 2020 – 14 April 2020 (21 days)
Phase 2: 15 April 2020 – 3 May 2020 (19 days)
Phase 3: 4 May 2020 – 17 May 2020 (14 days)
Phase 4: 18 May 2020 – 31 May 2020 (14 days)
Phase 5: (only for containment zones): 1 June 2020 – ongoing; scheduled to end on 30 June 2020.

The Government of India has restricted the supply through e-commerce to only essential items till May 3, 2020[1]. In Phase 3 of lockdown starting from May 4, 2020, the government had decided to allow e-commerce websites like Amazon and Flipkart to start delivering non-essential items in orange and green zones[2] (Jaipur being in red zone was secluded from this[3,4]). However, with the release of lockdown 4.0 guidelines on May 17, 2020, E-Commerce activities for non-essential goods were permitted even in Red Zones. However, in containment zones, the central government guidelines only permit essential services.[5]

The Covid-19 pandemic has changed the way we work, shop and communicate with people. People have been asked to work from home, they are going out only to buy household essentials and are constantly worried about the risks of getting infected in crowded public places like malls and supermarkets.

The uncertain nature of the corona virus is forcing consumers to stock-up products and buy in bulk. Prior to this outbreak, customers were used to getting anything they wanted within a day or two. However, the situation has changed. Almost all the stores whether offline or online are burdened with huge demand leading to shortage of supply.

As the society is thriving for survival, consumers are likely to shift more towards digital mode of buying. This may be because of two major reasons - the tendency to avoid crowded public places and to prevent immediate contact with the virus that may be present on the surface of the objects.

To fulfil the consumer demand during this pandemic and nationwide lockdown that is extended again and again because of the continuously increasing number of corona positive cases, many offline retailers and wholesalers, including Future Group, Spencer's Retail, Metro Cash and Carry and Walmart's Best Price, have started servicing customers online, building omni-channel models to deliver both goods and groceries. Future Group, which used to service online orders for groceries only from its Easy Day stores in Delhi NCR, has extended it to 250 of its Big Bazaar stores across the country. Though it has its own delivery fleet, they have also partnered with local delivery app Dunzo and logistics player Shadowfax for pick up and home delivery of orders.

"We were able launch BigBazaar.com within 10 days and since then we've scaled it to 10,000 orders a day," said Bharati Balakrishnan, senior VP, digital commerce, Future Group (Economic Times article dated April 15, 2020)[6].
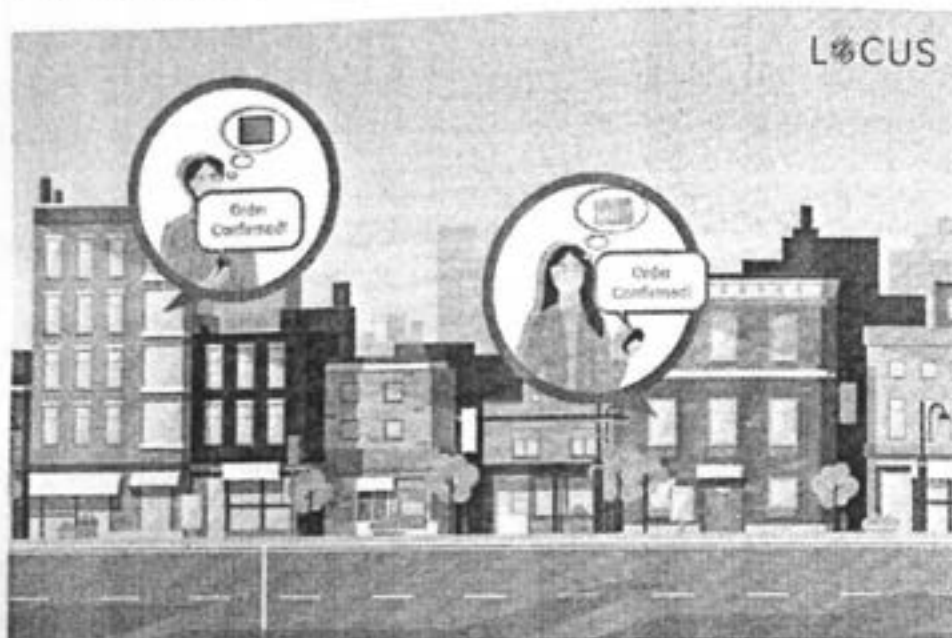
Spencer's Retail, Kolkata-based retailer also partnered with food delivery app Swiggy, cab-hailing app Uber and bike taxi startup Rapido to help deliver orders that came via customers on its website.

"Now, during the lockdown, our OOS (out of store) business has gone up from a low single digit to double digits, thanks to e-commerce and phone orders increasing multiple times," said Devendra Chawla, CEO of Spencer's Retail, which operates approximately 200 supermarkets in various cities.[6]

Metro Cash and Carry, a German wholesaler launched its mobile app earlier in April, 2020 in India. Initially, there was a plan to pilot the app in Bengaluru only, but owing to the effects of the Covid-19 pandemic, the facility was open nationwide. "We are already getting more than 100 online orders from traders per store per day across the country," said MD Arvind Mediratta.[6]

"Ticket size for essentials like groceries and pharmaceutical products has risen by over 75% during the lockdown period," said a PhonePe spokesperson. "We are seeing over 50% increase in transactions in recharges/ DTH categories. In an interesting trend, users are recharging not only for themselves but also for family and friends."[7]

The government of India has also made efforts to make the people of India aware of the virus and track the proximity with the infected person by going online. National Informatics Centre, Government of India developed a mobile tracking application-

Aarogya Setu meaning 'bridge to health' in Sanskrit. Using a phone's Bluetooth and location data, Aarogya Setu lets users know if they have been near a person with Covid-19 by scanning a database of known cases of infection. The data is then shared with the government to take the necessary steps to check for virus containment and take the people in quarantine/ isolation.

Other Similar Studies

A recent **Mckinsey study in China** suggests that consumers are likely to opt for online shopping even after the outbreak ends, for categories especially groceries and personal care. People would still avoid visiting crowded areas like malls or supermarkets and hence online buying is likely to continue for long even after the lockdown ends.[8]

According to the experts at **Infiniti Research**, An accelerated shift from store to e-commerce in grocery has been observed. E-commerce platforms show increase in sales, which is because of the new consumers trying to order grocery online. A recent report from Infiniti Research shows that in the four weeks ending March 22, 2020, a record amount was spent on groceries in supermarkets across the world, especially in the European region.[9]

The below study by Numerator.com conducted between March 1, 2020 to March 8, 2020 on shoppers who made purchases of groceries, household, or health and beauty products in-store or online shows that 46% of the consumers made online purchases which they would usually shop in store.

COVID-19 Impact on Consumer Behavior
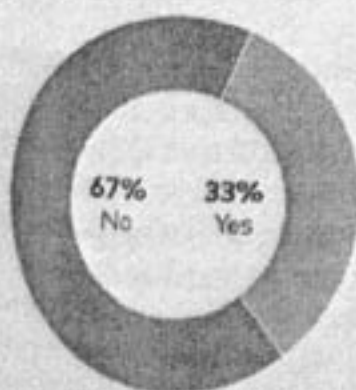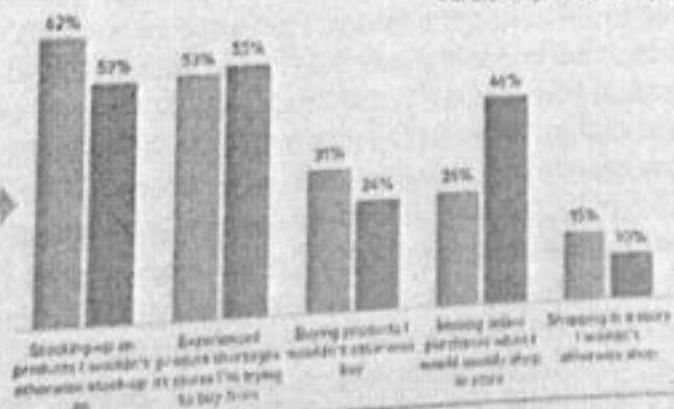
Source: Numerator.com

According to a study by Statista, the number of users in the e-Commerce market is expected to amount to 884.7m by 2024.
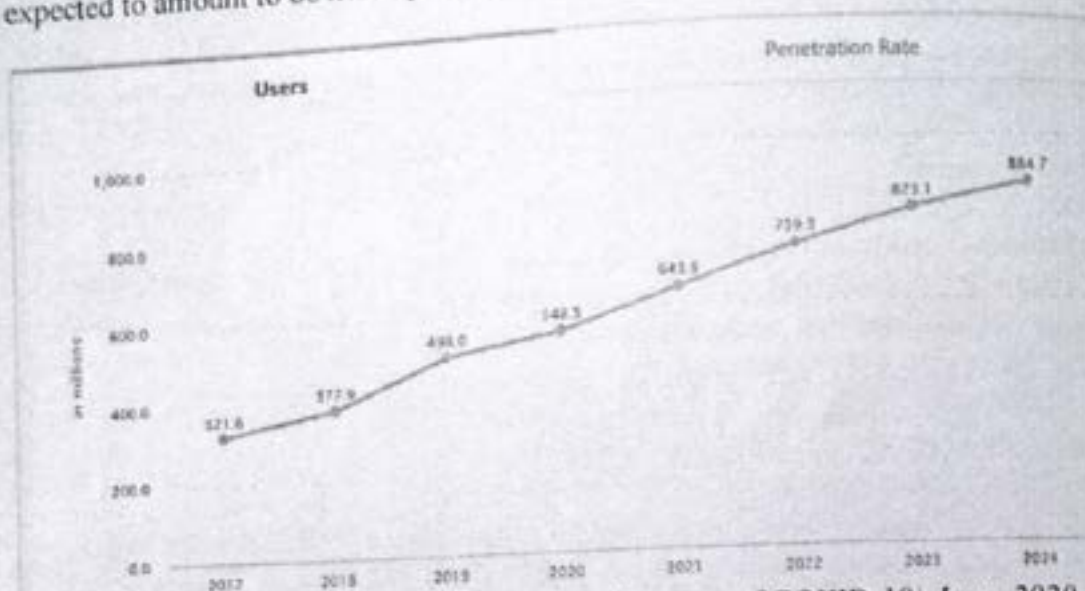
Source: Statista (Forecast adjusted for expected impact of COVID-19) June, 2020.

Is it Safe to Buy Online during the Pandemic?

Online buying is considered safer as According to the CDC, "There is likely very low risk of spread from products or packaging that are shipped over a period of days or weeks at ambient temperatures."[10] This statement refers to those packages that were in the process of shipment for at least several days and did not come into contact with any sources of contamination after packaging.

The World Health Organization (WHO) also stated in their website that: "The likelihood of an infected person contaminating commercial goods is low and the risk of catching the virus that causes COVID-19 from a package that has been moved, travelled, and exposed to different conditions and temperature is also low."[11]

But it can't be said that home delivery or online options are cent percent secure. Take for instance, the Cloud kitchen startup Box8 Case in Delhi which on April 16, 2020 reported that one of its delivery partners at its Malviya Nagar kitchen in South Delhi had tested positive for the novel coronavirus putting 72 families, who received orders from it, into self quarantine, all of them subsequently tested negative. Box8, whose parent company also operates Mojo Pizza, sells exclusively on Zomato and quoted that Zomato was doing its best to take precautionary measures such as temperature checks to ensure that its riders remain safe from the outbreak.[12]

Another case from Chennai on April 29, 2020, A delivery partner with online food ordering and delivery app Swiggy was among those who was tested positive for COVID-19. He was suspected to contract the infection from his father who was tested positive and got infected from other patients while he was admitted for his

chemotherapy sessions in Rajiv Gandhi Government General Hospital. The city corporation had prepared a list of 64 houses that the man had made deliveries to in the last 10 days and contact tracing was done (As on April 29, 2020).[13]

However, if we see the offline criterion, the utmost requirement for life- the vegetables that are majorly brought from the vegetable vendors are also no more safe to buy. In Jaipur, 13 vegetable and fruit sellers and seven chemists, milk and grocery sellers have tested positive for the Covid-19 infection (Source: India today article on May 08, 2020).

Research Methodology

Objective of the Study:

➤ To Find out if there is a change in buying behavior of Women in Jaipur during the Covid- 19 pandemic.
➤ To find the reason for the change in behaviors, if any.
➤ Will the pandemic lead to a permanent change in their buying behavior even after the lockdown ends.

Research period- April 20, 2020 to June 18, 2020

Population of the study- Women consumers of Jaipur

Sample size- 50

Research Design- The study has been conducted through survey method using a structured questionnaire filled through google form. For some of them, the responses were recorded via telephonic interviews.

Limitations of the Study

The study is limited to Jaipur City. The effect of the COVID-19 pandemic is different in different cities, states and countries. The Union Health Ministry of India on Wednesday (April 15, 2020) said that the districts across the country have been categorised in three zones to identify the coronavirus COVID-19 hotspots. The districts have been divided into Red Zone, Orange Zone and Green Zone based on the occurrence of COVID-19 cases in each of them in order to efficiently manage the fight against corona virus pandemic. The colour of these zones indicate the severity of the coronavirus outbreak in that particular district (The list for these zones are revised on a weekly basis). Some of the cities have been observed as the hotspots and hence come under the red zone for COVID-19 where COVID 19 reported cases are drastically increasing. Orange zone is the one where reported cases are a very few and the green zones include those areas which have not recorded even a single case of coronavirus (thankfully). As of April 20, Jaipur is one of the hotspots of COVID-19 constantly reporting positive cases (According to an article by Economic Times, India dated April 20, 2020). Hence, the

area of study. Another limitation here is that only women from well off and educated families could be contacted for survey.

Demographic profile of respondents

➤ **Age of Respondents**
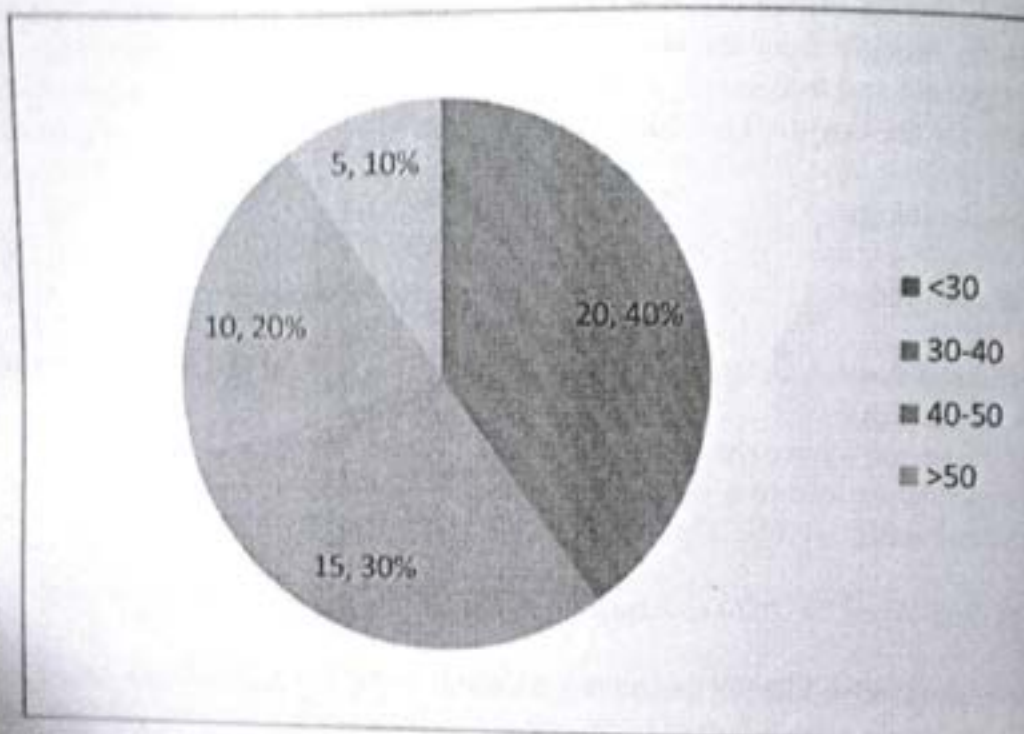
Figure 1 shows that the age of the respondents is majorly less than 30 years, 30% of them are between 30-40 years of age, and the rest are above 40 years.

➤ **Marital Status of Respondents**
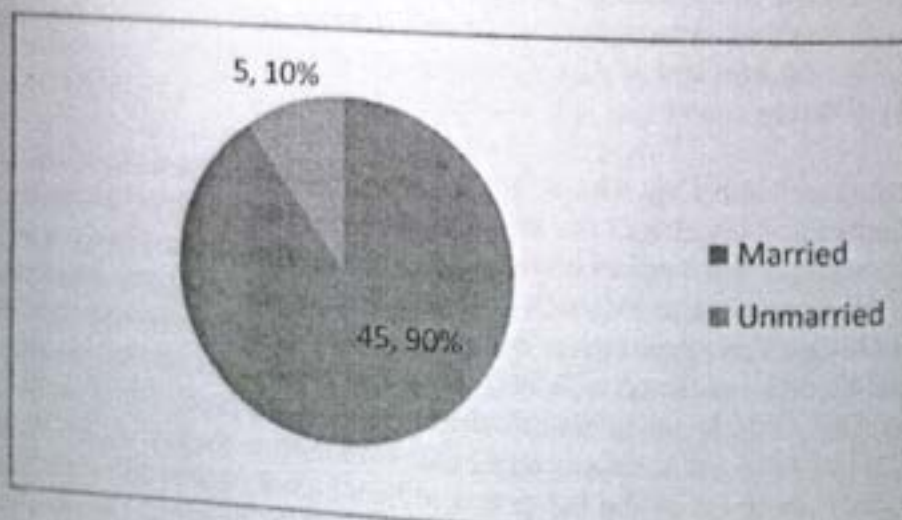
Figure 2 shows that 90% of the respondents are married and 10% of them are unmarried.

> **Educational Qualification of Respondents**
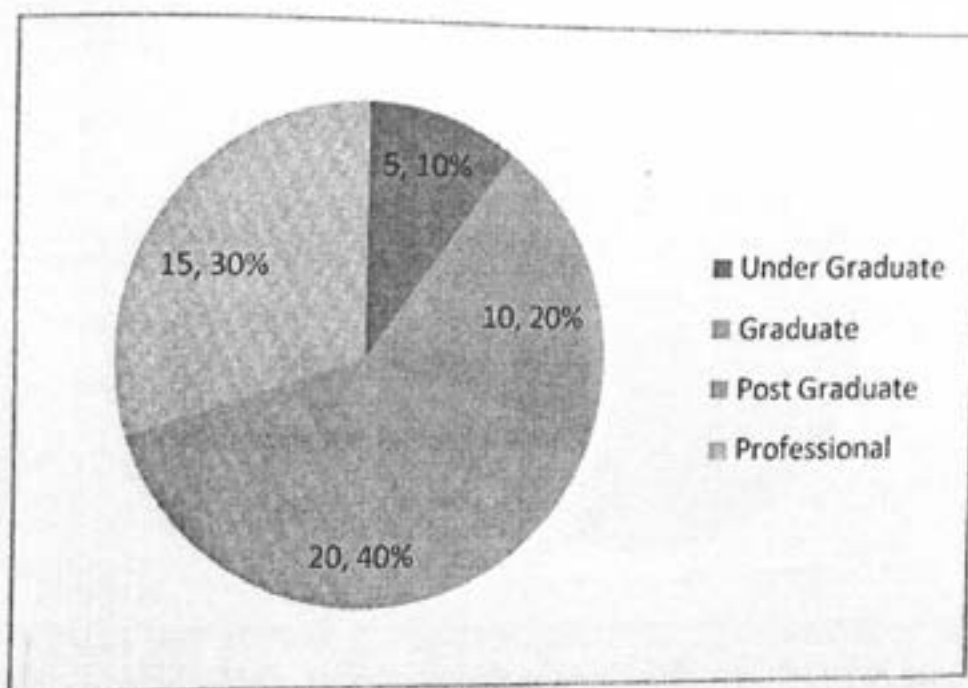
Figure 3 shows that 40% of the respondents are Post Graduates, Some of them are professionals, a few are graduates and others are only graduates.

> **Occupation of Respondents**
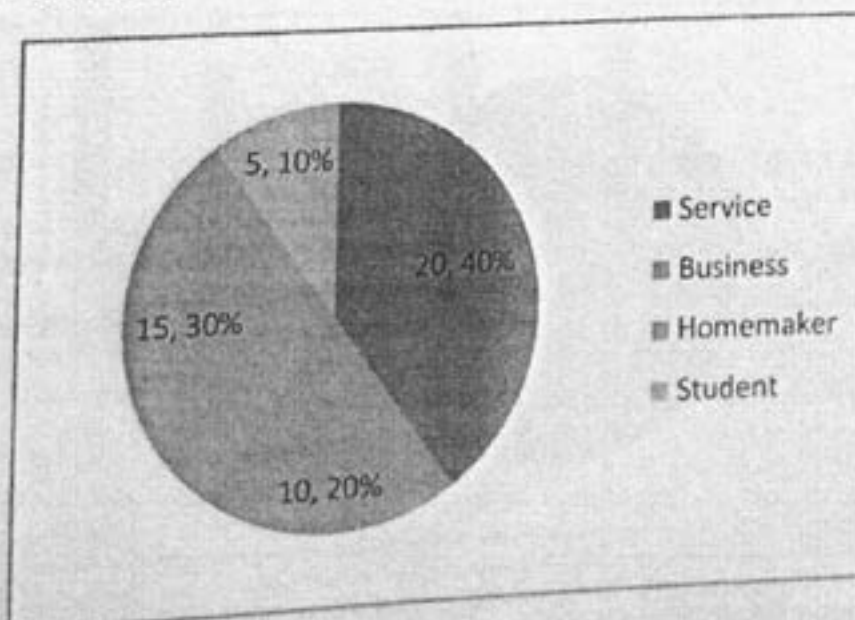
Figure 4 shows that majorly the respondents are from service sector (40%), Some of them are homemakers (30%), few of them operate a business, and others are students.

> **Annual Income of Respondents**
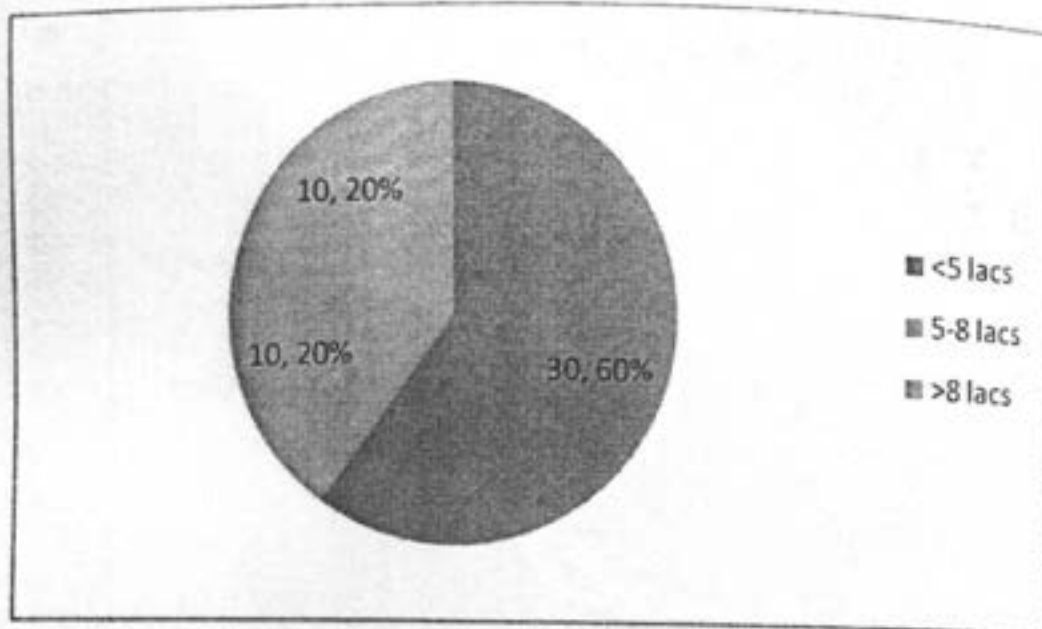
Figure 5 shows that 60% of the respondents fall under annual income below 5 lacs, 20% of the respondents fall in the category of annual income between 5 to 8 lacs and 20% of the respondents have annual income above 8 lacs.

> **Which mode of shopping do you generally prefer?**
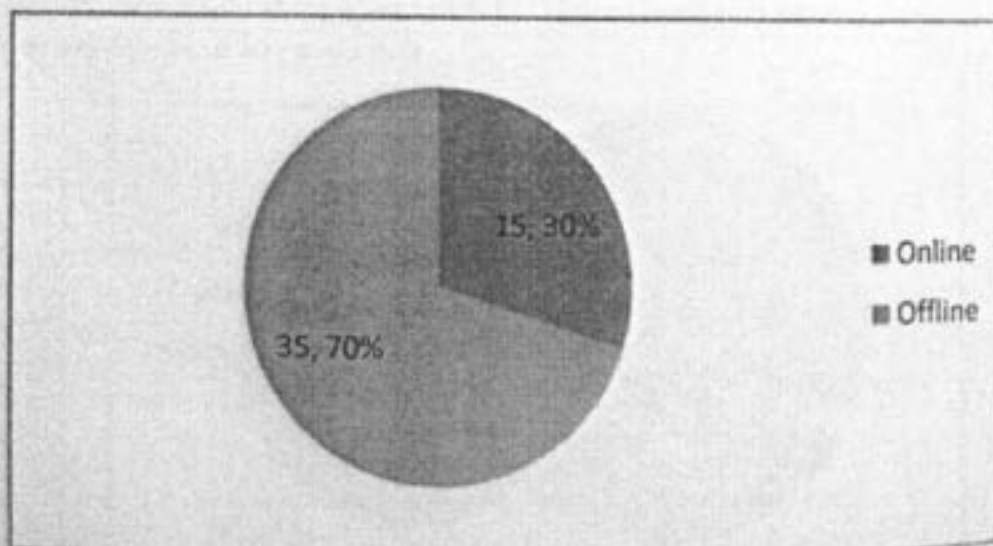
Figure 6 shows that generally 70 % of the respondents prefer offline shopping while 30% of the respondents prefer online shopping during their normal life routine.

➤ **Do you think it is better to do Online shopping during this COVID 19 pandemic rather than going for traditional brick and mortar shopping?**

- 20, 40%
- 30, 60%
- ■ Yes
- ■ No
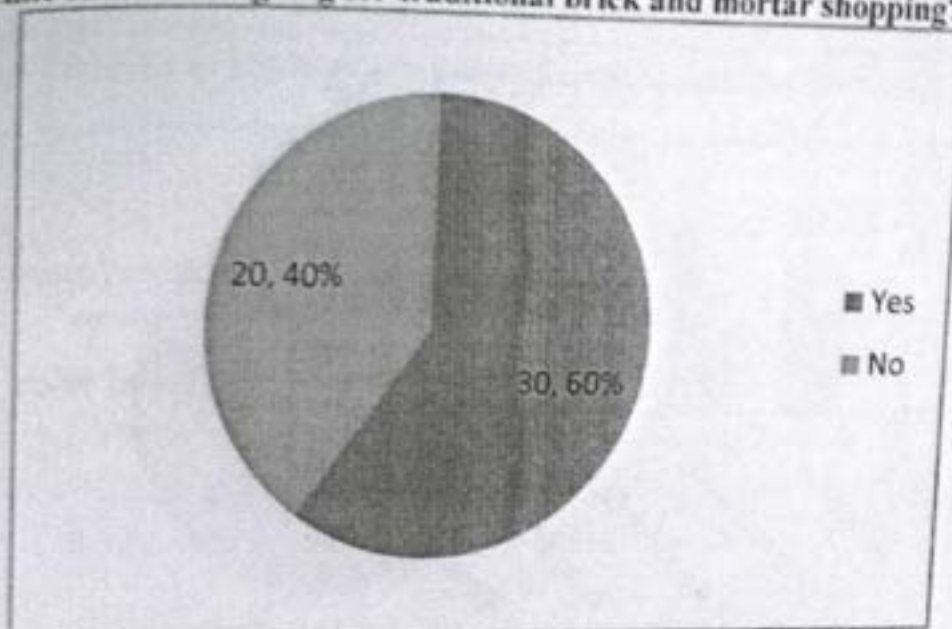
Figure 7 shows that 60 % of the respondents think that it is better to go for online shopping rather than offline shopping during this pandemic.

➤ **Which mode of shopping- offline or online do you prefer for the following products in your normal routine?**

■ Offline / Store Purchases

■ Online/ Home Delivery
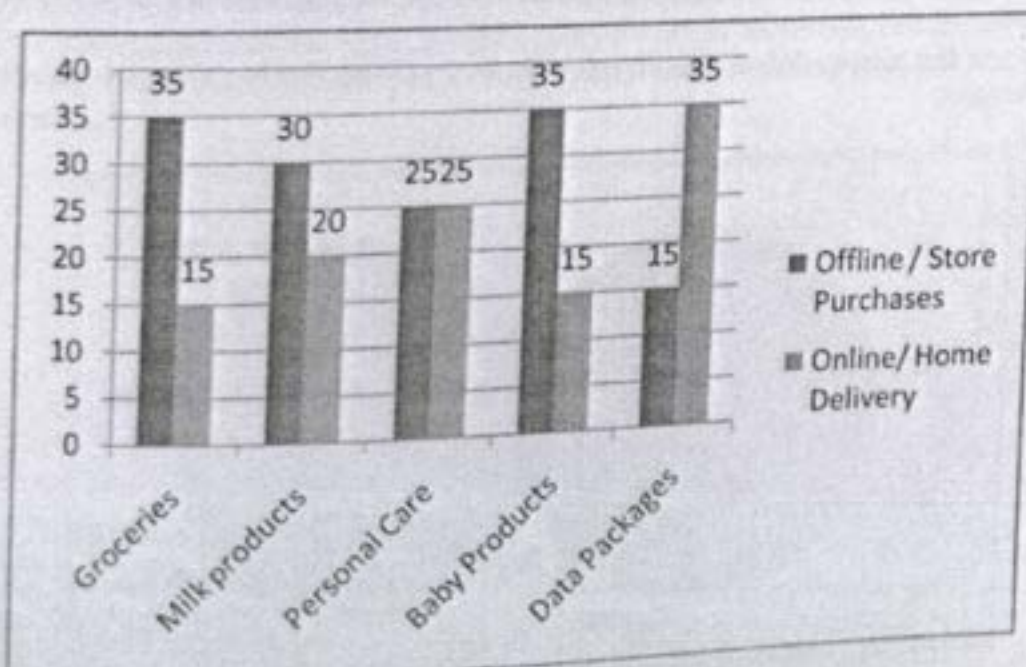
Figure 8 shows that Majority of the respondents used to go to the nearby stores/ malls/ supermarkets for buying the daily essentials whereas only a few of them used to for online or home delivery of the above products during their normal routine lives.

> Which is your preferred mode of shopping- offline or online for the following products during the COVID-19 pandemic?
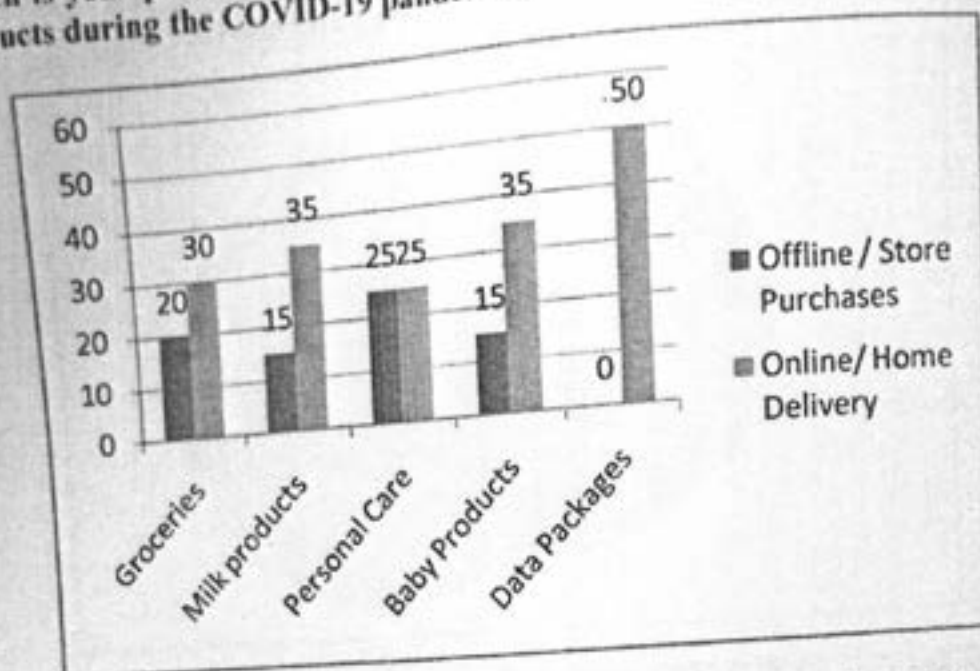
Figure 9 shows that Majority of the respondents who used to go to the nearby stores/ malls/ supermarkets for buying the daily essentials now prefer to buy those products online or get them delivered to their doorsteps in order to avoid the immediate contact with the (may be infected) products. A major shift in the buying behavior of groceries is observed during this pandemic.

> What is the reason for not preferring to buy offline during this corona virus outbreak?
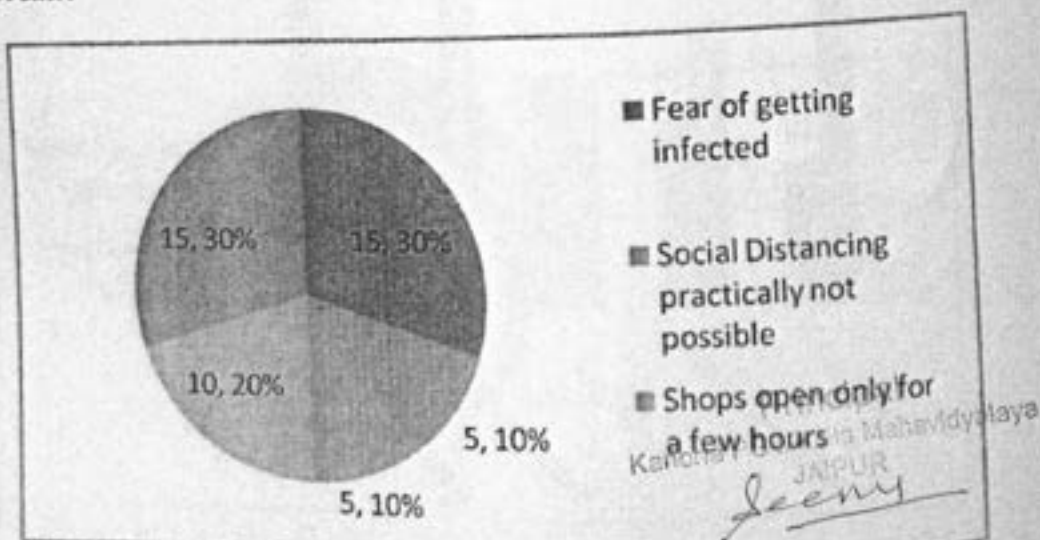
Figure 10 shows that 40% of the respondents are avoiding the nearby stores/ malls/ supermarkets for buying the daily essentials because of the fear of getting infected, some of them avoid because of social distancing not possible every time or because the

shops open at odd times- only for few hours, whereas 30% of them are still preferring the offline mode of buying.

> **What is the mode of payment you prefer for online orders/deliveries?**
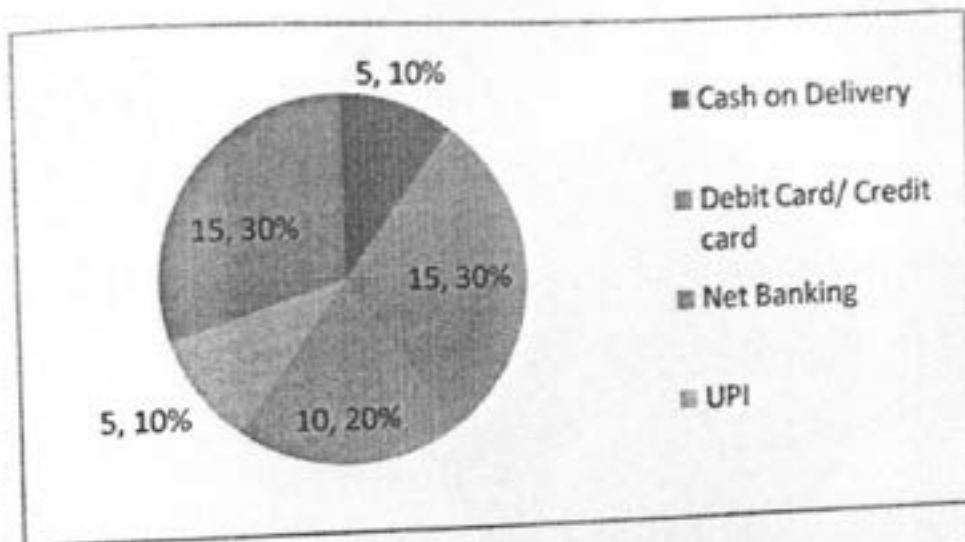
Figure 11 shows that 30% of the respondents prefer making payments through Debit/ Credit cards or through mobile wallets like paytm while doing online shopping, whereas 20% of them prefer to do net banking and the rest of them prefer either UPI. Only a few i.e. 10% of the respondent prefer Cash on Delivery because of the fear of infection from exchange of Currencies as the Virus is said to survive on the surface of Currency Notes.

> **What is the reason for not preferring to buy online during this corona virus outbreak?**
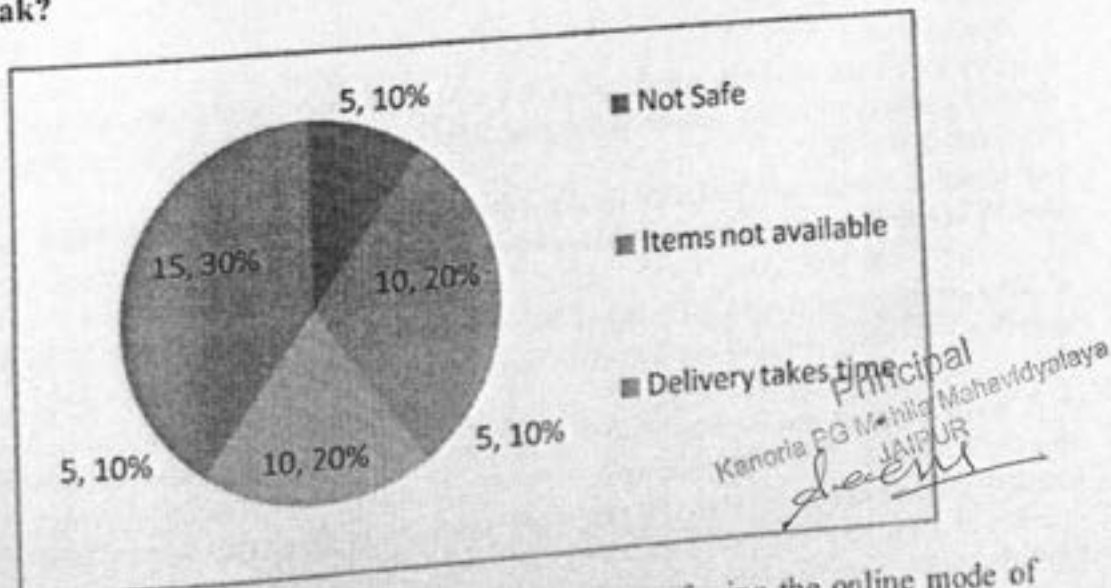
Figure 12 shows that 30% of the respondents are still preferring the online mode of buying, whereas 20% of them avoid online because they think it's not safe either (packets delivered may also contain virus). 20% of them say that the items are not

available online and the rest of them fear that the prepaid orders may not get delivered at all leading to scarcity of resources at home.

> **Do you think this pandemic is going to lead to a permanent change in your buying behaviors?**
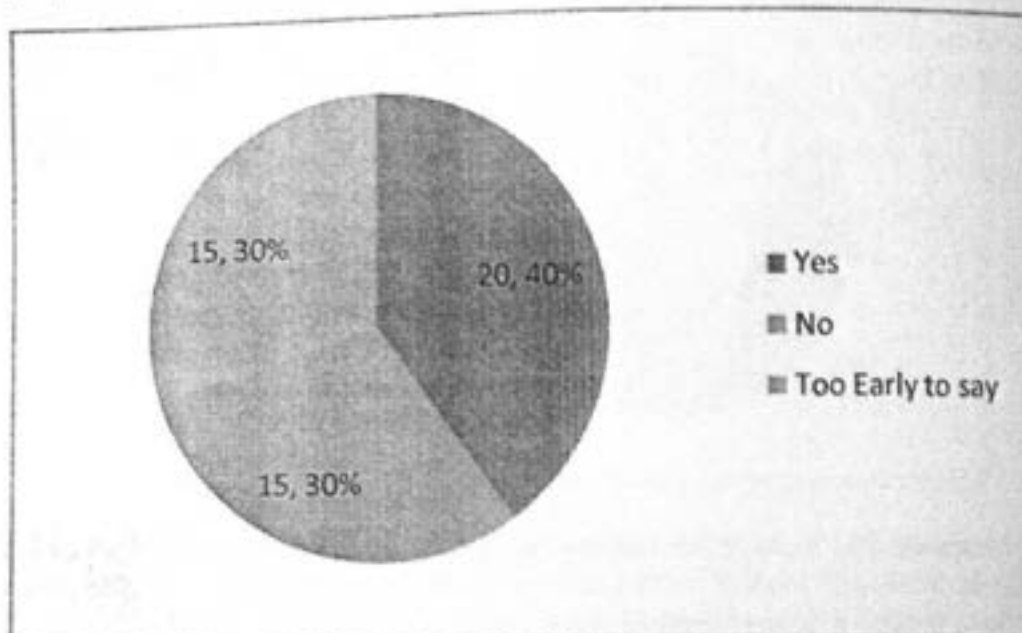
Figure 13

Figure 13 shows that 40% of the respondents think that this pandemic is going to bring a permanent shift in their buying behaviors, while others 30% of them think that it is too early to comment.

Findings

• Majority of the women consumers have changed their traditional brick and mortar shopping habits to either online buying or buying over telephones to get the products delivered at home.

Consumers are also using BOPIS facility (buy online, pick-up in store) (More details on BOPIS can be found on Shopify.in) to avoid being in stores for long durations.

• 60% of consumers especially married professionals in the age group of 20-40 years said that it's better to order online rather than going offline for daily essentials.

• A major shift in the buying habits of groceries, milk products and baby products is observed. Consumers who used to buy these products from nearby stores or malls or super markets have been seen buying these products from online stores/ home delivery options during the Noval Corona Virus Outbreak. This may be because of two reasons: One that they fear of getting infected outside or may be because the products are no more available at nearby stores/malls/ super markets.

- Some of the consumers who used to purchase the data packages for home entertainment and mobile recharges from offline exclusive stores are now purchasing the same through online mobile applications.

- On the other hand, there are consumers who still do not prefer online shopping because they feel that the prepaid orders may either take time to get delivered or may not be delivered at all. 20% of thee consumers say that the items they want are not available online.

Conclusion

COVID-19 is the official name for the Corona Virus disease 2019. As people are following social distancing and "Stay home Stay safe" criterion, there has naturally been a drop-off in the traditional brick-and-mortar buying habits of consumers. That would seem to mean that there would likely be an increase in online shopping as people turn to online orders/ telephonic orders/ home delivery options to purchase the items they might have otherwise purchased from nearby store/ malls/ super markets.

Amazon – one of the leading ecommerce players in the country, and the world, announced that the customers are relying on them like never before in their social distancing and self-quarantine efforts.

The above statements clearly show that there has been a change in the buying behaviors of women consumers in India from Offline to Online shopping because of the Corona Virus outbreak and it is expected that the Online shopping will continue to boom even after this Pandemic ends as consumers will now be more conscious of retailers' sanitation, health and safety of products but on the same time, consumers would also want timely delivery, compensation for cancellation of order and also more secured options for digital payments.

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Link for google form for survey:
https://docs.google.com/forms/d/1DNyWLqm_GdnlA2dvAnAeVdKF09Tn8NM22OygB84C5_Q/edit

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The Medicinal Significance of *Datura stramonium*: A Review

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ABSTRACT

Datura stramonium is commonly known as thorn apple belongs to family Solanaceae. It is a wild plant having various medicinal and pharmacological properties. Alkaloids, atropine, scopolamine, tannin, saponin, glycosides, phenol, sterols, lignin, fats, carbohydrates and proteins are different compounds present in Datura. *Datura stramonium* have antiepileptic, anti-asthmatic, analgesic, antioxidant, antimicrobial, insecticidal, repellent and organophosphate protective effects. The present review is focused on the phytochemical and pharmacological studies of the *Datura stramonium*.

Keywords: *Datura Stramonium*; Medicinal Plant; Phytochemistry; Pharmacological Activities; Traditional Uses

Introduction

Datura stramonium (DS) is an annual plant belongs to the family Solanaceae. It originates in the America but is found around the world including North, Central and South America, Europe, Asia and Africa [1]. Datura stramonium is a foul smelling, erect, free branching herb that forms a bush up to 2-5 feet tall. The root is long thick, fibrous and white. It has simple or bifurcated round, erect, glabrous stem. The leaves are 8-20cm long, smooth, toothed, soft and irregularly undulated. The leaves have a bitter and nauseating taste, which is imparted to extracts of the herbs and remains even after the leaves have been dried. Flowers are large, white, solitary and terminal. Fruit is 5cm long, four valve capsules, which is densely thorny and walnut sized. At maturity it splits into four chambers, each with dozens of seeds. Seeds are long, flat, reniform and black [2-7]. The genus Datura comprises all the nightshades and agricultural plants including potato, S. tuberosum, Lycopersicon, Coffeaarabica and pepper. Classification of different species within Datura genus relies heavily on genetic markers, which suggest that this genus has huge variation due to mutation [8-10].

Datura stramonium has long been known for its hallucinogenic and euphoric effects. It was dried and smoked for hallucination and total relaxation [1,11]. It is toxic when consumed improperly. Accidental poisoning of humans and animals, who consume food sources contaminated with *D. stramonium* has been reported. In areas where millet, wheat, rye, corn and bean seeds are used for human consumption and where *D. stramonium* is a common weed, the grain sometimes has been contaminated with Datura seeds. The large amount of Datura affects the central nervous system with symptoms such as confusion, bizarre behavior, hallucinations and subsequent amnesia [12-13]. Therefore, a thorough understanding of the possible pharmacological and toxicological effects of *D. stramonium* is needed. The review presents the major medicinal uses of Datura stramonium, discovered through last many years of research in animals and human subjects as well as in the other experimental studies.

Phytochemistry

D. stramonium contains sixty-four different types of tropane alkaloids. The major tropane alkaloids hyoscyamine and scopolamine and several minor tropane alkaloids have been identified in Datura species. The alkaloids scopoline, 3-(hydroxyacetoxy) tropane, 3-hydroxy-6-(2-methylbutyryloxy)

tropane,3a-tigloyloxy-6-hydroxytropane, 3,7- dihydroxy-6-tigloyloxytropane, 3-tigloyloxy-6-propionyloxytropane, 3-phenylacetoxy-6,7- epoxytropane, 3-phenylacetoxy-6-hydroxytropane,aponorscopolamine, 3a,6a-ditigloyloxytropane and 7-hydroxyhyoscyamine are reported for the first time by Berkov et al. [14]. Sterols and there derivatives [5.alpha.-Ergosta-7,22- dien-3.beta.-ol (16.53%), 3-Hydroxycholestan-5-yl,acetate (14.97%), and 26,26-Dimethyl-5, 24(28)-ergostadien-3.beta.-ol (10.39%)] are the major constituents of essential oil of Datura stramonium. The primary biologically active substances in *D. stramonium* are the alkaloids atropine and scopolamine Ivancheva [15]. The aqueous and ethanolic extract of the stem-bark of Datura stramonium contained alkaloids, saponins, tannins, steroids, flavonoids, phenols and glycosides. Alanine, glutamate, phenylalanine, tyrosine and many other amino acids were isolated from the seeds. The tropane alkaloids were the important anticholinergic alkaloids isolated from Datura stramonium. The highest content of alkaloid are present in the vegetative and generative phases of leaves and capsules, respectively. Generally, the younger parts of plants contained more alkaloids than older ones. Alkaloid content decreased rapidly in leaves in the generative phase. Scopolamine was lowest (0.013%) in roots in the vegetative period, and then totally disappeared in the generative period. Atropine present in roots in both the vegetative (0.045%) and generative (0.056%) periods. Stems were rich in atropine (0.070%) but poor in scopolamine (0.023%) in both stages [16-19]. The maximum contents of atropine are found in the stems leaves and seeds. The maximum contents of hyoscyamine and scopolamine are found in the stems and leaves of young plants, hyoscyamine being always the predominant component.

Traditional Use of Datura Stramonium

The World Health Organization (WHO) estimates that four billion people, about 80% of the world's population presently use herbal medicine for some aspect of primary health care. Plants generally produce many secondary metabolites which were constituted an important source of many pharmaceutical drugs [20-21]. In Ayurvedic medicine, *D. stramonium* is described as a useful remedy for various human ailments including ulcers, wounds, inflammation, rheumatism and gout, sciatica, bruises and swellings, fever, asthma, bronchitis and toothache. Many folk medicine remedies use *D. stramonium* therapeutically [22]. The juice of the leaves in warm milk was used to expel intestinal worms including cestodes, seeds with palm oil used externally for insect bites and stings insects. When the leaves of Datura stramonium mixed with mustard oil then it is useful in skin disorders. Juice of flower petals is used in ear pain and seeds are used as purgative, in cough, fever and asthma. Seeds are smoked due to its narcotic action [23-24]. In Western Nepal, leaves of Datura along with the leaves of Cannabis sativa and stem of Neopicrorhizascrofulariflora, are pounded with water and applied to treat headaches. Datura seeds are crushed with grains of rice and taken orally to relief in indigestion. In parts of Central Nepal fresh leaves are warmed and placed on a sprained body part repeatedly, before going to bed, for the alleged analgesic effect. In India, seeds are used as a tonic and febrifuge. The leaves are roasted and applied locally to relieve pain [25]. Native Americans used Datura seeds for many years as a euphoric agent. Since the 1800s, it was used as a therapeutic agent in Great Britain [26].

Pharmacological Activities

Organophosphate Poisoning (OP)

DS contains atropine and other anticholinergic compounds and it is very useful remedy for the central cholinergic symptoms of OP. Bania et al [27] reported the beneficial effects of DS seed extracts following a severe OP. According to their experiment, DS seeds were heated in water to make 2mg/ml atropine solution and administrated to male rats as a single intraperitoneal injection 5min before the subcutaneous injection of 25mg/kg of dichlorvos. Pretreatment with Datura seed extract significantly increased survival in a rat model of severe OP.

Antiepileptic Effects

According to Peredery and Persinger [28], rats were continuously administrated one of 3 herbal treatments S. lateriflora, *G. sempervirens* and *D. stramonium* through water supply for 30 days, one week after the induction of status epilepticus by a single injection of lithium (3mEq/kg)and pilocarpine (30g/kg). The number of spontaneous seizures per day during a 15min observation interval was recorded for each rat during the treatment period and during an additional 30 days when only tap water was given. Rats that received a weak solution of the three herbal fluid extracts displayed no seizures during treatment. However, when this treatment was removed, the rats displayed numbers of spontaneous seizures comparable to the controls.

Antimicrobial Activity

The methanol extracts of aerial part of DS showed the bactericidal activity against gram positive bacteria in a dose dependent manner [29]. Sharma et al. [30], suggested that DS was very effective as vibriocidal against various strains of Vibreo cholera and Vibreo parahaemolyticus. The minimum inhibitory concentration (MIC) value of acetone extracts of DS was in the range of 2.5-15 mg/ml serving as broad spectrum vibriocidal agents.

Anti-Asthmatic Activity

D. stramonium contains a variety of alkaloids, including atropine and scopolamine, having an anticholinergic and broncho dilating activity. Atropine and scopolamine act on the muscarinic receptors by blocking them (particularly the M2 receptors) on airway smooth muscle and submucosal gland cells, which dilate bronchial smooth muscle and ease asthmatic attacks. Charpin et al. [31] reported that using *D. stramonium* as an antiasthmatic, cigarette is an effective bronchodilator in asthmatic patients with mild airway obstruction.

However, the exposure of D. stramonium to the fetus when a mother uses it for asthma will cause a continuous release of acetylcholine, resulting in the desensitizing of nicotinic receptors, which could ultimately result in permanent damage to the fetus [32].

Analgesic Activity

The analgesic effect of alcoholic Datura seed was evaluated in acute and chronic pain using hot plate and formalin tests. The extracts when intraperitonealy administrated to the animals, they, dose dependently alleviated the pain, and ED50 was 25 and 50mg/kg in hot plate and formalin tests, respectively [33].

Antifungal Activity

According to Mdee et al. [34], the fungicidal effects of the acetone extracts indicate the potential of DS seeds as a natural source of antifungal agent. The MIC of DS extracts ranges from 1.25-2.50mg/ml.

Anticancer Activity

D. stramonium was reported to have anticancer effect against human epidermal carcinoma of the nasopharynx at a therapeutic dose of 0.05 to 0.1g. However, precaution should be taken while using Datura as an anticancer agent since adverse anticholinergic effects may occur [35].

Infertility in Women

Datura flowers are effective treatment of infertility in women. The dried powder of Datura flowers in dosage of 120 mg is given with honey 10 days after menstruation. It is given for 5 to 7 days. This remedy is effective in infertility of unknown reason [36].

Insecticidal Activity

Datura plant generates a characteristic odor that acts as repellent for various insects and pests. Kurnal, et al. [37] have reported that the ethanol extracts of D. stramonium leaf and seed showed potent acaricidal, repellent, and oviposition deterrent activity against adult two-spotted spider mites (Tetranychusurticae) under laboratory conditions. Leaf and seed extracts which were applied in 167.25 and 145.75g/L concentrations (using a Petri leaf disc-spray tower method), caused 98% and 25% mortality among spider mite adults after 48h, respectively. These results suggest that D. stramonium could be used to manage the two-spotted spider mite.

Dosage

DS is generally administrated at a dose of 60-185mg powder for leaf and 60-120mg powder for seed [38].

Conclusion

Plants are used as for food, shelter, fiber, tan, gum, oil, latex etc. They are rich source of nutrients, antioxidants, vitamins, carbohydrates, proteins, due to this; they also contributed immuno-modulatory effect. This review concluded that Datura stramonium is a wild plant having various medicinal and pharmacological properties and these properties exploited for cancer, rheumatism, ear pain, headache, wound, burn, stress, depression, insomnia, asthma, boils, and inflammation. Datura stramonium, exhibits pharmacological effect and prepared as herbal or botanical drugs by pharmaceutical industries for many diseases, but not used in native form because of its lethal effect.

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Applications of nanomaterials in wastewater treatment

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ABSTRACT

The accessibility of good quality water is important for all living creatures in the world. The major requirement in the present era is the treatment of wastewater due to scarcity of water resources. Adsorption, flocculation, filtration etc., are some of the techniques but they are used only for primary treatment of wastewater. It is required to develop techniques with low capital requirement and high efficiency. The recent advanced technology, nanomaterials have attracted the attention for wastewater treatment. Nanoscale properties of nanomaterials such as catalysis, adsorption, reactivity, greater surface area makes them effectively useful for the treatment of wastewater. Various types of nanomaterials are being used for the removal of different contaminants from wastewater. Activated carbon, carbon nanotubes, graphene, titanium oxide, magnesium oxide are some examples of nano-adsorbents which are used for the removal of heavy metals from wastewater. For the removal of organic and inorganic pollutants from water nanocatalyst such as electrocatalyst, photocatalyst have been potentially employed. This review article is focused on the advancements which have been made in the area of wastewater treatment by using nanomaterials.

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1. Introduction

Although 71% of the Earth's surface is covered with water, less than 1% is available for human consumption [1]. Water is the basic need and most vital substance required by all on earth. Due to the rapid industrialization different contaminants such as heavy metal ions, radionuclides, pathogenic bacteria, viruses are released into water resources which makes them harmful to human health. When the quality of water is degraded by industrial effluents, organic pollutants or any other compounds then it becomes wastewater. Some factors such as level of groundwater, land use affect the composition of wastewater. Selective treatment should be employed to filter water with the consideration of cost involved in filtration process [2].

Selecting the most efficient method and the right material for wastewater treatment is of utmost important, considering the efficiency and the cost of the treatment. Hence, while selecting the method of wastewater treatment, it's efficiency, reuse of the material used, eco-friendliness and cost effectiveness must be considered [3,4].

Conventional water treatment techniques like reverse osmosis, distillation, coagulation-flocculation, bio-sand and filtration are not capable enough in removing all heavy metal ions. As adsorption technology is cost effective, highly efficient, and easy to operate, it is regarded as an important method to remove heavy metal ions from wastewater.

Zeolites, activated carbon, chelating materials, clay minerals are some materials which are used to adsorb heavy metal ions from the solution. But the low sorption tendency of traditional sorbents restrict the use of these deeply [5]. Currently, nanotechnology, known due to its unique physiochemical properties of nanomaterials, is emerging as a widely applied technology in different areas of environmental remediation. For the elimination of organic and inorganic pollutants, toxic metals wide range of nanomaterial are being tested. Economically nanotechnology is helpful for the utilization of water resources and energy conservation [6].

Nanostructured adsorbents are also used for wastewater treatment as they exhibit much higher efficiency and reacts at faster rate. For the adsorption of metals and organic compounds magnetic nanoparticles are being developed. Nanofiltration technique

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is also used to remove industrial pollutants such as bisphenol-A, phthalates, alkylphenols, etc. from groundwater. In the modern era, a new term Green Nanotechnology is coined. The main aim of green technology includes minimal health hazards, environmental risks etc. [7]. This review focuses on the use of various nanomaterials applied in the treatment of wastewater.

2. Nanomaterials

Materials with the dimension of 1–100 nm are categorized as nanomaterials. The characteristic properties of nanomaterials such as adsorption, high surface to volume ratio, catalytic activities and reactivity make them significant. As nanomaterials are small in size, the surface area of nanomaterials is greater which make them highly compatible. Variety of nanomaterials are observed which exhibit their own specific properties [8].

2.1. Silver nanomaterials

Silver nanomaterials are widely used as in the form of colloidal silver. Silver nanomaterials has proven to be used as antimicrobial agents and have extensively used against naturally occurring microorganisms [9]. Vital cellular components of microorganism are disturbed by silver nanomaterial which results in death of pathogenic microorganism. Nanomaterial binds on the cell membrane leading to cell lysis. For community water, in hospitals silver nanomaterial are used for water purification. They have been used as a substitute for chlorine in filtration technique [10]. Silver nanomaterials are potentially used in reducing the biofouling and as an effective disinfectant in sewage and wastewater treatment for the removal of E. coli and other pathogen [11]. Ag nanomaterial are used with increased efficiency by inserting high porosity filters [12].

Pathogenic bacteria are killed by silver nanomaterials by inducing physical perturbation with oxidative stress through disturbance of vital cellular component. They are cost effectiveness possessing high antibacterial activity which have been considered as the most promising for water disinfection [13]. Polyethersulphone (PES) microfiltration membranes was used for incorporating silver nanomaterials synthesized by chemical reduction and the microorganisms present nearby the membrane were not active enough [14]. Environmental Protection Agency (EPA) and World Health Organization (WHO) has put forward that the standard for silver in drinking water was greater than the silver loss from silver nanomaterials [15].

2.2. Carbon nanomaterials

Carbon nanomaterials prepared from most abundant element carbon are extensively used for the purification of water. Carbon nanomaterials have the capability of regeneration by which the adsorption capacity of carbon spent can be recovered through which the economic application of activated carbon can be determined. But during regeneration some percentage of adsorption capacity will be lost [16].

The discovery of the first fullerene in 1985 has opened a new horizon for the synthesis of carbo nanotube (CNTs) [17]. The first CNT was fabricated in the year 1991 [18]. CNTs are synthesized from graphite using arc discharge; laser ablation; or by chemical vapor deposition from carbon-containing gas. Owing to their hydrogen bonding, hydrophobic interactions, ion exchange, electrostatic interactions with the pollutants of wastewater, CNTs have gained considerable interest in recent years. Researchers are now focusing on the incorporation of CNTs in several devices due to their outstanding adsorbance of organic and inorganic pollutants.

CNTs have been reported as strong sorbents for 1,2-dichlorobenzene [19], atrazine [20], butane [21], dichlorodiphenyltrichloroethane (DDT) [22], dioxin [23], peptone and α- phenylalanine [24], and other polar and nonpolar organic chemicals. Synthesized CNT-based membrane filters consisting of hollow cylinders coupled with radially aligned CNT walls have been effectively used to remove bacteria and viruses from contaminated water [25].

Heavy metals which are discharged into aquatic environment and absorbed in living tissues are to be removed from water and this can be achieved by using multi-walled CNTs whose adsorption capacity can be increased by oxidizing it with nitric acid [26]. CNTs possesses high capability as sorbents for organic compounds such as polycyclic aromatic hydrocarbons, phenolic compounds, endocrine disrupt compounds and antibiotics [27]. For some pharmaceuticals compounds like diclofenac sodium, carbamazepine, CNTs exhibit good mechanical strength, high sorption capacity, hydrophilicity and during regeneration process these compounds can be decomposed [28]. For improving the properties of CNTs sometimes they are mixed with other metals by which the number of oxygen, nitrogen or other groups increases on the surface of CNTs which enhances their dispersibilty and results in the improvement of their specific surface area [29–31]. The interstitial spaces and grooves present in the CNTs are sites of high adsorption for organic molecules and because of larger pores in bundles of CNTs they have high adsorption capacity for bulky organic molecules [32]. Due to short intraparticle diffusion distance and highly accessible adsorption sites, CNTs are used as better adsorbents for heavy metals [33].

2.3. Iron nanomaterials

Iron nanomaterials are widely used in wastewater treatment. The treatment done by using iron nanomaterials is mostly based upon reductive dehalogenation reaction. Iron nanoparticles are cost effective and on reaction with contaminants they are converted into hydroxides which works as flocculant, used in the removal of inorganic and organic contamination [34]. The hydrophobic membrane which is present around the nanomaterial of zinc act as a protective covering for it which otherwise might react with the contaminants and decreases the capacity of nanomaterial [35]. Iron oxide nanomaterial which possesses large surface area and high reactivity bind with the solid and colloidal impurities of water by acting as a solid sorbent. Elemental iron in combination with metal catalyst such as nickel, palladium, platinum forms bi metallic nanomaterial which increases the kinetics of redox reaction [36].

Iron nanomaterials can be used for the treatment of contamination depending upon their mobility; mobile contaminations and immobile contaminations. For static contaminant body, mobile iron is used and is directly injected upstream for treatment [37]. When immobilized into iron surface some contaminants such as Ar(III/V), U(VI), Se(VI) can be reduced to lower oxidation state [38]. Under anaerobic conditions, oxidation of Fe^0 can be done by H_2O or H^+ that produce Fe^{2+} and H_2 which are used as potential reducing agents for contaminants [39]. Halogenated organic compounds [40], nitroaromatic compounds [41], metalloids [42], inorganic anions such as phosphates and nitrates [43] have been successfully removed with the effects of adsorption, reduction, precipitation and oxidation by iron nanomaterials.

2.4. Iron oxide nanomaterials

Strong sorption capability, simple to operate, resourcefulness, and availability have attracted the attention towards the use of iron oxide nanomaterials in wastewater treatment. Magnetite,

maghemite and nonmagnetic hematite are most common forms of silver oxides [44]. Physical properties of contaminants in water can be influenced by magnetism which is an exceptional property that helps in water purification. When magnetic separation is combined with adsorption then it has been extensively used in the treatment of water and cleanup of environment [45]. To increase the adsorption capacity of iron oxide nanomaterials various ligands such as ethylenediammine tetraacetic acid (EDTA), L-glutathione, mercaptobutyric acid (MBA), meso-2,3-dimercaptosuccinic acid are being incorporated [46]. Magnetic properties of iron oxide in combination with adsorption performance should deal with wastewater treatment at promising approach. The physical, chemical and magnetic properties of iron oxide nanomaterials make it more efficient and cost-effective approach when compared to other conventional methods [47].

Iron oxide nanomaterials by absorbing visible light can act as a good photocatalyst. The generation of electron-hole pairs through the narrow band gap is attributed to the photocatalytic activity of iron oxide nanomaterials [48]. Iron oxide nanomaterials synthesized by thermal evaporation and co-precipitation results in photodegradation of Congo red dye which is an example of photocatalysis for safe and effective wastewater treatment [49]. Immobilization can also be done by using iron oxide nanomaterial. Iron oxide nanomaterial possesses chemical inertness and favorable biocompatibility due to which they have been widely used in immobilization technique [50]. Various phenomena such as electrostatic interaction, selective adsorption, ligand combination and surface binding explain the mechanism of removal of contaminants by iron oxide nanomaterials [51]. For inorganic and organic contaminants adsorption occurs via surface binding mechanism in which the contaminants diffuse into the adsorbent or are adsorbed for additional interaction [52]. The properties of iron oxide nanomaterials have shown a highly potential substrate in combination with biotechnology [53].

2.5. Titanium dioxide (TiO2) nanomaterials

TiO2 nanomaterials are currently used for the removal of different types of contaminants from wastewater that are comparatively less expensive than other nanomaterials. TiO2 nanomaterials do have a few favorable characteristics like high photosensitivity, availability, nontoxicity and eco-friendly [54]. TiO2 nanomaterial are less toxic to human beings and generate photocatalytic reactive oxygen species. Nanotubes, nanowires can be prepared with the help of TiO2. The antagonistic effect of TiO2 are shown at the minimum concentration of 0.1 to 1 g in 1L [55].

Titanium dioxide can be synthesized by:

- Metal organic chemical vapour deposition (MOCVD)
- Sol-gel process
- Wet chemical synthesis by precipitation of hydroxides from salts [56]

Photocatalytic oxidation in addition to filtration of organic contaminants can be done by TiO2 nanowire membrane. TiO2 microsphere, a new type of catalyst which was prepared by a sol-spraying calcination method, can easily settle in its aqueous suspensions under gravity. These TiO2 microspheres were found to be efficient in the photodegradation of salicylic acid (SA) and sulfosalicylic acid (SSA) and were reported to have a high potential for application in wastewater treatment [57].

High oxidative potential, biological and chemical inertness are some other properties possessed by TiO2. Various organic pollutants such as pesticides, dyes, polymers, phenolic contaminants have been decomposed by photocatalysis using nano-sized TiO2 under the influence of solar as well as artificial light [58]. Ultravi-

olet radiations are required for excitation for inducing charge separation within the particles by TiO2. Since TiO2 possesses low selectivity, it has the capability to degrade all kinds of contaminants [59]. For improving the photocatalytic activity of TiO2 metal doping has been demonstrated and silver has attracted the attention for doping [60]. However, doping with anions is considered as much cost effective and suitable for industrial applications [61]. Engates and Shipley have reported that at pH 8, TiO2 nanoparticles have the capability to adsorb metals such as Pb, Cd, Cu, Zn, and Ni [62]. In the last decade, visible light activated TiO2 nanoparticles have gained much attention [63]. For example, visible-light photo induced degradation of organic compounds by mesoporous Au/TiO2 nanocomposite microspheres has been reported [64].

2.6. Other nanomaterials

The biocompatible and biodegradable pristine cellulose nanomaterials (CNMs) and succinic anhydride functionalized cellulose nanomaterial (S-CNM) adsorbents prepared from Millettia ferruginea were found to be effective in removal of Cr(VI) ions from wastewaters [65]. Nanoporous carbon xerogels, nanostructured black carbon and exfoliated graphite nanoplatelets (xGnP) have been proposed for aqueous sorption of organic contaminants, aromatic compounds and phenolic compounds [66,67]. Hierarchical SiO2@γ-AlOOH spheres synthesized by using silica colloidal spheres have been used as adsorbents to remove Cr(VI) ions from wastewater [68]. Researchers have started working on developing bio-inspired nanoscale adsorbents and catalysts for the removal and degradation of a wide range of water pollutants. Spherical shaped iron nanoparticles with rhombohedral phase structure was prepared from the leaf extract of Amaranthus spinosus and were found to be applicable in photocatalytic degradation of aqueous solutions of methylene blue and methyl orange [69]. As(III) and As(V) were sequestered from wastewater using) iron nanoparticles synthesized from fresh mint leaves extract [70]. Synthesized palladium nanoparticles prepared from a fermentative cultivated mixed bacterial population has been found to be effective in the degradation of diatrizoate in wastewater [71]. Silver nanoparticles synthesized from A. agallocha leaves juice, iron nanoparticles synthesized from aqueous green tea extract were used for the removal and catalytic degradation of victoria blue, bromothymol blue and malachite green respectively [72–74].

3. Conclusion

Nanomaterials possesses a variety of physical and chemical properties which make them potential applicants for water purification. Locality, availability, feasibility, economic conditions are considered on choosing the type of nanomaterial employed for wastewater treatment. Nanomaterials overcome the difficulties faced during traditional and conventional methods by possessing cost-effectiveness, ecofriendly, environmentally friendly and time saving approaches. As sorbents nanomaterials are useful in removing heavy metals at high concentration, high selectivity. These properties make them fruitful in treatment technology. Larger contaminated sites can be cleaned up by nano remediation which reduces the cleanup time and contaminant concentration also. Metal oxide containing nanomaterial are considered as good tool as they are considered as immobilization carriers in biosensors and biosorbents.

Acting as sensors due to their size and other characteristics, nanomaterial have the property of detecting pathogens and some newly discovered substances in wastewater. Nanocomposite material is one more application of nanomaterials in which advantage to both host as well as nanomaterial is provided. Polymers, bio-

polymers, activated carbons, minerals can act as host which facilitate the stability and dispersion of loaded nanomaterials. Further work is being done to understand the interaction between immobilized nanomaterials and host and designing of nanomaterials of multifunctionality. Looking towards the current speed of development, nanomaterials are extremely promising for wastewater treatment.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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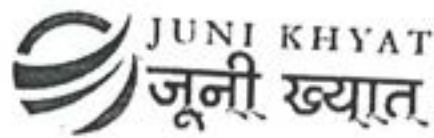
CERTIFICATE OF PUBLICATION

This Publication certificate has been issued to

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Department of Accountancy and Business Statistics Assistant Professor, Kanoria PG Mahila Mahavidvalay, Jaipur

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DIGITAL PAYMENT ADOPTION IN INDIA (A COMPARATIVE STUDY BEFORE AND AFTER COVID-19)

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Abstract

In Indian economy the digital payment is not a new phenomenon. However the COVID-19 has put a spotlight on inherent flows brought forth by rigidity or inflexibility of being overly reliant on cash as a sole method of payment, for many legacy players in the industry as well as individual consumers. This pandemic has given a sizeable push in the endeavor to marginalize cash transactions. The objective of this paper is to discover the actual impact of COVID -19 on the preferences of the people while making transactions. For primary data collection Google questioners have been sent to all over India to all the age group people. Respondents are from all type of socioeconomic status. Graphical and Tabulation approach has been used as a data tool. In this descriptive research paper a comparative study has been done for analysis. We find in our survey that when the cases of COVID-19 all at a rise in India the digital mode of payment has become a life savior as it not only eliminates the risk of social contact but also provides safety from leakage in economy with better security as well as easy and convenient way of transferring money. However consumer awareness and security concerns continue to be amongst the biggest hurdles and needs to regulate by government.

Introduction:

The corona virus pandemic shook the overall economy of the world, so there was no way for India to be left out unharmed from this major shock. According to Ministry of Statistics, India experienced a downfall of 3.1% in growth during fourth quarter of fiscal year of 2021. As per Chief Economic Advisor to the Government of India this drop is mainly due to the corona virus pandemic and in the views of World Bank "the current corona virus pandemic has magnified pre-existing rest to India's economic Outlook". The recently revised India's growth by the world Bank and other rating agencies for FY2021 turns out to be the lowest figures that India has experienced since India's Economic liberation since 1990s. State Bank of India research estimates a contraction of over 40% in the GDP in Q1 the contraction will not be uniform, rather it will differ according to various parameters such as state and sector. On 1 September 2020, the Ministry of Statistics released the GDP figures for Q1 (April to June) FY20, which showed a contraction of 24% as compared to same period in prior year. Along with the rest of the world, the Indian market also witnessed a dramatic growth in digital markets, specifically in payments. The value of digital payments in the south Asian country recorded a whopping 769 percent share of the GDP in fiscal year 2019. A collective leap in the direction towards cashless payments has got all stakeholders on board. And with the onset of the corona virus (COVID-19) pandemic, and subsequent lockdown, shopping moved online, further boosting online payments.

India's digitalized economy experienced a boom with Indians taking interest in advanced and easy to use digital payment methods for shopping, paying bill ,purchase of day to day items including transfer of funds which was further catalyzed by the Corona pandemic situation and constant lockdowns which made more and more population to acknowledge and utilize the digital payment methods.

People have started preferring digital payments over cash payments and there is noticed a sudden increase in quantity as well as frequency of digital payments. It is evaluated that the number of digital payments per capita has soared as high as 22.42 (Jan, 2021).Keeping this in view a survey was also conducted to analyze the current situation . The outcomes and result of the survey is included in this paper.

India is estimated to see tremendous growth in the transactions of mobile payments in terms of value, more so including the impact of COVID-19. This figure includes reaching nearly 660 million Indians. Incidentally, the country will contribute about 2.2 percent to the world's digital payment market.

Objectives:

The objectives of this paper are as follows:

- To discover the actual impact of COVID -19 on the preferences of the people while making transactions.
- To analyze the situation of digital payments in India and prevalent methods used to do such payments
- To ascertain the amount of users indulged in digital transactions.
- To evaluate and compare the digital payment per capita per annum over five years to evaluate and compare digital transaction volumes by various digital payment methods on a yearly basis to get a glimpse of how Corona pandemic gave boost to digital payments.
- To discuss various initiatives taken by government to increase the volume of digital transactions in India to facilitate public in general amidst the COVID-19 pandemic.

Research Methodology:

This research paper has been based on quantitative research approach. For primary data collection Google questioner has been sent to all over India to all the age group people. Respondents are from all type of socioeconomic status. There were 10 Multiple Choice questions in the questioner. 532 Reponses has been received. Graphical and Tabulation approach has been used as a data tool. In this descriptive research paper a comparative study has been done for analysis.

Digital payments in India at a glance:

Inception of digital payments in India was in 1990 when Government of India came with the concept of online banking which changed the entire perspective of financial services Further digital payments in India became more prevalent during the time of demonetization when India was thriving to become a cashless economy the pandemic of COVID-19 served as a catalyst to these digital payments.

As per the recent forecasting done by Accenture and released on November 24, 2020 – about 66.6 billion transactions worth USD 270.7 billion are expected to shift from cash to cards and digital payments by 2023 in India, and further increase to USD 856.6 billion by 2030. According to the report, the payment gateway aggregator market in India, is currently estimated to be at Rs 9.5 trillion. This indicates that the point of stagnation for the industry of digitalized payments is nowhere in near future rather this industry has lot of potential for growth and development and the various estimates by rating agencies proves that these digital payments are increasing continuously both in frequency and in volume .

The digital payments have been readily adopted by the general public of India as it includes various advantages such as consumer's convenience, safety, protection, speedy transactions, financial gains and no financial leakages. This leads to a win- win situation for the customers of digital payments. The various modes of digital payments available in India are as follows :-

- Unstructured Supplementary Service Data (USSD) channel
- Mobile wallets(e.g. Paytm, Free charge, Mobikwik, Oxigen, mRupee, Airtel Money, Jio Money, SBI Buddy, Citrus Pay, Vodafone M-Pesa, Axis Bank Lime, ICICI Pockets, SpeedPay etc.)
- Mobile Banking
- Aadhaar Enabled Payment System (AEPS)
- Banking cards including Debit card and Credit cards
- Unified Payments Interface (UPI)
- Internet Banking

Impact of COVID-19 on preferred mode of transaction:

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Keeping in view the recent emerging trends in change of mode of transaction a survey was conducted by us to check in reality the current status of digital payments in India

In the survey an attempt was made to ascertain the impact of COVID-19 on preferred mode of payment by respondents what are the hindrances in adoption of digitalized payments distribution of sample population making transactions by the attribute of age and also ascertain future Expectations of respondents.

The survey insights are as follows:-

1. **Preferred Mode Of Payments By the Respondents by the attribute of Age-**

Table-1

Age Group(in years)	Modes of payments and their Users			Total
	Cash	Credit card and Debit card	UPI Payments	
20-30	33	106	134	273
31-40	11	57	60	128
41-50	10	42	22	74
51 and above	7	33	17	57

Graph-1

● Cash   ● Credit and debit card   UPI and online wallet
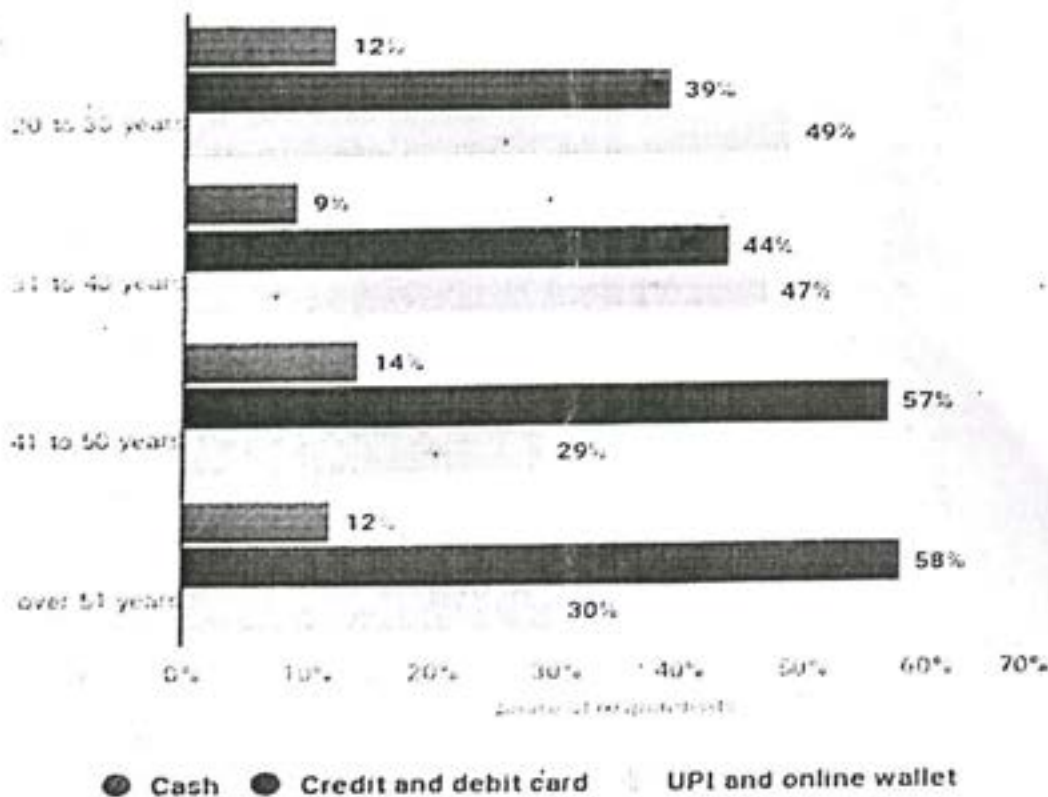
Interpretation-

A total of 532 respondents formed the sample population on which the online survey was conducted the respondents from the age group 20 to 30 years constituted the maximum number of respondents .The survey depicted that about 88% of the participants from the age group of 20 to 30 years , 91% of the participants from age group 31 to 40 years , 86% of the participants from the age group 41 to 50 years and 88% of the participants from the age group of 51 and above use digitalized payments (credit card debit cards and UPI payments) as their mode of payment . This implies that majority of all age groups preferred digitalized payment over cash payments.

2. **Impact of COVID-19 on preferred mode of payment by respondents-**

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Table-2

Particulars	No. of Respondents
Preferred Cash payments over digital payments	0
Preferred Digital payments over cash payments	372
Usage of only Digital payments	38
No change in preferred mode	61

Graph-2

0%	79%	8%	13%
preferred cash payments over digital payments	Prefer digital payments over cash payments	use of only digital payments	No change in preference

Interpretation-

The results of the online survey portray that a majority of 79% respondents reportedly preferred digital payments over cash payments during COVID-19 pandemic .This change however was not due to an insignificant reason but contain a series of reasons some of which being maintenance of physical distancing convenience and safety.

Some respondents amounting to 8% of the total sample population responded that they only used digital payments during the COVID-19 pandemic.

The survey also showed that there was no backward flow from digital transactions to cash transactions still about 13 % of the total respondents stated that there had been no change in the preferred mode of transactions be it cash or Digital mode.

3. **The hindrances limiting adoption of Digitalized payments In India-**

Table-3

Hindrances	No. of Participants
Unease in using Digitalised payments	231
Limited Infrastructure	94
Transactional charges	94
Lack of trust	14
Inadequate dispute handling	38

Graph-3

49% **20%** **20%** **3%** **8%**

| Unease in using digitalised payment | Limited Infrastructure | Transactional Charges | Lack of trust | Inadequate dispute handling |
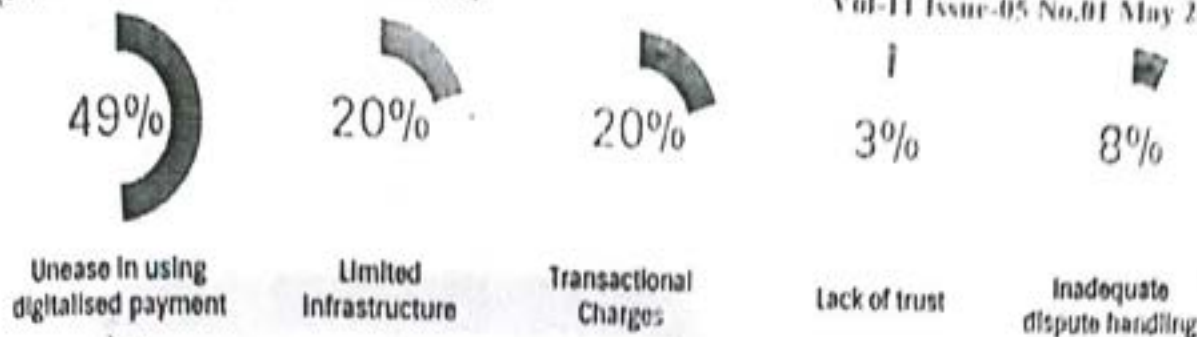
Interpretation-

The obstacles highlighted by the respondents in the adoption of digital payments in India includes unease in using digitalized payments , limited infrastructure ,transactional charges, lack of trust and inadequate dispute handling. Amongst all these hindrances most participants indicated lack of awareness across various aspects using in using the digitalised payments such as the transactional mechanism, use of vouchers and discount codes as a major obstacle. However only 3% of the respondents reported lack of trust as a hindrance. A considerable amount of respondents amounting to 20% of the sample population were concerned with the transactional charges and 20% of the sample population had limited infrastructure as their obstacle in adopting digitalized payment.

4. **Future expectations of respondents to switch back to cash payments post COVID-19 –**

Table-4

Future Expectation	No. of Participants
Most likely to switch over to cash payments	32
Somewhat likely to switch over to cashpayments	154
Unlikely to move back to cash payments	346

Graph-4

6% **29%** **65%**

| most likely to switch over to cash payments | somewhat likely to switch over to cash payments | unlikely to move back to cash payments |
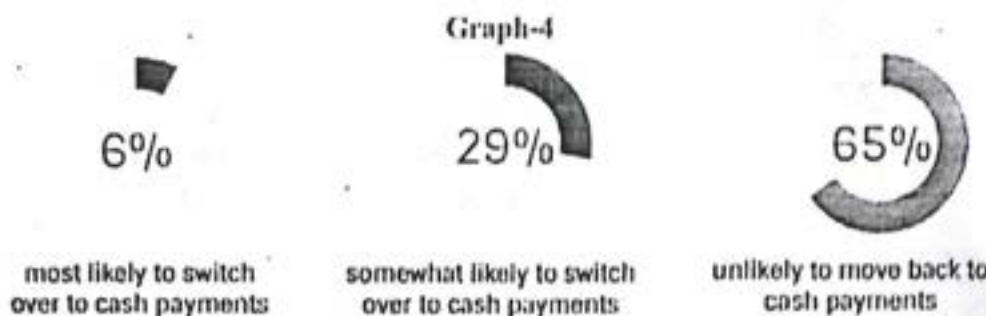
Interpretation-

When given option to the respondents about their future expectation regarding change in the preferred mode of payment after the COVID-19 scenario,majority of the participants amounting to 65% were certain about not moving from digital payments to the cash payments. However, about 29% of the participants was somewhat likely to switch over to cash mode of payment and only 6% of the participants were most likely to switch over to the cash payments after the COVID-19 pandemic.

5. **Some frequently used applications to make digital transactions In India**

Graph-5

Digital Payments App Usage in India - Januarry 2021
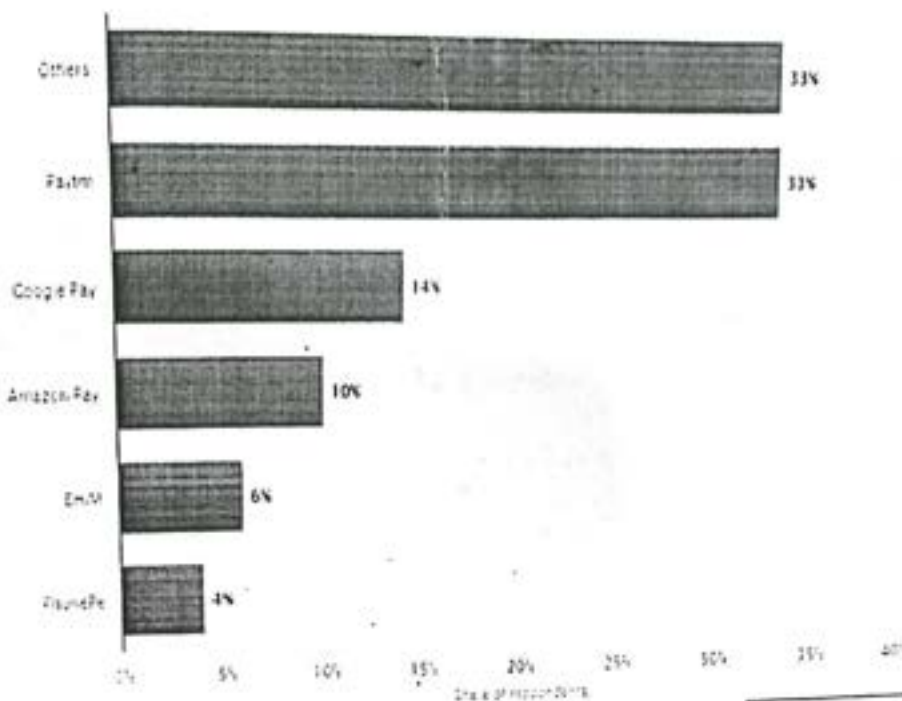
Source-statista.com_21March2021

Interpretation-

As per the reports of Statista Data Collection committee an online survey was conducted on2,345 participants to find about various digital payment apps used in India . amongst which Paytm is used by the majority of 33% of the Indian population indulged in digital transactions .Google pay is also used by a considerable amount of population despite the controversies which emerged relating to Google pay app BHIM app and PhonePe app are also used but they are not so quite popular among the Indian population, however Amazon pay is also spreading its roots in the Indian digital payment market and there are still 33% of people using other apps for Digital payments in India.

6. **Evaluation and comparison of digital Payments per capita-**
Graph-6

Comparative analysis of per capita digital payments(Dec.2014 - Dec.2020)
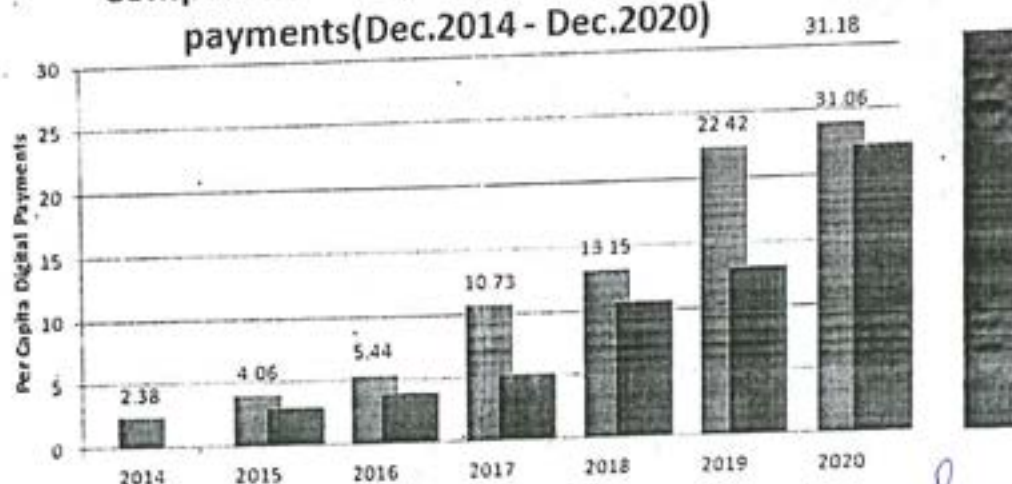
Source:timesofindia.indiatimes.com

Interpretation-

The recent data from the source of Times of India about comparative analysis of per capita digital payment there is an evident rise from 2014 to 2020 in the per capita digital payment when in 2014 it

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was just 2.38 there was a significant rise in the year 2019 of about 22.42 however the most significant rise is in between the year 2019 to 2020 which shows more than 50% rise in the per capita digital payment.

Recent Initiatives by Government of India to boost , monitor and measure Digital Payments:

- **Digital Payment Index-** The Reserve Bank of India has constructed a composed Digital Payment Index -DPI , to capture the extent of digitalization of payments across the country to enable measurement of deepening and penetration of digital payments in the country over different time periods. It has been constructed with March 2018 as the base period keeping DPI score for March 2018 as 100. It will be published on RBI website on semi-annual basis from March 2021

- **Use of Low-Cost Digital Modes-** The government made it mandatory for any business entity with annual turnover more than 50 crores to offer low cost digital modes of payments to the customers provided that no charges shall be imposed on customers as well as merchants to achieve this

- **DigiVaarta-** This scheme was launched by the government of India to spread the Awareness of digital money and also on the usage of BHIM app.

- **DIGI shala-** This is a program that is launched on DD channel to promote digital payments and spread Social awareness about modes of digital transactions prevalent in India.

- **Digi Dhan Abhiyan -** This program was launched to promote cashless transaction

- **Vittiya Saksarta Abhiyam-** This program or Abhiyan is an initiative by MHRD to engage youth in digital enabled cashless economy

  Lucky Grahak Yojana and **DigiDhan VyaparYojana –** This program is an initiative to attract more and more consumers as well as merchants towards digital transactions by offering cash rewards for personal consumption expenditures

- **TDS Deduction at Source-**To promote digital transactions and discourage the practice of making business payments in cash it was made a rule of levying 2% TDS on cash withdrawal exceeding rupees one crore in a year from a bank account.

- **Digital Smart Cards-** Recently government officials were given their pensions through digital Smart cards which lead to reduction in bribe

- **Go Digital and get discounts on Insurance, petrol and Diesel-** Government also took initiative for promoting digital transactions by giving 0.75% discount on petrol and diesel purchase if payment is done by E wallets or debit cards or credit cards

- **INR 10 lakhs of Insurance-** The ministry of Railways also issued and amazing scheme of travel insurance which will enable the passengers a travel Insurance of 10 lacs on unforeseen happenings if tickets are purchased digitally

- **Rupay Card from NABARD-** The government also issued to the farmers rupay card from Nabard who had Kisan Credit Card

- **10% discounts for highway tolls-** Government also provided a relaxation on highway tolls when the payment is made in digital mode

Findings:

When the cases of COVID-19 all at a rise in India the digital mode of payment has become a life savior as it not only eliminates the risk of social contact but also provides safety from leakage in economy better security and easy and convenient way of transferring money. Some of the recent findings from the survey conducted are as follows-

- There has been a sudden increase in the digital payments all over the India when all the industries are combating the situation of COVID-19 and struggling to even survive in this scenario , the industry of digital payments have grown rapidly since the past year.

- One of the most important finding is that most of the digital transactions are done by the people of age between 20 to 30 years as they are very much advanced and have the technical know how to do the transactions digitally contributing to about 48% of the total digitally active population.

- The number of digital transactions in India spreading at a massive rate and have reached to 31.1 8 per capita digital payment.

The companies of Paytm and Google pay are the preferences of the Indian population and about 40% of the total population who are digitally active are using the above-mentioned apps.

- From the survey it was evident that 94% of the population of India from urban areas have switched over to digital payments from cash have no intention of moving back to the cash payments.
- Indian population is still apprehensive of digital payments because of the security and trust issues which leads to disinterest in digital payment.
- With the government initiatives to boost digital payments in India there is no doubt that there will be rapid growth in the digital payment industry.
- Cash is not expected to disappear in the near future as people have difficulty in making digital transactions due to inappropriate infrastructure lack of awareness and cash payments being in their comfort zone.
- The epidemic of COVID-19 has played a great role in moving people from the cash based transactions to the digital base transactions leading to unprecedented rise in transaction volume in digital transactions post lockdown

Conclusion:

Cashless economy is not a new phenomenon for India. Digital payment system in India has witnessed a steady transformation since the 90's with the liberalization of the Banking Industry and Introduction of new technologies. Thereafter various payment products and service providers were launched time to time. Demonetization and Introduction of GST made the people of India bound to be IT friendly. But, the pandemic COVID-19 has put a spotlight on inherent flows brought forth by rigidity or inflexibility of being overly reliant on cash as a sole method of payment, for many legacy players in the industry as well as individual consumers. COVID-19 have given a sizeable push in the endeavor to marginalize cash transactions. However consumer awareness and security concerns continue to be amongst the biggest hurdles and needs to regulate by government. The increased adaptation in the short term is likely to accelerate the sustained shift towards digital payments.

Seem

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इतिहास, कला एवं संस्कृति की शोध पत्रिका

राजस्थानी साहित्य की अनमोल ऐतिहासिक धरोहर : कृषि कहावतें

डॉ. विष्णु प्रिया टेमानी

भाषा और साहित्य में सुन्दरता एवं सजीवता लाने के लिए कहावतों का प्रयोग युगों से होता आ रहा है। साहित्य को सारगर्भित बनाने के लिए कहावतें का प्रयोग किया जाता है। इन कहावतों की जननी मनुष्य जीवन के अनुभव है। जिस प्रकार वेद एवं पुराणों में महर्षि वेद मुनियों ने अपने कठिन तप एवं परिश्रम से मनुष्य मात्र के कल्याण के लिए मार्गदर्शक एवं ज्ञानवर्धक बातों का भंडार भरा है उसी प्रकार सामान्य मनुष्य द्वारा अपने ज्ञान एवं अनुभव के आधार सामान्य जनजीवन क्रियाकलाप में सहायता हेतु कहावतों का सूत्रपात किया गया। इसी संदर्भ में राजस्थानी कहावतें हमारी अमूल्य धरोहर है। राजस्थानी किसानों द्वारा रचित यह कहावतें जनजीवन के व्यवहार कुशलता की कुंजियाँ हैं।

यह कहावतें आज से सैकड़ों हजारों वर्षों के अनुभवों एवं शोध की पूंजी है तथा विज्ञान की कसौटी पर आज भी खरी उतरती हैं, भविष्य में होने वाली घटनाओं का पूर्वानुमान लगाना मनुष्य की वृत्ति है सामान्यता सांख्यिकी में आंकड़ों के आधार पर पूर्वानुमान लगाने की इस कला को *प्रायिकता* कहा जाता है इसी प्रकार राजस्थान में भी किसानों के द्वारा वर्षा के होने व न होने की *प्रायिकता* प्रकृति में होने वाले परिवर्तनों के आधार पर ज्ञात की जाती है—

अनोखी बात यह है कि राजस्थान में यह पूर्वानुमान, पूर्व कालीन किसानों के द्वारा कहावतों के रूप में पिरोया गया है ग्रामीण लोगों ने इन कहावतों में जो अनमोल ज्ञान भरा है वह प्राचीन पीढ़ियों के अनुभव का फल है आधुनिक वैज्ञानिक निरीक्षण पद्धतियों के सामने इन कहावतों की उपयोगिता कम नहीं है वास्तविक धरातल पर देखा जाए तो इन कहावतों के पूर्वानुमान सटीक प्रतीत होते हैं—

कीड़ी मेले इंड, चिड़ी रेत में नाहने।
कौंसी कामन दौड़, आभो लील रंग लाने।।
डेडरो डहक बाड़ां चढ़, बिसहर चड़ बैठे बड़ां।
पांडिया जोतिस झूठा पड़े, घन बरसी इतरागुणां।

अर्थात सूर्य का प्रचण्ड तेज (धूप), बतक का चिल्लाना, भैं का
पिघलना, हवा की तरफ पीठ देकर बकरी का बैठना, चिटियों का अंडे लेकर
चलना, चिड़ियों का धूल से नहाना, कांसे का रंग फीका पड़ जाना, आकाश
का गहरा नीला हो जाना, मेढ़कों का बाड़ में घुस जाना और सांपों का ऊंचे पर
चढ़ना, आगामी घनी जा पड़ेगा वर्षा के चिन्ह है चाहे ज्योतिषो को बात झूठी
पड़ जाय, पर ये शकुन अटल है।

परभाते गेह डंबरा, दोफारां तर्पत।
रातू तारां निरमला, चेला करो गछंत।

अर्थात यदि प्रातःकाल में बादल दौड़ें, दोपहर को धूप तेज हो पीलास
और रात्रि को निर्मल आकाश में तारे दिखाई दें, तो, हे शिष्य! उस देश में
अपना रास्ता लेना चाहिये (अर्थात् वहाँ अकाल पड़ेगा)।

आभा राता मेह माता, आभा पीला मेह सीला।

अर्थात यदि आकाश में ललाई दिखाई दे तो भारी वर्षा हो और पीलास
दिखाई दे तो वर्षा की कमी हो।

दुशमन की किरपा बुरी, भली सैन की त्रास।
आईंग कर गरमी करै, जद बरसन की आस।।

अर्थात शत्रु की कृपा की अपेक्षा मित्र की डाट डपट अच्छी है। जब
कड़ाके की गरमी पड़ती है और पसीना नहीं सूखता तब वर्षा की आशा होती है।

अगस्त ऊगा मेह पूगा।

अर्थात अगस्त तारा उगने पर मेह का अन्त समझना चाहिये।

अगस्त ऊगा मेह न मंडे। जो मण्डे तो धारन खंडे।।

अर्थात अगस्त के उगने पर (प्रारंभ होने पर) प्रथम तो वर्षा होगी ही नहीं
और हुई तो खूब मूसलाधार होगी।

सवार रो गाजियो।
(ने) सापुरस रो बोलियो, एल्यो नहीं जाय।।

चैत महीने चीज लुकोचे। धुर वैशाख केसू धोये।

अर्थात् यदि चैत्र भर बिजली न दिखाई दे तो वैशाख कि आरंभ में ही वर्षा होती है।

जेठा अन्त विगाडिया, पूनम ने पड़वा।

अर्थात् यदि जेठ की पूर्णिमा (पूर्णमासी) और आषाढ़ की प्रथमा (प्रतिपदा) को छींटें पढ़ें तो अपशकुन समझना

जेठ बीती पहली पड़वा जो अम्बर धरहते।
असाढ़ सावन काड कारो, भादखे विरखा कर।।

अर्थात आषाढ़ की प्रथमा को यदि बादल गर्जें या वर्षा हो, तो आषाढ़ और सावनमास सूखे जायेंगे और भादों में वर्षा होगी।

1. इस शोधपत्र के तृतीय एवं अंतिम चरण में त्योहारों पर नक्षत्रों की दशा का वर्षा पर प्रभाव बताने वाली कहावतों की विवेचना निम्नांकित है :

आखा रोहन पायरी, राखी सरवन न होय।
पोही मूल न होय तो, म्ही ठूलती जोय।।

अर्थात आखातीज (अक्षय तृतीया) पर रोहिणी नक्षत्र न हो, रक्षा बन्धन पर श्रवण नक्षत्र नहीं हो और पौष की पूर्णिमा पर मूल नक्षत्र न हों, तो संसार में विपत्ति आएगी।

स्वाते दीपक प्रजले, बिसाखा पूजे गाय।
लाख गयन्दा धड़ पड़े, या साख निरपफल जाय।

अर्थात यदि दिवाली स्वाति नक्षत्र में हो, और दूसरे दिन प्रातःकाल गौ पूजन के समय विशाखा नक्षत्र हो, तो खूब लड़ाई होगी (जिसमें लाखों हाथियों के शिर कटें या फसल अकार्थ जाय)

उपरोक्त अध्ययन से हमें ज्ञात होता है कि किस प्रकार राजस्थानी किसान हवा और अन्य प्राकृतिक लक्षणों से अपने भविष्य का पूर्वानुमान लगाने का प्रयत्न करने लगते हैं। इन्होंने अपने बहुत वर्षों के अनुभव से अपना ही के एक मौसम-विज्ञान (मिट्यूरोलोजीकल साइन्स) भी बना लिया है जो कई कहावतों और तुकबन्दियों में बहुत से ग्रामीण के लोगों के मुंह से सुनने को मिलता हैं।

राजस्थान की अर्थव्यवस्था एक कृषि प्रधान अर्थव्यवस्था है राज्य का प्रमुख व्यवसाय कृषि है राजस्थान की लगभग 70% जनसंख्या कृषि एवं

VOICES

Voices of Interdisciplinary Critical Explorations
(Peer Reviewed Journal)

Special Number: Children's Literature

Editor

Rajul Bhargava

Section II – Narratives

15

Exploring the Realm of Fantasy in E.B. White's *Charlotte's Web*

Swatti Dhanwni

Children's Literature is replete with animal characters. Animals of every variety populate all genres of Children's Literature like picture books, comics and short stories. Generally, the animals that figure in the stories of children are depicted as having acquired human qualities and intelligence. The animals are located either in a social set-up which is familiar to children or often the landscape is of an alternative or secondary world[1] which makes the story appealing to children.

The foremost responsibility of authors of Children's Literature is to make their stories interesting for the child readers. Hence, authors of Children's Literature generally use fantasy and anthropomorphism as narrative techniques to construct a story with an enchanting make-believe world. Fantasy is generally understood as a world created by the writer that is opposite to reality evoking a sense of wonder in the readers. A special device used by the writers is anthropomorphism. These talking animals behave like humans and can also read, cook, walk, eat, write and speak. Anthropomorphism together with fantasy creates a world that is enchanting to the child readers.

Fantasy is characterized by fantastic or improbable elements in the story. It is a fiction which describes things as contrary to reality and not things that are improbable. Reginald Eretnor, a Professor of Literary Theory at University of Konstanz in Germany, defines fantasy as imaginative fiction in which no logical attempt is made, or needed to justify the 'impossible' content of the story. Thus, fantasy contains impossible elements that are accepted as possible in the story. It depicts things that are contrary to the prevailing ideas of reality.

EFFECTS OF AEROBIC EXERCISES ON LIPID PROFILE OF DIABETES MELLITUS TYPE-2 PATIENTS

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ABSTRACT

Consistent aerobic exercise training for type 2 diabetic patients is known to have beneficial effects on whole-body glucose metabolism, very supportive to lowering triglycerides and bad cholesterol level, and also helps to maintain HDL level.The motive of the experimental study was to check the authenticity and acceptance of 12 months aerobic training for maintaining cholesterol & triglyceride level within limit. For the present study 20 male and 15 female, type 2 diabetic patients were selected for 12 months aerobics training to study the effectiveness of this training on cholesterol level. The range of age was fixed from 35 to 55 years. The study was conduct to find out the results on Lipid profile. So, HDL (High Density Lipoprotein), LDL (Low Density Lipoprotein), VLDL (Very Low Density Lipoprotein), Triglyceride and Total Cholesterol level were testedbefore starting the training and again after completing the training of 12 months. Mean value of HDL, LDL, VLDL, Triglyceride and total cholesterol was considered and compare between pre and post value.Considerable results were found for lipid profile tests. Cholesterol level was improved towards healthy limit, which concluded that aerobic activities play a vital role to maintain cholesterol level in type 2 Diabetes patients and regular practices on long term basis can achieve the goal of maintaining healthy cholesterol level.

Keywords: Diabetes mellitus type-2, aerobic exercise, triglyceride and total cholesterol

1. INTRODUCTION

Diabetes is a chronic disease which occurs when pancreas does not produce insulin or produce very little amount of insulin. This type of diabetes is called type 1 diabetes mellitus. In type 2 diabetes, insulin is produced by pancreas but body is not capable enough to use it effectively.

The prevalence of this disease worldwide is increasing day by day and the data on growth rate of diabetes cases are enough to worry about it seriously. In 2000, prevalence of diabetes was reckoned 2.8% and supposed to be increased by 4.4% in 2030[1]. Similarly in India, there was 31.7 million active cases of diabetes and figures are supposed to be increased by 79.4 million in 2030[2].

To control the disease, physical activeness is mandatory. Aerobic exercises can play a very vital role to manage sugar level in diabetic patients[3].

Now in the modern world of automation, there is not so much need of physical efforts to do your work. Most of people have desk job with very low energy consuming activity. There are lots of gadgets who are very supportive to do work effortless but they are also creating lazy environment around us. Sedentary routine is a major reason of diabetes[4].As the impact of daily aerobic training, it improves lipid levels and decrease blood glucose level in type 2 diabetic patients[5]. Daily aerobic exercise linked with restricted meal plan, is a very methodical way to improve the performance of mitochondrial enzymes[6]. Aerobic exercises training require a long term commitment to do exercises on regular basis. When aerobics are performed at necessary intensity and repetition, cardio respiratory system is improved[7]. Improved respiratory system improves blood circulation in our body. Some results shows that aerobics of adequate strength and normally 3 or more time per week, regulate the blood glucose level and diastolic blood pressure[8]. Aerobic training for 12 weeks or more helps to promote HDL cholesterol and demote LDL cholesterol & triglyceride level. It also improves the cholesterol ratio of HDL: LDL[9]. It is also mentioned in some studies that decreased LDL level minimize the risk of cardiovascular disease[10].

2. METHODOLOGY

2.1 Sample

Total 35 (20 male and 15 female) type 2 Diabetes mellitus patients were shortlisted to perform aerobic activities for 12 months period. The age criterion was 35 to 55 years. A short training schedule was conducted to introduce the basics of aerobic training with to do & not to do lists and some dietary restriction. Average duration for daily aerobic training was scheduled for 60 minutes. Sunday was considered as an off day for aerobic exercise.

2.2 Selection of Variables

The variables, selected for study, were LDL, HDL, VLDL & triglycerides. The values of all variables were tested by blood test. First time blood samples were collected before starting the aerobic training. And after completing 12 months aerobic training successfully, again blood samples were collected for lipid profile test.

2.3 Training Schedule

The schedule of aerobic training was determined with medium intensity initially and after 3 months, the intensity was increased. There was no difference in aerobics for male and female diabetic patients.

3. RESULTS

TABLE 1
ANALYSIS OF LIPID PROFILE IN TYPE 2 DIABETES MELLITUS PATIENTS, BEFORE & AFTER 12 MONTHS AEROBIC TRAINING

Variables	Pre (before 12 months)	Post (After 12 months)
High Density Lipoprotein	28.43 mg/dl	33.14 mg/dl
Low Density Lipoprotein	158.40 mg/dl	133.89 mg/dl
Very Low Density Lipoprotein	43.49 mg/dl	29.57 mg/dl
Triglycerides	221.29 mg/dl	152.09 mg/dl
Total Cholesterol	230.31 mg/dl	171.37 mg/dl
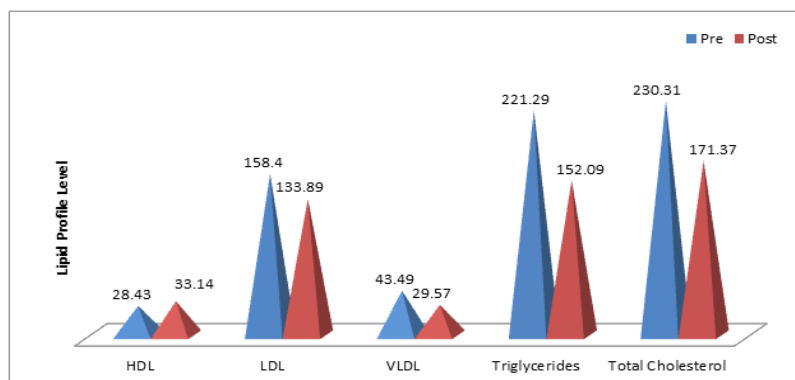
Figure 1: Alterations in lipid profile before and after 12 months aerobic training
TABLE 2

ENUMERATION STATISTICS OF PRE AND POST-TEST MEAN SCORES OF HDL CHOLESTEROL* LEVELS IN EXPERIMENTAL AEROBIC GROUP BEFORE AND AFTER 12 MONTHS INTERVENTION [N=35]

Group	Test	Mean	SD	SEM	t	df	Standard error of difference
Aerobic Group	**Pre**	28.43	4.48	5.60	4.2635	68	5.617
	Post	33.14	2.49	.42			

*Referencing the above Table, when we found the HDL Cholesterol in aerobic group (before & after 12 month training).

The value of 't' was found 4.2635 and the two tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be extremely statistically significant. The confidence interval mean of twelve months difference equals 23.9500 and 95% confidence interval of this difference ranged from 12.7405 to 35.1595.

TABLE 3
ENUMERATION STATISTICS OF PRE AND POST-TEST MEAN SCORES OF LDL CHOLESTEROL* LEVELS IN EXPERIMENTAL AEROBIC GROUP BEFORE AND AFTER 12 MONTHS INTERVENTION [N=35]

Group	Test	Mean	SD	SEM	t	df	Standard error of difference
Aerobic Group	Pre	158.40	7.57	1.27	14.5802	68	1.681
	Post	133.89	6.45	1.09			

*Referencing the above Table, when we found the LDL Cholesterol in aerobic group (before & after 12 month training).

In Aerobic group, the value of 't' was found 14.5802 and the two tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be extremely statistically significant. The confidence interval mean of twelve months difference equals 24.5100 and 95% confidence interval of this difference ranged from 21.1555 to 27.8645.

TABLE 4
ENUMERATION STATISTICS OF PRE AND POST-TEST MEAN SCORES OF VLDL CHOLESTEROL* LEVELS IN EXPERIMENTAL AEROBIC GROUP BEFORE AND AFTER 12 MONTHS INTERVENTION [N=35]

Group	Test	Mean	SD	SEM	t	df	Standard error of difference
Aerobic Group	Pre	43.49	5.46	4.99	7.5559	68	5.033
	Post	29.57	3.50	0.59			

*Referencing the above Table, when we found the VLDL Cholesterol in aerobic group (before & after 12 month training).

In Aerobic group, the value of 't' was found 7.5559 and the two tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be tremendously statistically significant. The confidence interval mean of twelve months difference equals 38.0300 and 95% confidence interval of this difference ranged from 27.9865 to 48.0735.

TABLE 5

ENUMERATION STATISTICS OF PRE AND POST-TEST MEAN SCORES OF TRIGLYCERIDES* LEVELS IN EXPERIMENTAL AEROBIC GROUP BEFORE AND AFTER 12 MONTHS INTERVENTION [N=35]

Group	Test	Mean	SD	SEM	t	df	Standard error of difference
Aerobic Group	Pre	221.29	26.55	4.48	14.7046	68	4.706
	Post	152.09	8.38	1.41			

*Referencing the above Table, when we found the Triglycerides level in aerobic group (before & after 12 month training).

In Aerobic group, the value of 't' was found 14.7046 and the two tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be tremendously statistically significant. The confidence interval mean of twelve months difference equals 69.2000 and 95% confidence interval of this difference ranged from 59.8093 to 78.5907.

TABLE 6

ENUMERATION STATISTICS OF PRE AND POST-TEST MEAN SCORES OF TOTAL CHOLESTEROL* LEVELS IN EXPERIMENTAL AEROBIC GROUPS BEFORE AND AFTER 12 MONTHS INTERVENTION [N=35]

Group	Test	Mean	SD	SEM	t	df	Standard error of difference
Aerobic Group	Pre	230.31	9.63	1.62	28.1515	68	2.094
	Post	171.37	7.79	1.31			

*Referencing the above Table, when we found the Total Cholesterol in aerobic group (before & after 12 month training).

In Aerobic group, the value of 't' was found 28.1515 and the two tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be extremely statistically significant. The confidence interval mean of twelve months difference equals 58.9400 and 95% confidence interval of this difference ranged from 54.7621 to 63.1179.

4. DISCUSSION

After comparing the results of lipid profile levels between pre and post aerobic training, significant results were achieved. The increment in HDL level was on satisfactory level. And there were fair fall in LDL, VLDL, triglyceride levels and total cholesterol level. Although the achieved test results of lipid profile still need to be improved but can't be ignored. The changes after 12 months aerobic training is highly considerable and the habit of regular exercise with significant increment in the intensity of exercise with time, could be helpful to maintain the cholesterol level within healthy limit.

5. CONCLUSION

After getting the significant results, aerobic exercise can be considered as an influential practice for type 2 diabetic patients and aerobics are effective to maintain cholesterol level.

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BIOREMEDIATION OF PETROLEUM WASTE CONTAMINATED SOILS: A REVIEW

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ABSTRACT

Since the industrial revolution, petroleum hydrocarbons are deleterious environmental contaminants which when introduced into the gleaming environment immediately diminishes its quality. The universal processes of extraction, refining, transporting and accidental spillage of petroleum contribute to soil pollution. Being toxic, mutagenic and carcinogenic, the petroleum hydrocarbons are a serious hazard to the environment. Bioremediation has appeared as one of the most promising treatment options carried out using microorganisms. It does not implement intensive chemical and mechanical treatments and has emerged as an environmental friendly and cost effective remediation approach for the removal of petroleum hydrocarbons. A successful bioremediation necessitates a better understanding of biodegradation mechanisms to accelerate transformation of petroleum hydrocarbon pollutants into less toxic and harmless by-products preserving environment and human health. This paper provides an overview of the recent literature inferring microbes as biodegraders, different approaches of bioremediation and provides suggestions for further developments.

Keywords: Bioremediation, biodegradation, microbes, petroleum hydrocarbons, pollution.

INTRODUCTION

Soil is one of the pristine natural resources which should be delicately and carefully protected. High levels of toxic contaminants pollute the soil. These soil pollutants not only diminish crop yields but also render it unsafe for consumption, thus reducing food security. Soil contaminated with petroleum hydrocarbons is a worldwide environmental problem. Petroleum is a complex mixture of hydrocarbons with different physical and chemical properties (Wang et al. 1998). Petroleum-based hydrocarbons are the major source of energy and raw materials for everyday use for industrial, commercial and domestic purposes. Anthropogenic activities such as mining, crude oil extraction etc. have revolutionized our society but our lives are made more comfortable at the cost of many folds increase in the environmental pollution.

The treatment and disposal of petroleum waste is a serious problem in recent years. The pollutants are released into nearby water bodies and soil due to lack of effective purification systems (Musa et al. 2015). Because of deleterious effect of these chemicals on human health and environment in the long term, they are classified as priority environmental pollutants by the US Environmental Protection Agency (1986). Not only accidental release of petroleum and petroleum products into the environment but also human activities concerning their production, refining, transportation, and storage, are the main cause of pollution (Varjani 2017, Yuniati 2018). The petroleum refineries effluent contains a huge quantity of petroleum byproducts, polycyclic and aromatic hydrocarbons, phenols, surfactants, sulfides, naphthaylenic acids and metals, including barium, lead, zinc, mercury, chromium, arsenic, and nickel. The constituents of petroleum industry effluents and oily sludge are hazardous to the environment as well as pose direct or indirect health risk to all life forms on the earth as they are toxic, mutagenic and carcinogenic (Varjani et al. 2019). Soil contamination with oil spills has been reported to be the most threatening and a major global concern today as it causes organic pollution of groundwater which limits its use, decreases the productivity of the agricultural soil and affects the indigenous organisms that dwell in the soil and destroy the food chain (Thapa et al. 2012).

Remediation of Petroleum Hydrocarbons

Several physical, chemical, and biological methods can be used for degradation of petroleum waste components (Singh et al. 2009). The best degradation technique is selected depending upon the quality and quantity of the contaminants,

treatment costs, type of the soil and environmental conditions like temperature, pH etc. at the polluted sites (US. DOD 1994).

The physical methods such as activated carbon adsorption, membrane filtration, dissolved salts removal by reverse osmosis, ultra-filtration, evaporation etc. and chemical methods like precipitation, electrochemical lytic processes, Fenton process, and photo-catalytic degradation, ultrasonication, etc. have been implemented for petroleum refinery wastewater treatment. But these methods have various restrictions like production of voluminous sludge, high cost of equipment, high operating costs etc. which makes them less economical and feasible (Hu et al. 2015, Singh et al. 2017). Moreover, low solubility, nonpolarity, and hydrophobic nature of petroleum hydrocarbons lay more challenges in the way of remediation (Vidali 2001).

Bioremediation has been recognized as one of the most propitious treatment alternatives for oil contamination (Bragg et al. 1994). It is an inexpensive, effective and eco-friendly approach as compared to other treatments. The process of bioremediation is defined as the use of microorganisms in the removal of pollutants from soil and terrestrial environments. Microorganisms have infallible capabilities of degrading all conventionally occurring compounds. These metabolic and enzymatic capabilities are exploited to detoxify or mineralize pollutants. Biodegradation of petroleum hydrocarbons is a complex process that depends on the quality and quantity of hydrocarbons present.

Indigenous or native hydrocarbon degrading microorganisms exhibit an instrumental role in the bioremediation process (Wilkes et al. 2016). Bacteria are outlined as principal degraders and most active bioremediating agents (Dell'Anno 2012, Meckenstock et al. 2016). Myriad studies have divulged that umpteen native hydrocarbon-degrading bacteria are present in oil spill areas and oil reservoirs (Yang et al. 2015), and their abundance depends on the types of petroleum hydrocarbons and the environmental factors prevailing in the surrounding (Fuentes et al. 2015).

From current studies, approximately seventy nine bacterial genera have been identified that are capable of degrading petroleum hydrocarbons (Tremblay et al. 2017). Some of them which play pivotal role in bioremediation are *Achromobacter*, *Acinetobacter*, *Alkanindiges*, *Alteromonas*, *Arthrobacter*, *Burkholderia*, *Dietzia*, *Enterobacter*, *Marinobacter*, *Mycobacterium*,

Pandoraea, *Pseudomonas*, *Staphylococcus*, *Streptobacillus*, *Streptococcus*, *Alcaligenes*, *Bacillus*, *Flavobacterium*, *Nocardia* and *Rhodococcus* (Roy et al. 2002, Foght 2008, Varjani 2017, Xu et al. 2018). It has been reported that the efficiency of biodegradation ranged from 0.13% to 50% for soil bacteria (Van Beilen et al. 2006). Microorganisms utilize petroleum hydrocarbons as a source of carbon and energy. Initially, dispelling of small chain (C1-C6) and saturated hydrocarbons occurs and then the aromatics are consumed during remediation (Das & Chandran 2011, Vandecasteele 2008). However, the feeble biodiversity of indigenous microflora and specialized microbes with complementary substrate specificity put limitation in the remediation of crude oil polluted sites (Ron & Rosenberg 2014). Thus, bioremediation involves the use of indigenous as well as introduced microorganisms to degrade environmental contaminants. The different approaches for bioremediation of crude oil polluted sites are (a) biostimulation, (b) bioaugmentation, (c) microbial consortium and (d) microbial cell immobilization systems.

(a). **Biostimulation** involves modification of the existing environmental conditions by the addition of substrates and oxygen that trigger microorganism activity to degrade the petroleum hydrocarbons faster (Basharudin 2008).

(b). **Bioaugmentation** implies addition of known oil degrading bacteria harboring specific catabolic abilities to complement the existing microbial population into a contaminated environment (Holliger et al.1997).

(c). **Consortium** is the mixed cultures of different hydrocarbon degrading microorganisms used together to clean the oil polluted sites. Different members of the consortium produce discrete enzymes that convert recalcitrant compounds to simpler form. Smaller compounds are again taken up by other series of microbes and degraded wholly. This implies that the complete remediation of petroleum hydrocarbon contamination requires the collaborative functioning of multifarious bacteria (Dombrowski et al. 2016). Based on this view, Varjani et al. (2015) constructed a halotolerant Hydrocarbon Utilizing Bacterial Consortium (HUBC) consisting of the bacterial isolates *Ochrobactrum* sp., *Stenotrophomonas maltophilia* and *Pseudomonas aeruginosa* that was found to be good at degrading crude oil (3% v/v), with a degradation percentage as high as 83.49%. This has accredited to the fact that the metabolic versatility of mixed cultures is superior to pure cultures in

utilizing hydrocarbon pollutants in petroleum crude as the sole carbon source (Varjani & Upasani 2013). A study conducted by Mandal and colleagues (2012) also reported that an indigenous microbial consortium of bacterial species when applied on the field scale at different oil refineries in India bioremediated 48,914 tons of different types of oily wastes successfully (total petroleum hydrocarbon (TPH)) to environment friendly end products.

(d) The use of immobilized microbial cell is another propitious approach that can be applied for bioremediation of petrowaste. Several methods used to prepare immobilized cells are physical adsorption, cross linking, covalent bonding, encapsulation and gel entrapment. The potential advantages of immobilization of cells using different carrier or support materials over free cells are maintaining sufficient microbial activity for a longer duration of time, are reusable, easily detached and show superior biodegradation efficiencies even at nonoptimal environmental conditions such as high pollutant concentrations, improper temperature, and pH (Partovinia and Rasekh 2018).

Generally, bioremediation technologies can be executed as *in situ* or *ex situ*. *In situ* remediation, the polluted soil is treated as it is at the original site under natural conditions. It is a cost effective, effortless, ecofriendly and tenable approach for the restoration of polluted sites (Partovinia et al. 2010). However, in *ex situ* bioremediation involve excavation and transportation of the polluted soil for treatment at above-ground facilities which makes the process costly, but as stated earlier *ex situ* bioremediation may be advantageously performed when the environmental conditions at the original polluted soil are suboptimal for microbial activity, for eg, the temperature is too low or if the nutrients are unevenly distributed. Several studies have mentioned various *in-situ* and *ex-situ* remediation techniques such as biosparging, bioventing, land farming, composting, soil biopiles, and biotrickling (Boopathy 2000, Partovinia et al. 2010).

Factors Affecting Biodegradation of Petroleum Hydrocarbon

The biodegradation of petroleum hydrocarbons is a complicated process controlled by various factors. The native structure and composition of the petroleum hydrocarbon pollutant is the prime factor (Okoh 2006). Linear and branched chain hydrocarbons with simpler structure can be easily biodegraded but the structural complexity of hydrocarbon makes them less susceptible to degradation. Alkylated aromatics, monoaromatics, cyclic alkanes > polyaromatics hydrocarbons (PAHs) are degradation resistant in increasing order (Ulrici 2000).

The microorganisms with suitable metabolic capabilities are another key requirement. The optimal rates of microbial growth and hydrocarbon biodegradation depend upon environmental conditions like temperature, pH, adequate concentrations of nutrients and oxygen availability. The most of oil degrading microorganisms are mesothermic degrading maximum at 30°C-40°C. At lower temperatures, the oil viscosity increases, making the oil more toxic and less appealing to degrading microbes (Atlas 1975). The optimal pH for oil degradation lies between 6 and 9. Therefore, pH of most of the petro waste contaminated sites is preferably adjusted to this optimal range adding lime (Alexander 1995). The microbial requirement for minerals like nitrogen, phosphorus and potassium is fulfilled by addition of urea, phosphate, N-P-K fertilizers, ammonium and phosphate salts to speed up the biodegradation of petroleum hydrocarbon pollutants (Boopathy 2000, Ron & Rosenberg 2014).The success of bioremediation depends on having the appropriate microorganisms in place under suitable environmental conditions and composition of the contaminant.

Petroleum oil degradation by bacteria can occur under both aerobic and anaerobic conditions (Zengler et al. 1999). Under aerobic conditions, O_2 acts as a powerful oxidant which oxidizes and cleaves the ring of aromatic petrochemical compounds. Oxygen serves as the final electron acceptor and a co-substrate for some key catabolic processes (Singh et al. 2017). The enzyme oxygenase plays key role in incorporation of molecular oxygen into the reduced substrate (Li & Liu 2002). Aliphatic hydrocarbons are initially converted into alcohols which are oxidized sequentially via dehydrogenases to carboxylic acids, then undergo â-oxidation to yield acetyl CoA, which is metabolised in the usual manner (Abbasian et al. 2015). In aromatic and polycyclic aromatic hydrocarbons (PAHs), the enzyme mono- or dioxygenase causes hydroxylation of the ring to form diols which then cleaved and further degraded (Goyal and Zylstra 1997).

Biosurfactants have been outlined as another factor playing a key role in bioremediation of oil sludge (Cameotra & Singh. 2008). These are divergent groups of surface active chemical compounds produced by a variety of microorganisms

which increase bioavailability of pollutants by solubilizing them.

CONCLUSION

The remediation of petroleum hydrocarbon pollutants in the environment is a matter of concern. Bioremediation has turned up as an efficient, cost effective and universal substitute for physicochemical techniques. By using microorganisms either individually or within consortium, harmful petroleum pollutants can be transformed to nontoxic compounds. Therefore, some of the approaches should be focused on narrowing the gaps in the field. Foremost the screening of the microbial strains suitable for environmental conditions at the contaminated site and establishing criterion for their introduction to the site should be done. Further, construction of novel bacterial strains using genetic engineering would give more potency for petroleum hydrocarbon degradation. The exploration of biocompatible surfactants for enhancing contact between bacteria and petroleum hydrocarbons is another requisite. Successful implementation of these strategies would help in achieving a significant reduction in petroleum hydrocarbon pollution and enhancing soil quality, protecting the environment and human health.

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Some important medicinal plants of Rajasthan, India

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Abstract
According to Shiva (1996) [1], there are around 17,000 flowering plant species that are found in India. Amongst these 7500 plant species are known for their medicinal values. Rajasthan harbors 2412 of the above flowering plants out of which 1900 are of medicinal value. Ayurved, the oldest medicinal system of India, described 2000 of the above medicinal plant species. "Charak Samhita" the oldest book on medicine, written by Sage Charak mentions rsions around 340 herbs and their indigenous use. In the present time medicinal plants have gained tremendous significance, approximately 25% of the drugs are derived and many other are synthesized from plants. During present investigation our major objective is to explore the potential in medicinal plants resources from the arid and semi-arid part of India. The study reveals that Rajasthan harbors a rich diversity of valuable medicinal plants and attempts are being made, at different levels, for documentation of some important medicinal plants of Rajasthan with their local name and their medicinal properties.

Keywords: medicinal plants, Rajasthan, ayurveda, endangered MAP

Introduction
Introduction Rajasthan is the largest State of India and well known for its bio-geographical habitats *viz.* arid and semi-arid. Rajasthan state is situated between 23º3' and 30º12' N latitude and 69º30' and 78º17' E longitude. The total land area of the state is about 3, 42,239 km². The average annual rainfall in the state is 525-675 mm, and the annual precipitation in different tracts of Rajasthan varies from 13 mm to 1766 mm. Within these arid and semi-arid habitats around 2412 different flowering plants are recorded. These unique habitats constantly magnetize plant lovers for its floral diversity. Hence various papers on plants diversity with their ecological and taxonomical information are recorded *viz.* Bhandari (1978); Puri et al. (1964); Sharma & Tiagi (1979); Shetty & Singh (1987, 1991, 1993); Sharma et al. (2005); Singh & Singh (2006) and Singh & Srivastava (2007) [2, 3, 4, 5, 6, 7, 8, 9, 10]. Kotia (2008) and Kotia et al. (2008) [11, 12] have also published a detailed floristical account for the natural habitat in Rajasthan, India. Similarly, in recent years Yadav & Meena (2016), Tiwari et al. (2016), Dhakad et al. (2019) and Kotiya et al. (2020a and 2020b), [13, 14, 15, 16, 17] has further described little more taxonomical research work for the Rajasthan State.

Approximately three lac plants occur in world among these around 52000 plants are medicinally valuable [18]. Rajasthan harbors a unique repository of around 1900 species of medicinally valuable plants because of the unique climatic condition of the state. There are 2412 flowering plants that are reported from Rajasthan [17]. Most of the species are used by local communities for their healthcare needs. A lot of work had been done by various workers on ethnomedicinal plants species [19, 20, 21, 22, 23, 24, 25]. Earlier, local people harvested medicinal plants for their own basic needs but, due to increased demands in present era, over exploitation has become a big challenge in the conservation of medicinal plants. In Rajasthan, communities living adjacent to the forests derives medicinal plants for their livelihood but others trade these species to the market directly.

Material and Methods
During the present investigation experience old age people interrogated to collect information about the common uses of medicinal plants for their local uses and an extensive literature survey was carried out for the compilation of information on the traditional systems of medicine in India, which include Ayurveda and traditional healer of medicine. Various research articles and different books on Rajasthan medicinal plants had surveyed in detail and all information compiled in Table-1.

Observation
Due to increasing commercial demand, over exploitation, habitat loss and other anthropogenic pressure, around 37 species are now RED-LISTED. Among these red listed species, 6 have been assessed Critically Endangered, 13 species as Endangered, while 18 species as Vulnerable. A detail list is given below (FRHT, 2008) [26]:

Critically Endangered MAP
Chlorophytum borivilianum (Safed Musli), *Eulophia ochreata* (Salam Mishri), *Tribulus rajasthanensis* (Gokhuru), *Commiphora wightii* (Guggal), *Cochlospermum religiosum* (Galgal), *Pterocarpus marsupium* (Bijasal).

Endangered MAP
Neurada procumbens (Chapari), *Calligonum polygonoides* (Phog), *Ephedra foliata* (Suao-phogaro), *Gymnema sylvestre* (Gudmar), *Leptadenia reticulata* (Jeevanti), *Boswellia serrata* (Salar), *Feronia limonia* (Kaith), *Manilkara hexandra* (Rayam/Rani), *Oroxylum indicum* (Fari), *Ougeinia oojeinensis* (Tanas), *Sterculia urens* (Karaya), *Stereospermum colais* (Padal), *Tecomella undulata* (Rohiro).

Vulnerable MAP

Arisaema tortuosum (Haapradakaro), *Blepharis linariifolia*, *Costus speciosus* (Mahalakri), *Peganum harmala* (Harmal), *Barleria acanthoides* (Vajradanti), *Ocimum gratissimum* (Ban-Tulsi), *Plumbago zeylanica* (Chitrak), *Celastrus paniculatus* (Malkangani/ Jyotismati), *Gloriosa superba* (Kalihari), *Holostemma ada-kodien* (Chhirbel), *Pueraria tuberosa* (Ghorabel), *Sarcostemma viminale* (Khir), *Buchanania lanzan* (Chironji), *Butea monosperma* var. *lutea* (Dhak), *Moringa concanensis* (Sargura), *Naringi crenulata* (Naupatti), *Schrebera swietenioides* (Mokha), *Terminalia arjuna* (Arjun).

Result and Discussion

Among these 1900 medicinal plants 100 ethnomedicinal and medicinal valuable plant species are mentioned below in the table with their local name and medicinal uses for particular diseases:

Table-1: Some Important Medicinal Plants of Rajasthan

S.N.	Botanical Name	Local Name	Medicinal Uses
1	*Abrus precatorius* L.	Chirmi	Leucoderma, Sciatica, Paralysis
2	*Abutilon indicum* (L.) Sweet	Kanghi	Uterine haemorrhagic discharges Febrifuge, Anthelmintic, Diuretic, Alexiteric. Toothache, Lumbago, Piles. Chest troubles, Bronchitis, Gonorrhoea
3	*Acacia catechu* (L. f.) Willd.	Katha/ Khair	Astringent, Cooling, Antipyretic, Itching, Leprosy, Boils, Psoriasis, Inflammation, Leucoderma
4	*Acacia leucophloea* (Roxb.) Willd.	Urajio/ Ranj	Astringent, Inflammations, Bronchitis, Leprosy
5	*Acacia nilotica* (L.) Del.	Babul	Astringent, Alexipharmic, anthelmintic, Diarrhea, Piles, Leprosy, Urino-genital disorders.
6	*Acacia senegal* (L.) Willd.	Kumatiyo	Emollient, Inflammation, Hemorrhage, Intestinal mucous, Food for diabetes. Infection of Eyes
7	*Achyranthes aspera* L.	Andhi- Jaro/ Undo katto	Laxative, skin diseases. Astringent Laxative Dysentery, Piles, Eruption, Colic, Gonorrhoea
8	*Adhatoda zeylanica* Medic.	Adusa	Dysentery. Diuretic bronchitis, Asthma, sore. Emmenagogue, Gonorrhoea. Blood circulation Jaundice Leprosy Heart troubles, Loss of memory, Leucoderma, Tumors
9	*Aegle marmelos* (L.) Corr.	Bel	Astringent, Dysentery, Diarrhea, Laxative, Cooling, Asthmatic complaints, Fever, Analgesic, Appetizer.
10	*Aloe vera* (L.) Burm. f.	Gheekumari	Rheumatism
11	*Andrographis paniculata* (Burrn. f.) Wall. ex Nees	Kalmegh	Debility, Dysentery, Dyspepsia, Febrifuge, Stomachic, Tonic Alternative, Anthelmintic
12	*Argemone mexicana* L.f.	Satyanasi	Diuretic, Purgative, Aphrodisiac, strangury, Leucoderma.
13	*Asparagus racemosus* Willd.	Satawari	Aphrodisiac, Laxative, Expectorant, Galactagogue, Tuberculosis, Leprosy, Epilepsy, Night blindness, Diseases of kidney, liver, eye & throat
14	*Azadirachta indica* A. Juss.	Neem	Antiperiodic, Anthelmintic, Diuretic, Blood & Skin disease, Leprosy, Alexiteric, Ulcers, Insecticidal, Ophthalmia, Biliousness
15	*Bacopa monnieri* (L.) Wettst.	Brahmi	Diuretic, Nerve tonic, Memory promoter, Epilepsy, Insanity, Asthma, Nerve breakdown.
16	*Balanites aegyptiaca* (L.) Del.	Hingotia	Anthelmintic, Alternative, Analgesic alexipharmic, antidysentric, Analgesic, Leucoderma, Ulcers, Skin diseases. Purgative
17	*Barleria prionitis* L.	Pila piyabansa	Alexiteric, Bronchitis, Blood Complaints, Leucoderma. Appetizer, Blood & skin disease, Inflammation
18	*Barleria cristata* L.	Vajra danti	Inflammation, Fever, Bronchitis Biliousness
19	*Boerhavia diffusa* L.	Punarnava/ Satta	Astringent, Biliousness, Leucorrhoea, Blood purifier Alternative, Inflammation, Anaemia, Heart troubles, Asthma Dyspepsia, Tumors, Spleen diseases, Alexiteric, Appetizer, Ophthalmia, Carminative, Tonic, Lumbago, Diuretic, Emetic, Expectorant, Liver complaints.
20	*Boswellia serrata* Roxb. ex Coleb.	Salar	Biliousness, Dysentery, Skin diseases, Ulcer, Blood purifier. Leucoderma, Piles Antipyretic, skin & Blood diseases, Vaginal discharge, diabetes, Bronchitis
21	*Butea monosperma* Lam.	Palas	Aphrodisiac, Laxative, Dysentery, Stomach worms, Eye diseases. Leprosy, Gout, Skin disease. Diuretic, Anthelmintic, Piles.
22	*Calotropis gigantea* (L.) R. Br.	Safed-Aak	Leprosy, Leucoderma, Ulcers, Tumours, Piles, Spleen and Liver troubles, Asthma, Syphilis, Inflammation, Ascites, Abdominal disease
23	*Calotropis procera* R.Br.	Madar/Aak	Leprosy, Elephantiasis, Toothache. Stomachic, Appetizer, Asthma
24	*Capparis decidua* (Forssk.) Edgew.	Ker	Carminative, Aphrodisiac, Appetizer, Emmenagogue, alexipharmic, Lumbago Rheumatism, Hiccup. Analgesic. Diaphoretic Alexiteric, Laxative, anthelmintic, Ulcer, Cough, Asthma, Piles. Biliousness, Cardiac troubles
25	*Cassia auriculata* L.	Anwal	Urinary discharge, Tumours, Skin disease, Asthma, Anthelmintic, Leprosy, Throat troubles, Ophthalmic, Diabetes, Dysentery
26	*Cassia fistula* Linn.	Amaltas	Skin diseases Laxative, Purgative.
27	*Cassia occidentalis* Linn	Anwal	Skin diseases. Astringent. Anthelmintic. Diabetes and urinary disorders Ophthalmia, Conjunctivitis.
28	*Celastrus paniculata* Willd.	Malkangani	Emmenagogue, Brain tonic, Abdominal complaints
29	*Chenopodium album* Linn.	Bathua	Appetizer, Anthelmintic, Diuretic, Laxative, Aphrodisiac, Abdominal pain, Eye disease, Piles, Tonic, disease of Blood, Heart & spleen.
30	*Chenopodium ambrosoides* L.	Sugandha vastuka	Carminative, Emmenagogue, Pectoral complaints, Amenorrhoea, nervous

			affections, Anthelmintic
31	*Chlorophytum breviscapum* Dalz.	Safed Musali	Tonic
32	*Cissampelos pareira* L.	Patha/ Brihatika	Diuretic, Emmenagogue, Dyspepsia, Diarrhoea, Dropsy, Cough.
33	*Cleome gynandra* L.	Hulhul	Laxative, Anthelmintic, Diuretic, Ulcer, Leprosy. Malaria, Piles, Lumbago, Anthelmintic, Carminative
34	*Citrullus colocynthis* (L.) Schrad.	Tumba	Purgative, Jaundice, Rheumatism, Urinary disease. Drastic, Hydragogue, Cathartic, Stomachic.
35	*Clerodendron phlomidis* L.	Arni	Laxative, Alexipharmic, Anemia, Diabetics, Chyluria, Bronchitis, Dyspepsia, Inflammation, Piles.
36	*Cocculus hirsutus* (L.) Diels.	Jaljamni/ Pilwan	Alexipharmic, Antipyretic, Laxative, Soporific, Venereal pains. Gonorrhoea.
37	*Commiphora wightii* (Arn.) Bhandari	Guggal	Rheumatism, Laxative, Aphrodisiac, Anthelmintic, Biliousness, Ulcers, Piles, Urinary troubles, Asthma, Tumours, Leucoderma
38	*Cordia dichotoma* Forst. f.	Lasora	Astringent, dry cough, Disease of Urethra, Ulcers, Headache
39	*Cordia gharaf* (Forsk.) Ehrenb. Ex Asch.	Gundi	Astringent, Headache, Constipation, Stomach worms, Piled, Toothache
40	*Crateva nurvala* Buch. - Ham.	Barna	Urinary complaints, edema, Constipation, tonic, Antiperiodic, Goiter, Obesity.
41	*Curculigo orchioides* Gaertn.	Kali-musli	Carminative, Antipyretic, Tonic, Aphrodisiac, Bronchitis, Lumbago, Ophthalmia, Diarrhea, Dyspepsia Gonorrhoea, Hydrophobia. Diuretic, Aphrodisiac, Jaundice, Asthma, Piles, Colic.
42	*Cuscuta reflexa* Roxb.	Akash–bel	Aphrodisiac, Diuretic, Paralysis, Heart & Spleen Disease, Lumbago Emmenagogue, Sedative, Biliousness.
43	*Cynodon dactylon* Pers.	Dub	Astringent, Diuretic, Dropsy.
44	*Datura stramonium* L.	Dhatura	Antispasmodic, Narcotic Asthma, Anodyne Sedative, Intoxicant, Carbuncles.
45	*Desmodium gangeticum* (L.) DC	Salpiani/ Kareti	Alternative, Aphrodisiac, Diuretic, Anthelmintic, Fevers, Typhoid, Dysenetry, Piles, Asthma.
46	*Diospyros melanoxylon* Roxb	Abnus/ Kendu	Diarrhea, Dyspepsia. Ophthalmia, Aphrodisiac, Leucorrhoea, Night blindness, spleen enlargement. Digestive, Carminative, Biliousness.
47	*Echinops echinatus* Roxb.	Oont-kateli	Alternative, Diuretic, Nerve tonic, Hysteria, Dyspepsia, Ophthalmia, Cough, Scrofula, Seminal debility
48	*Eclipta alba* (L.) Hassk.	Jalmagra	Emetic, Purgative, Antiseptic Tonic, Hepatic & Spleen enlargement, Jaundice, Skin diseases
49	*Ehretia laevis* Roxb.	Tombolan	Venereal diseases.
50	*Enicostema axillare* (Lam.) Raynal	Nawri/Nemi	Dropsy, Rheumatism, Abdominal Ulcer, Hernia, Swellings, Itches, Malaria. Aphrodisiac
51	*Euphorbia caducifolia* Haines.	Dandathor	Carminative, Laxative, Appetizer, Alexipharmic, Bronchitis, Tumours, Delirium, Piles, Spleen enlargement, Anemia, Ulcers Fever, Leucoderma.
52	*Evolvulus alsinoides* L.	Shankhpushpi/Visnukr antha	Bronchitis, Asthma, Fever Diarrhea, Tonic
53	*Fumaria indica* (Haussk.) Pugsley	Pitpapra	Leucorrhoea, Burning sensation, Ulcer, Leprosy, Biliousness.
54	*Gloriosa superba* L.	Kalihari	Bowel complaints. Anthelmintic, Laxative, Alexiteric, Abortifacient, Ulcer, Leprosy, Piles.
55	*Gmelina arborea* Roxb.	Hawan	Anthelmintic, Hallucination, Fever, Piles, Gonorrhea, Foetid discharge, Cough. Leprosy, Blood diseases. Aphrodisiac, Diuretic, Hair tonic, Cooling, Anemia, ulcer, Vaginal discharge
56	*Gymnema sylvestre* (Retz.) R. Br. ex Schult	Gudmar	Anthelmintic, Alexiteric, Heart & Eye troubles, Leucoderma, Asthma, Bronchitis, Ulcers. Stomachic urinary diseases.
57	*Hemidesmus indicus* (L.) R. Br.	Anant-Mul	Antipyretic, Antidiarrhoeal, Diuretic, Aphrodisiac, Leprosy Bronchitis, Diseases of Blood Diaphoretic, Syphilis, Leucoderma, Diseases of brain Liver & kidney
58	*Jatropha curcas* L.	Ratanjot/ Jamalghota	Emetic, Purgative. Antidiarrhoeal Lactagogue Diuretic, Biliousness, Anaemia. Fistula, Heart disease. Rheumatism, Herpes, Pruritus.
59	*Jatropha gossypifolia* Linn	Mayla/ Ratanjoti	Emmenagogue. Ecezema, Carbuncles, Itches. Emetic, Insanity, Purgative
60	*Justicia procumbens* L.	Kagner	Biliousness, Intoxication, fever, Diuretic, Enriches blood, Leprosy. Mental & Blood diseases. Biliousness, Intoxication, fever, Diuretic, Enriches blood, Leprosy. Mental & Blood diseases.
61	*Leptadenia reticulata* (Retz.) Wight & Arn.	Jhumka / Jeevanti	Stimulant, Tonic
62	*Martynia annua* L.	Bagh-nakhi/ Billi	Inflammation, Epilepsy, Tuberculous glands in the neck, Sore throat, Alexiteric, Ulcer
63	*Melia azedarach* L.	Bakain / Moyan	Anthelmintic, Anemia, Leucoderma, Piles, Skin disease, Blood purifier.
64	*Moringa oleifera* Lam	Sainjna	Aphrodisiac, Analgesic, anthelmintic Ulcers heart troubles, Ophthalmia, Hallucination Muscular & spleen diseases, Leucoderma, Tumors, Eye diseases, Heart complaints
65	*Nyctanthes arbor-tristis* L.	Harsingar	Bronchitis Rheumatism, Fever Inflammation Piles, Skin Diseases
66	*Ocimum basilicum* L.	Ram tulsi	Anthelmintic, Alexipharmic, Antipyretic diseases of heart & Blood Diuretic Biliousness, Leucoderma. Bowel complaints. Stimulant, Diuretic. Gonorrhoea,

			Diarrhoea, Dysentery.
67	*Ocimum canum* Sims.	Bapchi	Fever, Parasitic diseases. Expectorant, Anticaterrhal, Nasal haemorrhage, Antirehumatism.
68	*Pandanus fascicularis* Lam.	Kewra	Stimulant, Antispasmodic, Rheumatism, Headache, Tumours
69	*Pedalium murex* L.	Bara-gokhru	Antibiliousness. Gonorrhea, Dysuria, Antispasmodic, Aphrodisiac, Diuretic, Demulcent, Emmenagogue.
70	*Peganum harmala* L.	Harmal	Emmenagogue, Galactagogue Expectorant, Anthelmintic, Lumbago Urinary troubles, Ophthalmia, Rheumatism, Bronchitis.
71	*Pergularia daemia* (Forssk.) Chiov.	Gadaria-ki-bel	Anthelmintic.
72	*Phyllanthus emblica* L.	Aamla	Burning sensation, Vomiting, Thirst, Leprosy, Constipation, Inflammation, Piles, Leucorrhoea.
73	*Phyllanthus niruri* L.	Bhui-Awala	Stomachic, Dysentery, Dropsy. Ulcer, Wounds, Ringworm Jaundice.
74	*Physalis minima* L.	Papotan	Diuretic, Tonic, Purgative, Spleen enlargement
75	*Plantago ovata* Forsk	Isabgol	Astringent, Tonic, Biliousness, Cough, Dysentery, Leprosy.
76	*Plumbago zeylanica* L.	Chitrak	Dyspepsia, Dysentery, Leucoderma, Piles, Inflammation, Rheumatism, Bronchitis, Anemia, Liver & Intestinal complaints.
77	*Prosopis cineraria* (L.) Druce	Khejri	Dysentery, Bronchitis, Asthma, Leucoderma, Piles, Astringent, Leprosy
78	*Psoralea corylifolia* L.	Bavchi	Dental diseases Diarrhoea Diuretic, Leprosy, Skin diseases, Asthma, Bronchitis, Piles.
79	*Ricinus communis* L.	Erandi/ Arand	Asthma, Bronchitis, Leprosy, Rectal disease, Fever, Purgative, alternative, Skin diseases. Galactagogue, Aphrodisiac, Anthelmintic
80	*Salvadora oleoides* Dence	Mitha-jal	Appetizer, Alexipharmic, Laxative, Vesicant Purgative, Carminative, Bronchitis, Spleen enlargement, Piles
81	*Salvadora persica* L.	Kharo-jal	Astringent, Anthelmintic, Diuretic, Analgesic, Liver tonic.
82	*Sapindus emarginatus* Vahl	Areetha	Diaphoretic, Diuretic, Emetic, Gonorrhoea. Rheumatism, Lumbago, Emmenagogue.
83	*Sesamum indicum* L.	Til	Aphrodisiac, Spleen troubles, Piles bleeding Menorrhoea Diuretic, Diaphoretic, Cooling Hair growth, Diarrhoea, Ulcers Dry cough, Asthma, Lungs diseases, Small pox, syphilis, Ulcers.
84	*Solanum nigrum* L.	Makoy	Diseases of eye, ear, nose, Ulcer on the neck, Head ache, Aphrodisiac, Alternative, Diuretic, Inflammation, Asthma, Bronchitis, Fever, Leucoderma, Piles, Heart & Eye disease. Laxative, Gonorrhoea
85	*Solanum virginianum* L.	Nili-kateli	Expectorant, Cough, asthma, chest pain, catarrhal fever. Pain reliever, Rheumatism. Throat sore, Cough, Toothache.
86	*Syzygium cumini* (L.) Skeels	Jamun	Bronchitis, Asthma, Dysentery, Blood impurities, Astringent, Diabetes, tonic, Diuretic
87	*Tamarindus indica* L.	Imli	Paralysis, Urinary discharge, Gonorrhea, Blood disease, Appetizer, Laxative, Heating, Tonic to heart
88	*Tecomella undulata* (Sm.) Seem.	Rohida	Abdominal & liver complaints. Laxative, Anthelmintic, Ulcers, Blood & eye diseases.
89	*Tephrosia purpurea* (L.) Pers.		Alexipharmic, Ulcers and wounds, spleen complaints Anthelmintic, Antipyretic, Diseases of heart, spleen, Lever and blood, Leprosy, Asthma Bronchitis. Syphilis, Gonorrhoea, Lung troubles.
90	*Tinospora cordifolia* (Willd.) Miers	Neem Giloi	Emetic, Visceral obstruction. Rheumatism, Jaundice, Urinary infection, Dyspepsia
91	*Tribulus terrestris* L.	Gokhru	Aphrodisiac, Alternative, Diuretic. Appetizer, strangury, Leprosy, Piles, Heart diseases. Aphrodisiac, Blood purifier Diuretic, Aphrodisiac.
92	*Urgenia indica* (Roxb.) Kunth.	Koli kanda	Dropsy, Spermatorrhoea, Pyelitis, Insanity, Rheumatism, Laxative, Cough, Glandular swelling
93	*Urtica dioica* Linn	Bichu-booti	Anthelmintic, Alexiteric, Diuretic, Emmenagogue, Purgative, Bronchitis, Asthma, Dropsy, Rheumatism, Skin diseases, leprosy. Diuretic, Anthelmintic, Nephritic troubles, Haemorrhage in kidney & Uterus, Jaundice
94	*Vernonia cinerea* (L.) Less.	Sahadevi	Diaphoretic, strangury, Promotes perspiration, Spasm of bladder. Conjunctivitis Anthelmintic, Alexipharmic
95	*Vitex negundo* L.	Nirgundi	Astringent, Cephalic, Stomachic, Anthelmintic, Hair tonic, Spleen enlargement, Ophthalmia, Leucoderma, Inflammation, Asthma, Biliousness.
96	*Withania coagulans* (Stocks) Dunal	Paneer-bandh	Asthma, Biliousness, Strangury Emmenagogue, Diuretic, Ophthalmia, Lumbago, Liver troubles, Piles.
97	*Withania somnifera* (L.) Dunal	Ashgandh	Alternative, Aphrodisiac, narcotic, tonic. Alternative, Narcotic, Bronchitis, Psoriasis, Ulcers, senile debility, Rheumatism, Tonic. Diuretic, Hypnotic.
98	*Wrightia tinctoria* (Roxb.) R. Br.	Khirni	Biliousness, Piles, Skin diseases.
99	*Xanthium strumarium* L.	Adhasisi	Headache, Appetizer, Leucoderma, Toothache,
100	*Zizyphus nummularia* Burm.f	Jharber	Cough, cold skin diseases. Astringent, Cooling. Biliousness, sores, Ulcered gums.

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FLORISTIC DIVERSITY OF UMARI DHAM SACRED GROVE IN JAIPUR, RAJASTHAN, INDIA

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ABSTRACT

The Umari Dham is a sacred grove situated at the Jamwa Ramgarh Wildlife Sanctuary, Jaipur District of Rajasthan, India. It's a beautiful arbour near the city of Jaipur. Umari Dham sacred grove has a temple, which has been visited by worshippers for approximately 450 years. During present field investigation, attempts were made to categorize the floral diversity of this sacred grove, and around 215 flowering plant species belonging to 159 genera under 52 families have been recorded according to Angiosperm Phylogeny Group III (APG III) classification. This grove serves as a vital pool for preservation of threatened, endemic and medicinal plant species.

Keywords: sacred grove, threatened, Jaipur, Rajasthan, sanctuary

INTRODUCTION

The sacred groves are forest fragments which are delimited and protected by indigenous communities under their religious beliefs. Thus, these groves not only conserve nature but also the traditional knowledge associate with it. In Rajasthan, sacred groves are called "Orans/Gochar". Indigenous people residing in these communities live in harmony with nature and conserve its valuable flora and fauna. The locals protect forest and natural vegetation for their religious beliefs and traditional rituals that have run through their several generations. Cultural and religious festivals are often arranged by local people in these sacred groves and they call such a festival "Mela" [1]. Sacred groves are places where religion interacts with nature [2]. Many sacred groves were established thousands of years ago, when the human's life was in its pre agricultural, hunting and gathering stages. Groves vary in sizes from a small patch of trees to several acres of densely vegetated areas. In these sacred groves, many old and rare plant species are found that are protected by indigenous peoples in order to perform their religious rituals [3]. These groves are hence dedicated to the local folk deities and so the cutting of trees, grazing and hunting is prohibited in these areas [4]. Sacred groves are classified into three categories i.e., traditional sacred groves, temple sacred groves and groves around the burial or cremation ground [5].

Sacred groves are scattered all across India especially in those regions where indigenous communities reside, such as the Western Ghats, the North Eastern and Central hill tracts [6 - 10]. The total number of sacred groves in India could be in ranging from 100,000 to 150,000 [11]. In Rajasthan sacred groves have been known by various names, such as Vani in Mewar, Kenkri in Ajmer, Oran in Jodhpur, Bikaner and Jaisalmer, Shamlatdeh and Devbani in Alwar [12]. Around 560 sacred groves have been documented in the state of Rajasthan [13]. Malhotra (2001) [14] reported sacred groves from the Eastern of the Aravalli range to the Western part of the state. In Aravalli region of Rajasthan, the groves can be categorized into three types i.e., those located near the village, some dedicated to Lord Shiva, and the ones dedicated to a single tree [15].

STUDY AREA

The Jamwa Ramgarh WLS is the Southern extension of the Sariska Tiger Reserve. It is located in North-East direction of Jaipur. The geographical coordinates of the Sanctuary extend from 76° 03'E longitude and 27° 02'N latitude. The vegetation of Sanctuary corresponds to Northern Tropical Dry Deciduous Forests and Northern Tropical Thorn Forest [16]. During a field excursion to Jamwa Ramgarh Wildlife Sanctuary, a sacred grove i.e., Umari Dham was recorded. The grove has been protected and managed by local community. Umari Dham is located at 27˚03'10.5" N and 076˚04'58.4" E in Jaipur District of Rajasthan State (Figure 1). The sacred groves, as the name suggests, are associated with certain deities. This grove also has a historical temple (Figure 2). It is a memorial grove and worship in the memory of a saint Swami Ramdamodar Das. A day's festival colloquially known as the "Mela" is organized in the memory of saint by the descendants and people from the local community. As per the biogeography classification, it falls in semi-arid zone. The semi-arid climate is characterized by very hot summers and very cold winters. The

temperature ranges between 2 °C to 48 °C. The annual average rainfall is 673.9 mm.

Figure 1. Geographical location of Umari Dham sacred grove [17]
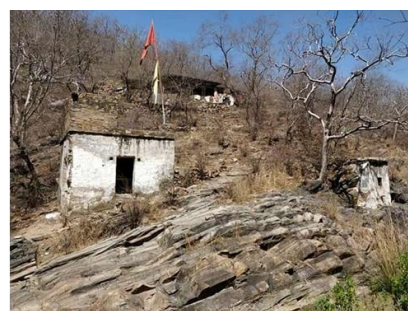
Figure 2. Umari Dham temple

MATERIALS AND METHODS

This paper describes a case study of Umari Dham sacred grove which is basically a temple grove situated within the Jamwa Ramgarh Wildlife Sanctuary, Jaipur. This sacred grove has existed for the past approximately 450 years, according to the temple priest. An extensive survey has been made during the different seasons and whole area of sacred grove has been examined. All the specimens have been collected and preserved in Rajasthan university herbarium (RUBL). Identification of plant species has been done by the Flora of Rajasthan and Flora of North East Rajasthan [18 - 21].

RESULTS AND DISCUSSION

This sacred grove contains 215 flowering plant species (Table 1), belonging to 52 families and 159 genera. The identified plant species have been classified on the basis of Angiosperm Phylogeny Group III classification (2009) [22]. The dominant orders in this region are Poales and Fabales (32), Asterales (20), Malvales and Lamiales (19) and Caryophyllales (17), Figure 3. Similarly, the dominant families are Fabaceae (31), Poaceae (28), Asteraceae (20) and Malvaceae (19), Figure 4. The life forms found in the study area are tree (27), shrub (25), climbers (22) and herbs (142). Herbaceous plants are governing the habitat and represented by 142 individual plants, including one parasite plant, Figure 5.

Table 1. Plant species recorded from Umari Dham sacred grove

Superorder/Order	Family & Species	Common name	Life form
MONOCOTS			
Liliales	**Colchicaceae**		
	Gloriosa superba L. (Figure 7F)	Kalvari/Kalihari	Climber
Asparagales	**Asparagaceae**		
	Asparagus racemosus Willd.	Satabari	Climber
COMMELINIDS			
Commelinales	**Commelinaceae**		
	Commelina benghalensis L.	Bukana	Herb
	Commelina forskalaei Vahl	Kankawa	Herb
	Cyanotis axillaris (L.) D. Don.	-	Herb
	Cyanotis cristata (L.) D. Don.	Bokani	Herb
	Murdannia nudiflora (L.) Brenan	Kanshura	Herb
Poales	**Cyperaceae**		
	Bulbostylis barbata (Rottb.) Clarke	-	Herb/Sedge
	Cyperus bulbosus Vahl	-	Herb/Sedge
	Cyperus iria L.	-	Herb/Sedge
	Cyperus triceps (Rottb.) Endl.	-	Herb/Sedge
	Poaceae		
	Apluda mutica L.	Phulkia/Bhanjura	Herb/Grass
	Aristida funiculata Trin. &Rupr.	-	Herb/Grass
	Arthraxon lanceolatus (Roxb.) Hochst.	-	Herb/Grass
	Bothriochloa pertusa (L.) A. Camus	Karad	Herb/Grass
	Brachiaria ramosa (L.) Stapf	Kuri	Herb/Grass
	Cenchrus biflorus Roxb.	Bhurat	Herb/Grass
	Cenchrus ciliaris L.	Neenjna	Herb/Grass
	Cenchrus setigerus Vahl	-	Herb/Grass
	Chloris virgata Sw.	-	Herb/Grass
	Chrysopogon fulvus (Spreng.) Chiov.	-	Herb/Grass
	Cynodon dectylon (L.) Pers.	Doob	Herb/Grass
	Dactyloctenium aegyptium (L.) Willd.	Makra-ghas	Herb/Grass
	Desmostachya bipinnata (L.) Stapf	-	Herb/Grass
	Dichanthium annulatum (Forssk.) Stapf	Karad	Herb/Grass
	Digitaria pennata (Hochst.) T. Cooke	-	Herb/Grass
	Echinochloa colona (L.) Link	Homa	Herb/Grass
	Eleusine indica (L.) Gaertn.	-	Herb/Grass
	Eragrostis ciliaris (L.) R.Br.	Under puncho	Herb/Grass
	Eragrostis pilosa (L.) P. Beauv.	-	Herb/Grass
	Eragrostis tremula (Lam.) Hochst. ex Steud.	Phulna ghas	Herb/Grass
	Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	Kali-lamp	Herb/Grass
	Melanocenchris jacquemontii Jaub. & Spach.	-	Herb/Grass
	Oplismenus burmannii (Retz.) P. Beauv.	-	Herb/Grass

Table 1. Plant species recorded from Umari Dham sacred grove (continued)

Superorder/Order	Family & Species	Common name	Life form
	Paspalidium flavidum (Retz.) A. Camus	Chapri	Herb/Grass
	Saccharum bengalense Retz.	-	Herb/Grass
	Saccharum spontaneum L.	Kans	Herb/Grass
	Setaria intermedia Roem. & Schult.	-	Herb/Grass
	Setaria italica (L.) P. Beauv.	-	Herb/Grass
Ceratophyllales	**Ceratophyllaceae**		
	Ceratophyllum demersum L.	Sivar/Jal butti	Herb
EUDICOTS			
Ranunculales	**Menispermaceae**		
	Cissampelos pareira L.	Patha/Brihatika	Climber
	Cocculus hirsutus (L.) Diels.	Chhireta/Bilwani	Climber
	Cocculus pendulus (J. R. & G. Forst.) Diels.	Pilwan/Jal jamni	Climber
	Papaveraceae		
	Argemone mexicana L.	Pili kantali	Herb
	Argemone mexicana L. var. *ochroleuca* (Sweet) Lindl.	Satyanasi	Herb
CORE EUDICOTS			
ROSIDS			
Vitales	**Vitaceae**		
	Cayratia trifolia (L.) Domin.	Amabel	Climber
FABIDS			
Zygophyllales	**Zygophyllaceae**		
	Tribulus terrestris L.	Chhota Gokhru	Herb
Celastrales	**Celastraceae**		
	Maytenus emarginatus (Willd.) Ding Hou	Kankeda	Tree
Malpighiales	**Euphorbiaceae**		
	Euphorbia caducifolia Haines.	Danda thor	Shrub
	Euphorbia hirta L.	Dudhi	Herb
	Euphorbia prostrata Ait.	-	Herb
	Euphorbia thymifolia L.	Dudhi	Herb
	Ricinus communis L.	Arand	Shrub
	Securinega leucopyrus (Willd.) Muell. - Arg.	Salpan	Shrub
	Phyllanthaceae		
	Phyllanthus amarus Schum. & Thom.	Bhui amla	Herb
	Phyllanthus reticulatus Poir.	-	Herb
Cucurbitales	**Cucurbitaceae**		
	Bryonopsis laciniosa (L.) Naud.	Shivlingi	Herb
	Coccinia grandis (L.) J.O.Voigt	Kundru	Climber
	Cucumis callosus (Rottl.) Cogn.	Kachrio	Climber
	Momordica balsamina L.	Jangli karela	Climber
	Momordica dioica Roxb. ex Willd.	Kakoda	Climber

Table 1. Plant species recorded from Umari Dham sacred grove (continued)

Superorder/Order	Family & Species	Common name	Life form
	Mukia maderaspatana (L.) M. Roem.	Ankh phutani ki bel	Climber
	Trichosanthes dioica Roxb.	Palwal	Climber
Fabales	**Fabaceae**		
	Abrus precatorius L.	Chirmi/Ratti	Climber
	Acacia leucophloea (Roxb.) Willd. (Figure 6G)	Khejra	Tree
	Acacia nilotica (L.) Del. (Figure 7C)	Babul	Tree
	Acacia senegal (L.) Willd.	Kumbat	Tree
	Aeschynomene indica L.	Chhui-mui	Herb
	Albizia lebbeck (L.) Benth.	Siras	Tree
	Albizia odoratissima (L. f.) Benth.	Kali Siras	Tree
	Alysicarpus monilifer (L.) DC.	-	Herb
	Alysicarpus vaginalis (L.) DC.	-	Herb
	Atylosia platycarpa Benth.	-	Climber
	Bauhinia racemosa Lam.	Jhinjha	Tree
	Butea monosperma (Lam.) Taub. (Figure 6B)	Palas/Cheela	Tree
	Cassia absus L.	Chaksi	Herb
	Cassia fistula L.	Amaltas	Tree
	Cassia mimosoides L.	Ikrar	Shrub
	Cassia obtusifolia L.	Puadia	Herb
	Cassia tora L.	Panwar/Chakvada	Herb
	Crotalaria medicaginea Lam.	Gulali	Herb
	Desmodium repandum (Vahl) DC.	-	Herb
	Iidigofera astragalina DC.	-	Herb
	Indigofera cordifolia Heyne ex Roth	Meh-phuli	Herb
	Indigofera linnaei Ali	-	Herb
	Indigofera sessiliflora DC.	-	Herb
	Indigofera tinctoria L.	Neel	Herb
	Mucuna pruriens (L.) DC.	Kaunch	Climber
	Prosopis juliflora (Swartz.) DC.	Bilayati babul	Tree
	Rhynchosia minima (L.) DC.	Chiro motio	Climber
	Tephrosia purpurea (L.) Pers.	Dhamasa	Herb
	Tephrosia strigosa (Dalz.) Sant. & Mahesh.	Jhino-biyano	Herb
	Tephrosia uniflora Pers.	-	Herb
	Tephrosia villosa (L.) Pers.	Sarfonka	Shrub
	Polygalaceae		
	Polygala erioptera DC.	Sarbhagolia	Herb
Rosales	**Moraceae**		
	Ficus benghalensis L.	Bargad/Bar	Tree
	Ficus racemosa L.	Gular	Tree
	Ficus religiosa L.	Pipal	Tree

Table 1. Plant species recorded from Umari Dham sacred grove (continued)

Superorder/Order	Family & Species	Common name	Life form
	Rhamnaceae		
	Ziziphus mauritiana Lam.	Pemjibor	Tree
	Ziziphus nummularia (Burm. f.) Wight &Arn.	Jharbor	Shrub
	Ziziphus xylopyrus (Retz.) Willd.	Gat-Bor	Tree
	Ulmaceae		
	Holoptelea integrifolia (Roxb.) Planch.	Papri/Churel	Tree
MALVIDS			
Myrtales	**Combretaceae**		
	Anogeissus pendula Edgew. (Figure 7D)	Dhok	Tree
	Lythraceae		
	Ammannia baccifera L.	Jal bhangra	Herb
	Myrtaceae		
	Syzygium cumini (L.) Skeels	Jamun	Tree
	Syzygium heyneanum (Duthie) Wall. ex Gamble	Jamuni	Tree
Brassicales	**Capparaceae**		
	Capparis decidua (Forssk.) Edgew.	Ker	Shrub
	Capparis sepiaria L.	Jal/Chhail	Shrub
	Maerua oblongifolia (Forssk.) A. Rich. (Figure 6A)	-	Shrub
	Cleomaceae		
	Cleome gynandra L. (Figure 6F)	Safed bagra	Herb
	Cleome viscosa L.	Bagra/Pili hulhul	Herb
Malvales	**Malvaceae**		
	Abutilon indicum (L.) Sweet	Tara kanchi	Shrub
	Corchorus aestuans L.	Hade-ka-khet	Herb
	Corchorus depressus (L.) Stocks	Chamkash	Herb
	Corchorus tridens L.	Kagnasha	Herb
	Grewia flavescens A. Juss.	Pili gangeti	Shrub
	Grewia tenax (Forssk.) Fiori	Gangeran	Shrub
	Grewia tiliifolia Vahl	Dhamni	Shrub
	Grewia villosa Willd.	Ban phalsa	Shrub
	Hibiscus lobatus (Murr.) O. Kuntze	-	Herb
	Malvestrum coromandelianum (L.) Garcke	-	Herb
	Melhania futteyporensis Munro ex Mast.	-	Herb
	Sida acuta Burm. f.	Bal	Shrub
	Sida cordifolia L.	Sahadari/Kharanti	Shrub
	Sida mysorensis Wight & Arn.	-	Herb
	Sida ovata Forssk.	Dabi	Shrub
	Sterculia urens Roxb.	Kadaya	Tree
	Triumfetta rhomboidea Jacq.	Lapta/Chirpat	Herb
	Triumfetta pentandra A. Rich.	Mandli	Herb
	Waltheria indica L.	Halduli	Herb

Table 1. Plant species recorded from Umari Dham sacred grove (continued)

Superorder/Order	Family & Species	Common name	Life form
Sapindales	**Anacardiaceae**		
	Rhus mysorensis G. Don	Dansara	Tree
	Burseraceae		
	Boswellia serrata Roxb. ex Cocleb.	Salar	Tree
	Rutaceae		
	Aegle marmelos (L.) Corr.	Bel	Tree
	Sapindaceae		
	Cardiospermum halicacabum L.	Chirphuta	Herb
Santalales	**Loranthaceae**		
	Dendrophthoe falcata (L. f.) Ettingsh.	Banda	Parasite
Caryophyllales	**Aizoaceae**		
	Trianthema portulacastrum L.	Santi	Herb
	Amaranthaceae		
	Achyranthes aspera L.	Andhi jhara	Herb
	Alternanthera pungens Kunth	-	Herb
	Amaranthus viridis L.	Jangli chauli	Herb
	Celosia argentea L.	Surligarke	Herb
	Chenopodium murale L.	Moti sil	Herb
	Digera muricata (L.) Mart.	Lehsua	Herb
	Gomphrena celosioides Mart.	-	Herb
	Pupalia lappacea (L.) Juss.	Undio bhurat	Herb
	Cactaceae		
	Opuntia stricta (Haw.) Haw.	Nagphani	Shrub
	Caryophyllaceae		
	Spergula fallax (Lowe) Krause	Khandidal	Herb
	Nyctaginaceae		
	Boerhavia diffusa L.	Punarnavwa/Santi	Herb
	Plumbaginaceae		
	Dyerophytum indicum (Gibbs ex Wight) Kuntze	-	Shrub
	Plumbago zeylanica L.	Chitrak	Shrub
	Polygonaceae		
	Polygonum plebeium R. Br.	-	Herb
	Portulacaceae		
	Portulaca oleracea L.	Kulpha	Herb
	Portulaca pilosa L.	-	Herb
ASTERIDS			
Ericales	**Ebenaceae**		
	Diospyros melanoxylon Roxb.	Timroo/Tendu	Tree
	Primulaceae		
	Anagallis arvensis L.	Neel	Herb
LAMIIDS			
	Boraginaceae		
	Cordia dichotoma Forst. f.	Lasora	Tree
	Ehretia laevis Roxb.	Bainoha	Tree
	Heliotropium marifolium Retz.	-	Herb
	Trichodesma indicum R.Br.	Chhota kulpha	Herb

Table 1. Plant species recorded from Umari Dham sacred grove (continued)

Superorder/Order	Family & Species	Common name	Life form
Gentanales	**Apocynaceae**		
	Calotropis procera auct. non (Ait.) Ait. f.	Madar/Aak	Shrub
	Catharanthus pusillus (Murr.) G. Don	Hingmu	Herb
	Cryptostegia grandiflora Roxb. ex R. Br. (Figure 7G)	Rubber ki bel	Climber
	Ichnocarpus frutescens (L.) R. Br.	Kali Dudhi	Climber
	Pergularia daemia (Forssk.) Chiov.	Gadaria ki bel	Climber
	Sarcostemma acidum (Roxb.) Voigt	Somlata	Shrub
	Wrightia tinctoria (Roxb.) R. Br.	Kerni/Dudhi	Tree
	Rubiaceae		
	Borreria articularis (L. f.) F.N. Will.	-	Herb
	Borreria pusilla (Wall.) DC.	-	Herb
	Oldenlandia corymbosa L.	Pitta papro	Herb
Lamiales	**Acanthaceae**		
	Adhatoda zeylanica Medik.	Adusa	Shrub
	Blepharis maderaspatensis (L.) Heyne ex Roth	-	Herb
	Dipteracanthus prostratus (Poir.) Nees	-	Herb
	Elytraria acaulis (L. f.) Lindau	-	Herb
	Indoneesiella echioides (L.) Sreem. (Figure 6D)	Pathar chatta	Herb
	Justicia simplex D. Don.	Kagner	Herb
	Peristrophe bicalyculata (Retz.) Nees	-	Herb
	Lamiaceae		
	Anisochilus carnosus (L. f.) Wall.	Panjiri	Herb
	Anisomeles indica (L.) Kuntze (Figure 7A)	-	Herb
	Hyptis suaveolens (L.) Poit.	-	Herb
	Leucas aspera (Willd.) Link	Munda patti/Gotta	Herb
	Leucas urticifolia (Vahl) R. Br.	-	Herb
	Ocimum canum Sims	Mar tulsi	Herb
	Linderniaceae		
	Lindernia ciliata (Colsm.) Pennell	-	Herb
	Lindernia crustacea (L.) F. Muell.	-	Herb
	Pedaliaceae		
	Pedalium murex L. (Figure 7E)	Bara gokhru	Herb
	Sesamum mulayanum Nair (Figure 7B)	Jangli til	Herb
	Scrophulariaceae		
	Lindenbergia indica (L.) Vatke	-	Herb
	Verbenaceae		
	Phyla nodiflora (L.) Greene	Jal buti	Herb
Solanales	**Convolvulaceae**		
	Evolvulus alsinoides L.	Phooli	Herb
	Ipomoea eriocarpa R. Br.	Nakhri	Climber
	Ipomoea indica (Burm. f.) Merr.	Morning glory	Climber
	Ipomoea pes- tigridis L.	Panchpatta	Climber

Table 1. Plant species recorded from Umari Dham sacred grove (continued)

| Superorder/Order	Family & Species	Common name	Life form
	Solanaceae		
	Datura stramonium L.	Dhatura	Herb
	Physalis minima L. (Figure 6E)	Chirphoti/Papotan	Herb
	Solanum nigrum L.	Kali mukkoi	Herb
	Solanum surattense Burm. f. (Figure 6C)	Nar kanta/Bhurangini	Shrub
CAMPANULIDS			
Asterales	**Asteraceae**		
	Acanthospermum hispidum DC.	Dokanta	Herb
	Bidens biternata (Lour.) Merr. & Sherffex Sherff	-	Herb
	Blainvillea acmella (L.) Philipson	Kanghi	Herb
	Eclipta alba (L.) Hassk.	Bhringraj	Herb
	Erigeron bonariensis L.	-	Herb
	Emilia sonchifolia (L.) DC.	-	Herb
	Glossocardia bosvallia (L. f.) DC.	Chiriya ka Chugga	Herb
	Gnaphalium luteo-album L.	-	Herb
	Laggera alata (D. Don.) Schultz Bip. ex Oliver	-	Herb
	Launaea procumbens (Roxb.) Ramayya& Rajagopal	-	Herb
	Oligochaeta ramosa (Roxb.) Wagen.	-	Herb
	Parthenium hysterophorus L.	Gajar ghas	Herb
	Pulicaria angustifolia DC.	Soneli	Herb
	Sclerocarpus africanus Jacq.	-	Herb
	Sonchus oleraceus L.	-	Herb
	Tridax procumbens L.	Sadahari	Herb
	Verbesina encelioides (Cav.) Benth. &Hk. f. ex A.Gray	-	Herb
	Vernonia cinerea (L.) Less.	-	Herb
	Vicoa indica (L.) DC.	-	Herb
	Xanthium strumarium L.	Chirchita/Adhasisi	Herb
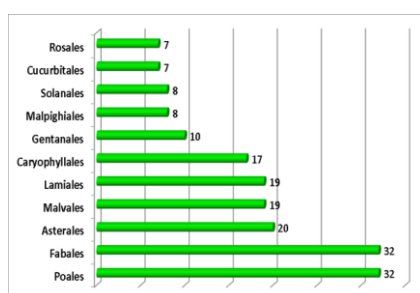
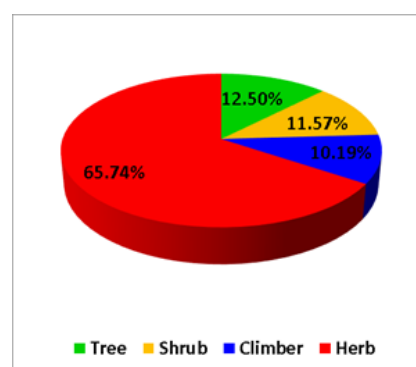Figure 3. Dominant orders of the Umari Dham sacred grove

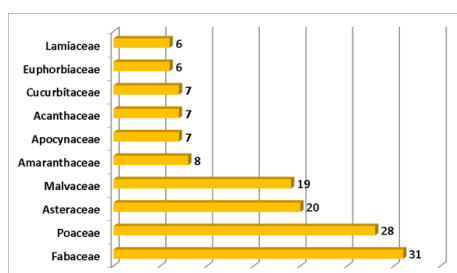Figure 5. Habit categorization of plant species in Umari Dham sacred grove

Figure 4. Dominant families of the Umari Dham sacred grove

Figure 6. A) *Maerua oblongifolia* (Forssk.) A. Rich., B) *Butea monosperma* (Lam.) Taub., C) *Solanum surattense* Burm. f., D) *Indoneesiella echioides* (L.) Sreem., E) *Physalis minima* L., F) *Cleome gynandra* L., G) *Acacia leucophloea* (Roxb.) Willd

Figure 7. A) *Anisomeles indica* (L.) Kuntze, B) *Sesamum mulayanum* Nair, C) *Acacia nilotica* (L.) Del., D) *Anogeissus pendula* Edgew., E) *Pedalium murex* L., F) *Gloriosa superba* L., G) *Cryptostegia grandiflora* Roxb. ex R. Br.

CONCLUSION

Umari Dham temple grove is a part of Jamwa Ramgarh Wildlife Sanctuary and hence is an important region for conservation of biodiversity. It is a home to many threatened and medicinal plants such as *Gloriosa superba* L., *Asparagus racemosus* Willd., *Cocculus pendulus* (J.R. & G. Forst.) Diels., *Tribulus terrestris* L.*, Ricinus communis* L., *Abrus precatorius* L., *Mucuna pruriens* (L.) DC., *Cleome gynandra* L., *Rhus mysorensis* G. Don., *Boswellia serrata* Roxb. ex Cocleb., *Plumbago zeylanica* L., *Diospyros melanoxylon* Roxb., *Boerhavia diffusa* L., *Sarcostemma acidum* (Roxb.) Voigt, *Calotropis procera* auct. non (Ait.) Ait. f., *Adhatoda zeylanica* Medik.*, Pedalium murex* L., *Evolvulus alsinoides* L., *Eclipta alba* (L.) Hassk., *Tridax procumbens* L. and *Glossocardia bosvallia* (L. f.) DC. The expansion of the invasive species like *Prosopis juliflora*, *Hyptis suaveolens*, *Parthenium hysterophorus etc.* in the grove has created huge impact on the native species. Although under the bounds of the Jamwa Ramgarh Wildlife Sanctuary, the sacred grove of Umari Dham is presently under threat and it could be due to the dwindling of the religious beliefs or the modernisation and rapid extension of the urbanization. So, there is a need for conservation measures for the protection of biodiversity. The following measures may be adopted:

- sustainable collection of forest products and control the over harvesting of forest products,
- creating awareness about the importance of biodiversity,
- taking some effective actions for the prevention of overgrazing or rotational grazing should be adopted to maintain the habitat,
- preventing deforestation for fuel wood.

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Acknowledgements

INFLATIONARY UNIVERSE IN BIANCHI TYPE-II SPACE-TIME WITH HIGGS FIELD AND FLAT POTENTIAL IN GENERAL RELATIVITY

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Abstract: In this paper, we have investigated inflationary scenario in Bianchi Type II space-time with flat potential and Higgs field in general relativity. We find that Higgs field evolves slowly but universe expands. The model represents inflationary scenario and accelerating universe. The anisotropy is small & the model isotropizes at late time.

Keywords: Inflationary, Bianchi II, Flat Potential, General Relativity.

1. Introduction

Bianchi type II space-time play a significant role in description of early stages of evolution of universe. The importance of Bianchi type-II space time is given by Asseo and Sol [1]. Bianchi type-II models have been studied by Hajj-Boutros [12], Dunn and Tupper [10], Banerjee et al. [7], Bali and Singh [3] to name a few. Astronomical observations support the existence of anisotropic universe that approaches to isotropic phase at large as mentioned by Land and Magueijo [13]. The stage of accelerated expansion of the universe is known as inflation. The notion of inflation is to explain the flat, homogeneous and isotropic nature of the present day universe. In the beginning of 1980, Guth [11] proposed inflationary model of the universe in the context of grand unified theory (GUT) which was accepted soon as model of early universe due to appearance of a flat potential as in GUT phase transition. In inflationary models, the universe undergoes a phase transition due to the evolution of Higgs field ϕ. Inflation occurs if potential $V(\phi)$ has flat region and in this region ϕ evolves slowly but the universe expands in an exponential way due to the vacuum field energy as mentioned by Stein-Schabes [16]. The flat part of the universe is associated with vacuum energy which is identified as cosmological constant (Λ). Barrow and Turner [8] pointed out that the large anisotropy prevents transition into an inflationary era as per Guth original inflationary scenario. Rothman and Ellis [14] have investigated that we can have solution of isotropy problem if we work with anisotropic metrics and these can be isotropized and inflated under very general circumstances. Inflationary cosmological models are also investigated by Bali [4], Chakravorty [9], Bali and Jain [5], Bali and Singh [6] to name a few.

2. The metric and field equations

We consider Bianchi type II space-time in the form

$$ds^2 = -dt^2 + R^2(dx^2 + dz^2) + S^2(dy + xdz)^2 \tag{1}$$

Where R and S are metric potentials and are functions of cosmic time t alone. The Einstein field equations are given by as

$$R_{ij} - \frac{1}{2}Rg_{ij} = -T_{ij} \tag{2}$$

$$T_{ij} = \partial_i\varphi\partial_j\varphi - \left[\frac{1}{2}\partial_\alpha\partial_\varphi^d 1V(\varphi)\right]g_{ij} \tag{3}$$

The energy conservation law coincides with equation of motion for ϕ and we have

$$\frac{1}{\sqrt{-g}}\partial_i\left(\sqrt{-g}\partial^i\varphi\right) = -\frac{dV}{d\varphi} \tag{4}$$

Which leads to

$$\varphi_{44} + \left(2\frac{R_4}{R} + \frac{S_4}{S}\right)\varphi_4 = -\frac{dV(\varphi)}{d\varphi} \tag{5}$$

The Einstein field equation (2) with (3) for the space-time (1) leads to

$$2\frac{R_{44}}{R} + \frac{R_4^2}{R^2} + \frac{3}{4}\frac{S^2}{R^4} = -\frac{1}{2}\varphi_4^2 + v(\varphi) \tag{6}$$

$$\frac{R_{44}}{R} + \frac{S_{44}}{S} + \frac{R_4S_4}{R_3} + \frac{1}{4}\frac{S^2}{R^4} = 1\frac{1}{2}\varphi_4 + v(\varphi) \tag{7}$$

$$2\frac{R_4S_4}{RS} + \frac{R_4^2}{R^2} - \frac{1}{4}\frac{S^2}{R^4} = \frac{1}{2}\varphi_4^2 + v(\varphi) \tag{8}$$

3. Solution of field equations

Equations (6) and (7) lead to

$$\frac{R_{44}}{R} + \frac{R_4^2}{R^2} - \frac{S_{44}}{S} - \frac{R_4S_4}{RS} - \frac{S^2}{R^4} = 0 \tag{9}$$

For deterministic solution of equation (9), we assume that shear (σ) is proportional to the expansion (θ) i.e. $\frac{\sigma}{\theta}$ = constant. This leads to

$$R = S^n \tag{10}$$

where Q and S we metric potentials and, n is a constant. The condition $\frac{\sigma}{\theta}$ = constant is assumed as per Astronomical observations mentioned by Thorne [ ]. Using equation (10) in (9), we have

$$2S_{44} + 4n\frac{S_4^2}{S} = \frac{1}{(n-1)S^{4n-3}} \tag{11}$$

which leads to

$$\left(\frac{ds}{dt}\right)^2 = f^2 = \frac{1}{2(n-1)}S^{4-4n} + \alpha^2 S^{-4n} \tag{12}$$

where $S_4 = f(S)$ and α^2 is constant.

Therefore the metric (1) can be written as

$$ds^2 = -\left(\frac{dt}{ds}\right)^2 ds^2 + S^{2n}(dx^2 + dz^2) + S^2(dy + xdz)^2 \tag{13}$$

After suitable transformation of coordinates, the space-time (13) leads to

$$ds^2 = -\frac{dT^2}{\frac{T^{4-4n}}{2(n-1)}+\alpha^2 T^{-4n}} + T^{2n}(dx^2 + dz^2) + T^2(dy + xdz)^2 \tag{14}$$

Special model

To get the deterministic result in terms of cosmic time t, we assume n = 3/2. Thus equation (12) leads to

$$\frac{S^3 dS}{\sqrt{S^4+\alpha^2}} = dt \tag{15}$$

From equation (15), we have

$$S^4 = 4\,(t+\gamma)^2 - \alpha^2 \tag{16}$$

Where γ is a constant and

$$R^2 = S^3 = [4(t + \gamma)^2 - \alpha^2]^{3/4} \tag{17}$$

$$\xi = 2(t + \gamma) => \xi^2 = S^4 + \alpha^2 = 4(t + \gamma)^2$$

$$S^4 = 4\tau^2 - \alpha^2$$

$$R^2 = S^3 = (4\tau^2 - \alpha^2)^{3/4}$$

The metric (1) in terms of cosmic time t leads to

$$ds^2 = -d\tau^2 + (4\tau^2 - \alpha^2)^{\frac{3}{4}}(dx^2 - dz^2)$$

$$+(4\tau^2 - \alpha^2)^{\frac{1}{2}}(dy - xdz)^2 \tag{18}$$

where $t + \gamma = \tau$

4. Physical and geometrical aspects

The spatial volume (V) the expansion (θ), the shear (σ), the deceleration parameter (V) for the model (18) are given by

$$V = R^2 S = 4\tau^2 - \alpha^2 \tag{19}$$

$$\theta = 2\frac{R_4}{R} + \frac{S_4}{S} = \frac{8\tau}{4\tau^2-\alpha^2} \tag{20}$$

$$\sigma = \frac{1}{\sqrt{3}}\left(\frac{R_4}{R} - \frac{S_4}{S}\right) = \frac{\tau}{\sqrt{3}\,4\tau^2-\alpha^2} \tag{21}$$

$$\frac{\sigma}{\theta} = \frac{1}{8\sqrt{3}} = \text{a very small quantity} \tag{22}$$

$$q = -\frac{\frac{\ddot{V}}{V}}{\frac{\dot{V}^2}{V^2}} = -\frac{(4\tau^2-\alpha^2)}{8\tau^2} \tag{23}$$

The spatial volume (V), expansion (θ), shear (σ) for the model (13) are given by :

$$V = R^2 S = S^{2n+1} = T^{2n+1} \tag{24}$$

where $2n + 1 > 0$.

$$\theta = 2\frac{R_4}{R} + \frac{S_4}{S}$$

$$= (2n + 1)\sqrt{\frac{1}{2(n-1)}T^{2-4n} + \alpha^2 T^{-4n-2}} \tag{25}$$

$$\sigma = \frac{1}{\sqrt{3}}\left(\frac{R_4}{R} - \frac{S_4}{S}\right)$$

$$= \frac{n-1}{\sqrt{3}}\sqrt{\frac{1}{2(n-1)}T^{2-4n} + \alpha^2 T^{-4n-2}} \tag{26}$$

$$\frac{\sigma}{\theta} = \frac{n-1}{(2n+1)\sqrt{3}} = Constant \tag{27}$$

where $n > 1$. The rate of Higgs field (ϕ) for the model (14) is given by

$$\phi_4 = \frac{l}{T^{2n+1}} \tag{28}$$

5. Determination of Higgs fields (ϕ)

From equation (5), we have

$$\varphi_{44} + \left(2\frac{R_4}{R} + \frac{S_4}{S}\right)\varphi_4 = 0 \tag{29}$$

as potential $V(\phi)$ is constant.

Equation (24) leads to

$$\phi = \frac{\beta}{4\alpha}log\left(\frac{\tau-\alpha/2}{\tau+\alpha/2}\right) \tag{30}$$

where β is constant.

6. Conclusion

The spatial volume for the model (IF) increases with time showing inflations scenario. The shear (σ) leads to zero for large time. This indicates that the model isotropizes at late time. Since $\frac{\sigma}{\theta}$ is very small. It indicates that expansion dominates over shear. The deceleration parameter (q) is negative i.e. $q < 0$, which shows that the model represents accelerating universe. The Hubble parameter decreases with time. The Higgs fields (ϕ) evolves slowly for $\tau > \alpha/2$ but universe expands. In the model (14), the spatial volume increases with time showing inflationary scenario. The deceleration parameter $q < 0$ which shows accelerating phase of universe. The spatial volume (V) for the model (14) increases with time indicating inflationary scenario. The Higgs field (ϕ) evolves slowly but universe expands. The ratio of σ and θ is very small and the model isotropizes at late time.

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