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Green synthesis of ZnO nanoparticles and their characterization by different technique

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ABSTRACT:

This paper Presents Green synthesis of ZnO nanoparticles by using extract of fruits of *Syzygium cumini* (Black berry).The Zinc sulphate (0.2M), Sodium hydroxide(0.2M)(and definite volume of extract of fruits of black berry (1-5 ml in 100 ml of total solution) have been used as initial precursors. The nanoparticles have been characterized by Scanning electron microscope (SEM), Energy dispersive x-ray spectrometer (EDS) and Transmission electron microscopy (TEM) for analyze elemental analysis, particle size and morphology respectively. These particles can be use in photocatalytic degradation of toxic dyes.

KEYWORDS: Green synthesis, ZnO nanoparticles, *Syzygium cumini*, TEM.

INTRODUCTION:

ZnO nanoparticles show variety of applications in the field of optoelectronics, semiconductors, catalysis, coatings, solar cells, ceramics and humidity sensors. Transition metal oxides are considered to be promising materials as electrode materials for supercapacitor applications among which zinc oxide (ZnO) has been found to be a desirable candidate for supercapacitors material because of its high specific surface area, biocompatibility and excellent electrochemical activity. Zinc oxide with various morphologies and different synthesis routes has already been reported since long time. Recentaly ZnO/CuO nanocomposite material has been synthesized and has been used for humidity sensor application [1]. ZnO nano-platelets have been prepared using a high pressure reactor via hydrothermal route. Hydrothermal preparation of ZnO electrodes have been synthesized from different precursors for electrochemical supercapacitors [3].One-pot electrodeposition synthesis of ZnO/graphene composite has been done and has been studied its use as binder-free electrode for supercapacitor [4]. Zinc oxide/activated carbon nanofiber composites have been investigated for high-performance supercapacitor electrodes [5]. Highly porous $ZnCo_2O_4$ nanotubes have been prepared with enhanced electrochemical property for supercapacitor [6]. Nano ZnO@reduced graphene oxide composites have been synthesized via green route in supercritical fluid for high performance supercapacitor [7]. 3D graphene/ZnO nanorods composite networks have been synthesized for super capacitor electrodes [8]. ZnO

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nanoparticles have been embedded in graphene nanosheets for high perform supercapacitors [9]. Effect of Mn doping concentration on structural, morphological and op properties of ZnO Nano-particles has been demonstrated by V. D. Mote [10]. H performance of solid-state supercapacitors based on graphene-ZnO hybrid nanocomposites been shown by Z. Li *et al* [11] Microwave-assisted synthesis of graphene-ZnO nanocompo have been obtained for electrochemical supercapacitors [12]. A novel high power symm ZnO/carbon aerogel composite electrode has been made for electrochemical supercape [13]. Nanorods of ZnO and ZnO/CdO have been synthesized synthesized by therm decomposition and their use has been reported for photocatalytic degradation of of methyl blue under visible light [14]. The synthesis and properties of ZnO-graphene nano hybrid h been done for photodegradation of organic pollutant in water [15]. The Deposition of Z nanoparticles onto graphene in a polyol system has been shown by W. Zou *et al* [16]. But less recent work significantly reports the role of the fruits extract as a capping as wel reducing agent in synthesis of nanoparticles of the Zinc oxide.

In this paper ZnO particles have been prepared by green method and obtained white powder been dried with in oven at 80 °C. The structure and morphology of the grown Z nanostructures has been reported by using UV-Visible spectroscopy, scanning elec microscopy (SEM) with energy dispersive spectroscopy (EDS) and transmission elec microscopy (TEM) respectively. This syhthesizes material can be used in energy stor devices.

RESULT AND DISCUSSION:

UV–visible absorption spectra of zinc oxide nanoparticles in aqueous solution have b recorded. The characteristic absorption band at around 475-480 nm and 550-590 (surface-plasmon) have been found due to of zinc oxide and Zn nanoparticles respectively. value of absorption band have been found same as reported in the literature. The broderne the absorption band and surface –plasmon probably arises from the wide size distributio zinc nanoparticles.

Figure 1 (a) shows the SEM images of zinc oxide nanoparticles (NPs) prepared with 0.2 zinc sulphate and 1mL of black berry fruit (KACHCHA fruit) extract has been used reducing as well as capping agent. Figure 1 (d) shows the EDS of selected area of SEM im as shown in figure 1 (a). The EDS analysis shows the elemental composition of zinc oxygen in synthesized materials. The EDS results (% ratio of Zn and O) show the formati ZnO nanoparticles. The HR-TEM image as shown in figure 1 (b) reveals that synthesized are polycrystalline in nature. Figure 1(c) shows that obtained NPs have been found spher and elongated in shape. The size of particles has been found be 10-30 nm.

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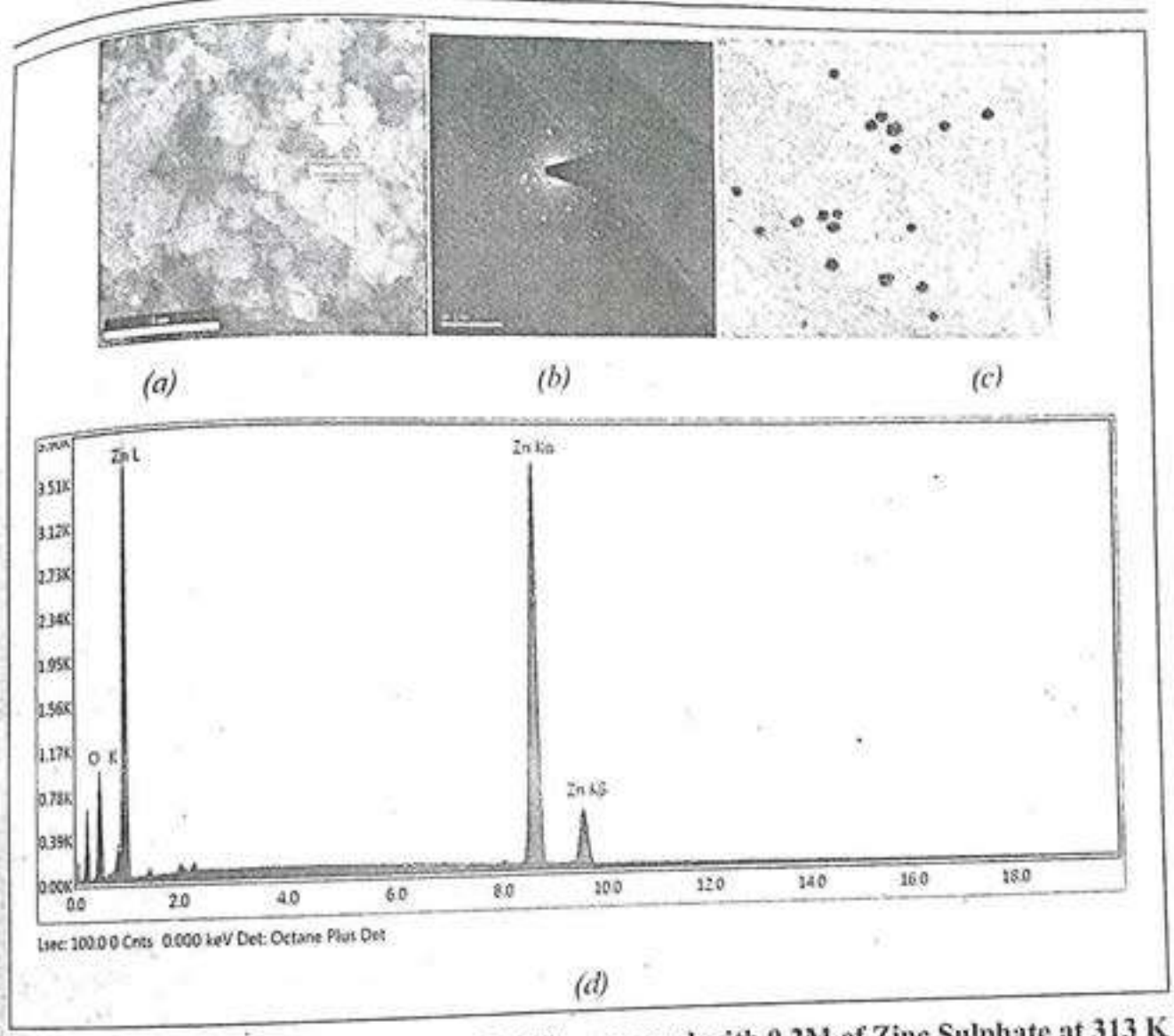

Figure 1: (a) **SEM images of zinc oxide NPs prepared with 0.2M of Zinc Sulphate at 313 K (40^{0}C), Scale bar 5µm, (b) HR-TEM showing polycrystalline nature of synthesized ZnO nanopowder, scale bar 10 1/nm , (c) TEM images of prepared zinc oxide , scale bar 100nm, (d) EDS of prepared zinc oxide obtained with selected area of SEM images as shown in (a) .**

EXPERIMENTAL:

The extract of *Syzygium cumini* (black berry, Kachcha fruit) has been prepared using deionised water (w/v, 25g/100mL). The 100 mL solution of A. R.grade of zinc sulphate (0.2M) has been prepared in 250 mL of conical flask and 1 mL of fruit extract has been added. In the above solution sodium hydroxide of 0.8 g has been added for getting basic medium of the reaction. This set-up has been kept on heating plate with magnetic stirrer for 2 hour at 313 K (40^{0}C). The obtained powder material has been filtered with whatmann filter paper no. 42 and washed using

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ethanol to remove impurities. The synthesized powder material has been characterized by Visible spectroscopy, EDS, SEM and TEM respectively. The chemical composition of synthesized material has been observed by scanning emission microscopy with EDS (model JEOL-JSM-6610). The morphological analyses of the nanoparticles have been carried out by FEI TECHNAI (model number G2 T20) transmission electron microscope (operated at kV).

CONCLUSION:

We have prepared Zinc oxide nanoparticles by using extract of *Syzygium cumini* (black fruits. Herein no reducing and capping have been used. This is a novel green syn technique which is simple and environment friendly. It is an easy, fast, and cost eff technique and doesn't involve any harmful and environmentally toxic chemicals previously in conventional chemical reduction methods. These particals can be used in energy storage devices as well as in degradation of organic pollutants.

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