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## Photodegradation of Acid Yellow 220 in aqueous solution by Photo-Fenton Reagent

Ashok k.Kakodia<sup>1</sup>, Ramesh K. Menaria<sup>1</sup>, Atul K. Bhatnager<sup>2</sup>, Bhupendra K. Sharma<sup>1</sup>, **Kunad Tanwar<sup>3</sup>**

<sup>1</sup>Department of Chemistry, S. G. G. Government College, Barwara, Rajasthan;

<sup>2</sup>Department of Chemistry, B. B. D. Government College Chimanpura, Jaipur, Rajasthan;

<sup>3</sup>Department, of Chemistry, N. I. T. Sitapura, Jaipur

### Abstract

Advanced oxidation processes (AOPs) are widely used for the removal of health hazardous organic pollutants from industrial and municipal wastewater. Acid Yellow 220, which has a complex molecular structure with azo aromatic groups, is widely used in textile industry. Degradation of Acid Yellow 220 by Photo-Fenton reagent has been investigated under irradiation of visible light in aqueous solution. The parameters that influence degradation such as concentration of Acid Yellow 220, FeSO<sub>4</sub>, H<sub>2</sub>O<sub>2</sub>, light intensity and pH of the experimental solution were studied. The optimum condition for the photocatalytic degradation of dye was established. The kinetic of degradation of dye in the dilute solution is follows first order kinetics.

**Key Words:** Photocatalytic Degradation, Acid Yellow 220, Photo-Fenton.

### Introduction:

In recent years, acid dyes have been commonly used due to their advantages such as better dyeing processing conditions and bright colors. Acid dyes in dyeing wastewater have been identified as recalcitrant compounds since they contain high alkalinity, high concentration of organic materials and strong color in comparison with other dyes. Many azo dyes and their intermediate products are toxic mutagenic or carcinogenic to aquatic life and human<sup>1</sup>.

The non-biodegradability of textile wastewater is due to the high content of dyestuffs, surfactants and other additives, which are generally organic compounds of complex structure. It is difficult to treat these wastewaters by conventional technologies<sup>2</sup>.

Advanced oxidation processes (AOPs) have provided innovative, cost-effective catalyzed chemical oxidation for treating pollutants in low or high concentration from contaminated soil, sludge and water. AOPs are based on the generation of hydroxyl radical (OH) which has a high oxidation potential (2.8 V) that completely convert organic contaminant into CO<sub>2</sub>, H<sub>2</sub>O and inorganic ions or

biodegradable compounds<sup>3</sup>. These methods are environmental friendly. Therefore, AOPs are considered as promising treatment methods to wastewater.

Common AOPs which are widely used are H<sub>2</sub>O<sub>2</sub>/UV<sup>4</sup>, TiO<sub>2</sub>/UV<sup>5</sup>, Ozonation<sup>6</sup>, O<sub>3</sub>/UV<sup>7</sup>, Fenton reagent<sup>8</sup>, UV-Fenton<sup>9</sup>, process electron beam irradiation<sup>10</sup>, sonolysis<sup>11</sup>, wet-air oxidation<sup>12</sup> and various combination of these methods<sup>13</sup>. Photocatalytic degradation has been proved to be a promising method for the treatment of wastewater contaminated with organic and inorganic pollutants<sup>14-18</sup>. Fenton and Fenton type processes have proven to yield very good results either for complete mineralization of azo dyes or for their transformation into less complex structures that are more easily biodegradable. It can be used to degrade many pesticides<sup>19</sup>, harmful chemicals<sup>20,21</sup> and dyes<sup>22-24</sup>. It has been shown that Photo-Fenton reagent cleaves the conjugated bonds of azo-dyes chromophores, leading to color removal and enhancing the biodegradability of the treated wastewater. It has the advantages of coagulation and catalytic oxidation, as well as being able to generate oxygen in water.