International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 06
May 2019

Impact of Photocatalytic degradation of pollutants of Textile industry by Nanocatalyst ZnO

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Abstract:

Textile industrialization shows the growth of country but these industries also affect the water quality in a direct manner as well as indirect manner. Most of these textile industries produce waste containing toxic heavy metal and organic and inorganic effluent. Photocatalytic degradation is a important technique for removing impurities from industrial waste by the use of light radiation and particles. This paper aims, to review the recent works on the photocatalytic degradation by using ZnO photo catalyst for textile polluted water. Various operation parameters such as colour, pH, temperature, TDS, COD to their effect on photo degradation by using nanocatalyst ZnO. Result indicate, this laboratory experiment performance have been investigate of the solar photo catalytic degradation process can efficiently treat textile effluent and reduce the levels of COD, TDS, alkalinity and color. Experimental runs can be used to identify the operational parameters to perform wastewater degradation on large scale for recycling purpose.

Keywords: Textile industries waste water, COD, color, ZnO Nanocatalyst, Photodegradation.

I. Introduction

The growth of industries, the production of useful products has been focused on and generation of waste byproducts has been largely ignored. Researchers all over the world have been working on various approaches to address this issue. It produces large quantities of coloured dye effluents, heavy metals and toxic pigment from manufacturing and processing processes in the textile industry. Some physical and chemical methods are used for removal these toxic effluents but these conventional treatment methods do not degrade the effluents up to the limit it can be recycled and also require detection time of several days. Photocatalytic degradation has a new route for the

degradation of organic compounds. Semiconductor photocatalysis has become more and more important since it has a great potential to contribute to such environmental problems. This process is of particular interest due to its ability to use solar energy. ZnO has attracted much attention with respect to the degradation of various pollutants because of its high photosensitivity, stability, and wide band gap. Previous studies have proved that ZnO can degrade some organic pollutants under UV irradiation. ZnO has used in water purification and water treatment. Most of the textile dyes and effluents are non-biodegradable and their release into the environment poses a major threat to the surrounding eco systems. ZnO mediated semiconductor photocatalysis is gaining more importance due to its high production of hydroxyl radicals. It is also inexpensive, nontoxic, abundantly available and stable.

II. SAMPLE COLLECTION & ANALYSIS OF SAMPLE

For the present study of assessment of water quality, was selected textile industry, Budni (M.P.). This area is involved in manufacturing and trade of textile products principally cotton. The area lack proper drainage system and as a result of this, all the industrial waste water effluents are drained into the river which effects the nearby irrigation agricultural products and the quality of ground water due to high level of BOD, COD , pH , temperature etc. Samples of the effluent were collected in sterile, dry and properly stopper plastic bottles. Temperature of the effluent was determined at the spots, whereas, the rest of physiochemical parameters were determined instantly after bringing the samples in the research laboratory Govt. NMV college Hoshangabad. Various methods used for analysis are summarized in Table I.

TABLE I

S.N.	PARAMETERS	UNIT	SAMPLE VALUE
1	Temperature	℃	25
2	Color	-	Bluish black
3	pH	-	10
4	TDS	ppm	5860
5	Phe. alkalinity	mg/L	146
6	Total alkalinity	mg/L	192
7	Total hardness	mg/L	250
8	D.O.	mg/L	9.7
9	C.O.D.	mg/L	1219

III.EXPERIMENTAL

3.1 Instrument

For Photo degradation we use photo catalytic reactor. This reactor is made up with a high quality glass double wall beaker. It is joined with beaker and magnetic stirrer on hot plate instrument. The beaker is irradiated by mercury lamp. Lamp is situated perpendicular above beaker. The radiation source is mercury lamp.

3.2 Procedure

For the degradation experiments, in a photo catalytic reactor we take sample water and nanocatalyst ZnO. The suspension was subjected to irradiation under mercury light for a fixed interval of time. The sample solution was stirred magnetically throughout the period of experiment and fixed the temperature. When the suspension have been stirred well than we take water parameters like COD, temperature, TDS. By the volumetric titration method, we titrate the above solution with FAS (0.1N) solution and calculate the value of Chemical Oxygen Demand (COD). Before photo degradation the value of sample of Chemical Oxygen Demand (COD) was **1219** mg/l.

3.3 Photocatalytic set up

The experiments were conducted under solar radiation; the value of COD is reduce by photodegradation process at different concentration, different temperature and different time.

Set I- In apparatus take 40 ml sample solution and add 0.5 mg ZnO nanocatalyst. On 30°C temperature it is degraded by magnetic stirrer for two hours. After cooling down titrate above solution with std. ferrous ammonium sulphate solution. Calculated the COD value is 1192 mg/l.
Set II- In apparatus take 50 ml sample solution and add 0.5 mg ZnO nanocatalyst. On 40°C temperature it is degraded by magnetic stirrer for two hours. After cooling down titrate above solution with std. ferrous ammonium sulphate solution. Calculated the COD value is 1016 mg/l.
Set III- In apparatus take 60 ml sample solution and add 0.5 mg ZnO nanocatalyst. On 50°C temperature it is degraded by magnetic stirrer for two hours. After cooling down titrate above solution with std. ferrous ammonium sulphate solution. Calculated the COD value is 832 mg/l.
Set IV- In apparatus take 60 ml sample solution and add 0.5 mg ZnO nanocatalyst. On 60°C temperature it is degraded by magnetic stirrer for two hours. After cooling down titrate above solution with std. ferrous ammonium sulphate solution. Calculated the COD value is 632 mg/l.

IV RESULT AND DISSCUSSION

After photo degradation the effect of variation of parameters like pH, TDS and COD on exposure time for the degradation of pollutant was studied and show in the Table 2

Table: II

Parameters	Set-I	Set-II	Set-III	Set-IV
PH	9.8	9.4	9.2	8.8
TDS (ppm)	4930	5010	5190	5460
COD (mg/l)	1192	1016	832	632

Above table II show after photo reduction the pH of textile sample water was slightly decrease and the value of TDS was increased. Chemical Oxygen Demand was minimized by the photodegradation. After degradation sample color turn into light sky blue color.

V CONCLUSION

In this experimental work, the effectiveness of using ZnO nanoparticles by solar photo catalysis in minimizing COD, toxic organic pollutants from textile industry waste water was investigated. It is observed that the solutions obtained after photodegradation show a significant COD removal .The performance of the synthesized ZnO nanoparticle developed good photocatalytic activity at different temperature, different concentration of sample. Therefore, prepared ZnO nanoparticles can be utilized as a photocatalyst in wastewater treatment for environmental applications.

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