International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2022; 10(4): 45-46

Received: 20-05-2022
Accepted: 03-07-2022

Adithya Conjeevaram Gopal
Research Scholar, Loyola Institute of Frontier Energy, Department of Chemistry, Loyola College (Autonomous), Chennai, Tamil Nadu, India

Dr. MF Valan
Research Supervisor and Scientist, Loyola Institute of Frontier Energy, Department of Chemistry, Loyola College (Autonomous), Chennai, Tamil Nadu, India

Corresponding Author:
Dr. MF Valan
Research Supervisor and Scientist, Loyola Institute of Frontier Energy, Department of Chemistry, Loyola College (Autonomous), Chennai, Tamil Nadu, India

Photo-chemical treatment of dyes and wastewater by methods based on inorganic chemistry in the year 2010: A review

Adithya Conjeevaram Gopal and Dr. MF Valan

Abstract
There has been a rise in environmental pollution due to harmful dyes which are being released into land and waterways by chemical and textile industries. This has forced the scientific community to look out for suitable solutions for treatment of waste water and the simultaneous removal of toxic dyes from the water bodies and land. Photo-chemical methods based removal of dyes has been an interesting avenue for wastewater and effluent treatment in recent times. The methods based on inorganic chemistry for removal of toxic dyes is briefly reviewed.

Keywords: Cucumber, boron, yield, quality, Konkan

Introduction
Toxic dyes: A bane for the environment
There has been a rise in the interest on removal of toxic dyes let out from the textile, leather and chemical industries, into water bodies and wastewater. Dyes are colored chemicals which provide an aesthetic appearance to clothes. However, synthetic dyes have been a bane to the environment. They have been chiefly implicated in pollution of water bodies. The increase in pollution due to harmful dyes has forced the scientific community to look for a suitable solution for the treatment of wastewater and industrial effluents.

Review of literature
Photo-chemical degradation of synthetic dyes for wastewater and effluent treatment has been extensively researched in recent times. The word ‘Photo’ means light. This method also employs the use of suitable catalysts for accelerating the process of dye degradation in the presence of light.
Hussein and Abass conducted an extensive study on the photocatalytic treatment of wastewater using zinc oxide, anatase (titanium dioxide) and rutile (titanium dioxide) [1].

Experimental summary: The authors Hussein and Abass designed a simple photocatalytic reactor with the help of a mercury lamp and a Pyrex beaker fitted with a magnetic stirrer. The two catalysts namely ZnO and TiO_2 were taken. The decolorization efficiency was recorded. The effect of the masses of anatase, rutile and ZnO on photocatalysis were also studied. Up to 90 percent efficiency was achieved with ZnO as photocatalyst whose mass was measured 350 mg. The time taken for each photocatalyst for decolorization was 1 hour [1]. The experiment was carried out with both polluted wastewater and simulated wastewater. The outcome was positive on both the counts.
Yuvraj Jhala *et al*. 2010 [2] have studied the photochemical degradation of neutral red using potassium trisoxalatoferrate (III). Photochemistry is in the nascent stage for research and development but it is an interesting area for studies in environmental applications. Various parameters such as pH, concentration of dye, concentration of complex and quantity of light intensity have been measured.

Experimental summary
Three beakers were taken wherein all the beakers contained the dye neutral red, The first beaker was kept in dark condition.

The second beaker was kept under light. The third beaker was kept whereby the beaker contained the dye along with the complex. The optical densities (OD) were recorded at various time points and a graph was plotted between time (minute) and (1+log OD). The graph was descending and linear. It was inferred from this graph that the time taken for decolorization increased with decrease in (1+ log OD).

Subsequent studies revealed that the rate of reaction was higher at pH values up to 5 but the rate decreased above 5 pH. The rate of bleaching of the dye increased with increase in the concentration of the dye. Also the rate of reaction was higher when the concentration of the oxidant catalyst was 6.66×10^{-6} M but subsequently adverse effects on the reaction was seen due to increase in the concentration of the oxidant catalyst above the said value mentioned. Further, increase in the light intensity was directly proportional to the rate of reaction as noted from the graphs [2].

Chaturvedi *et al*. 2010 [3] have recorded the photocatalytic activity of Manganese Dioxide on Janus Green B.

Experimental summary: Four beakers containing the dye Janus Green B solution were taken. The first beaker contained the dye and was kept in dark. The second beaker contained the dye and was exposed to light. The third beaker contained both the dye and MnO_2 and was kept in the dark. The fourth beaker contained both the dye and MnO_2 and was exposed to light. The graph between (2+log OD) and time was plotted. The graph was found to be linear and descending which indicated the increase in time required for photolytic degradation and decolorization of dye. The optimum concentration of the dye was found to be 7.6×10^{-6} M after which the reaction was affected. Similarly, the optimum concentration of manganese dioxide was found to be 0.6 g *i.e.* the saturation point wherein the reaction was affected after increasing the concentration of the catalyst. The increase in intensity was directly proportional to the degradation of the dye [3].

Gandhi *et al*. 2010 [4] have studied the photocatalytic activity of a combination of zinc sulfide and cobalt sulfide [4] on methylene blue.

Experimental summary: The photocatalytic semiconductor was prepared as follows: Separate and clear solutions of zinc sulfate and cobalt sulfate (M/2 each) were prepared and were made alkaline by adding NH_4Cl and NH_4OH solutions to them each. Hydrogen sulfide gas was passed in to each of the solutions and the precipitates CoS and ZnS were obtained. The wet cake thus obtained, was washed with distilled water and subsequently, crystals were obtained. The reaction was carried out. Next, log OD vs time graph was plotted which showed that the time was directly proportional to the rate pf reaction. The graph was linear and descending. The saturation points were noted as follows: Optimum pH = 7.5, optimum concentration of methylene blue = 2.0×10^{-5} M optimum concentration of the catalyst = 1.10 g. The optimum values were thus defined because the rate of reaction decreased while increasing the above-mentioned parameters. The intensity of light was directly proportional to the reaction rate, as noted from the graphs.

Conclusion
Photocatalysis is an emerging and an interesting tool for treatment of wastewater and industrial effluents. From the above discussion, it is inferred that light and catalyst are the two major requirements for wastewater and effluent treatment. The increase in environmental pollution due to harmful and synthetic dyes has resulted in increasing research on photocatalytic treatments for effluent treatment.

Scope for the future
The environmental toxicity and pharmacological effects of catalysts used in photochemical treatment of effluents also need to be evaluated so as to prevent biomagnification and toxicity in living organisms.

Acknowledgment
The authors would like to thank the management of Loyola College (Autonomous) for providing facilities and infrastructure to carry out the review. The support extended to us by the Director, Loyola Institute of Frontier Energy, Loyola College (Autonomous) is gratefully acknowledged.

References
1. Falah Hussein H, Thekra Abass A. Photocatalytic treatment of Textile Industrial Wastewater. International Journal of Chemical Sciences, 2010.
2. Yuvraj Jhala, Anil Chittora K, Ameta KL, Punjabi PB. Photochemical degradation of Neutral Red using Potassium Trisoxalatoferrate (III) as an oxidant. International Journal of Chemical Sciences, 2010.
3. Nitin Chaturvedi, Sunayana Sharma, Sharma MK. Chaturvedi RK. Photocatalytic degradation of Janus Green B using Manganese Dioxide. International Journal of Chemical Sciences, 2010.
4. Neelam Gandhi, Vijaya Sharma, Ankur Khant, Khandelwal RC. Preparation and Use of CoS-ZnS (1:10) in Photodegradation of Methylene Blue. International Journal of Chemical Sciences, 2010.
5. Lal K, Bhojak N. Adsorbents for removal of hazardous organic substance from waste water and natural water samples: A review. Int. J Adv. Chem. Res. 2021;3(2):17-19. DOI: 10.33545/26646781.2021.v3.i2a.37