

# Nano-Technology in Photocatalytic Application: $WO_3$ Based Materials-Kinetic and Mechanistic Investigations

## Abstract

Different methods including microbial degradation, adsorption on activated carbon, biosorption, chemical oxidation (using agents such as ozone, hydrogen peroxide, and chlorine), deep-well injection, incineration, and solvent extraction used for the treatment of industrial wastewater, but, limited owing to high cost, carbon removal of solvents and oxidation of material. Dyes degradation using photocatalysis is one of promising techniques to get to treat hazardous dyes in industrial wastewater. In photocatalysis light is used to enhance the rate of reaction. A quantity of material which is used to enhance the reaction rate under the light that material is photocatalyst. When light falls on photocatalyst it degrades all contamination dyes. The best catalyst use for the degradation is  $WO_3$  but it not much effective alone therefore we always use composite with it for enhancement of its efficiency.

**Keywords:** Dye degradation; photocatalyst;  $WO_3$

## Mini Review

Volume 1 Issue 6 - 2017

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Received: August 09, 2017 | Published: December 27, 2017

## Introduction

A huge amount of organic and inorganic waste is formed throughout the world after consuming the goods. There are various applications of the Organic dyes in leather, textile, paints, and in other different industries. It is a great concern issue to contaminate wastewater by different organic dyes [1,2]. Organic dyes are very cancer-causing to humans even at low concentrations (0.001mg/L). As organic dye is the basic key point for the wastewater treatment. According to the world wide survey "Global water supply 2000" it is estimated that in developing countries 1.3 billion persons cannot clean their water even for drinking [3,4]. Therefore, being the part of society it is our moral duty to help others. There are many techniques to purify water e.g. filtration, distillation, boiling etc. Photocatalytic Dye. And degradation has following properties like reusability, low cost, complete degradation and ecofriendly.

## Photocatalysis

Photocatalysis is a combination of two word "photo" and "catalysis". Photo means light and catalysis is the process in which rate of reaction increases rapidly with the addition of anything without changing the net concentrations [5-7]. The substance which is used to increase the rate of reaction is termed as catalyst. This substance reduces the activation energy and activates the reaction immediately [8,9]. As Photocatalysis is the reaction under the use of light to activate the catalysts and increase the rate of reaction with the involvement of light itself. The material used to increase the rate of reaction without consuming itself in Photocatalytic dye degradation we usually use tungsten trioxide  $WO_3$  [9-11]. But it is more effective when we use some composite with it. Transition metal oxides are important area for the research in these days. Tungsten oxide ( $WO_3$ ) is one of them having wide range of study with considerable attention due to its encouraging physical and chemical properties. There is a small

band gap and flexibility in corrosion effects,  $WO_3$  has been widely considered as a feasible candidate for visible-light photocatalyst. However, various basic issues have to be mentioned before they are available for wide industrial applications [12]. Pure  $WO_3$  has usually greater electron-hole recombination rate so it is not effective photocatalyst. It has negative position of its conduction band (CB) it faces different difficulties to reduce the oxygen. Therefore, different methods have been adopted to enhance the activity of tungsten oxide particles. There are many ways to increase its efficiency of  $WO_3$ . One of the most promising ways to accomplish this goal is to design heterogeneous catalysts. So far, various heterogeneous  $WO_3$  based heterogeneous structures, such as  $WO_3/SiO_2$ ,  $WO_3/TiO_2$ ,  $WO_3/NiO$ , and  $Pt/TiO_2-WO_3$ , have been designed toward good catalytic performance [9,3-6].

## Conclusion

Water can be purifying by using Photocatalytic dye degradation. These dyes are injurious to health. We may use  $WO_3$  Photocatalyst by doping it with sulphide nitride and oxide but we prefer metal oxide for doping because of its wide band gap and other properties. There are different techniques for degradation but Photocatalytic is latest one. There are many characterization techniques used like transmission electron microscopy (TEM), infrared spectroscopy (FTIR), photo-co-relation spectroscopy (PCS) and UV-Vis-spectroscopy. Parameters studied to optimize the photocatalytic process are light irradiation time, dye concentration stirring rate and incident light energy and intensity.

## Acknowledgement

None.

## Conflict of interest

Authors declare there is no conflict of interest.

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