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Nano-technology in photocatalytic application: WO3 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 reactio. A quantity of material which is used to enhance the reactional 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

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Introduction

A huge amount of organic and inorganic wastage 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 concerned 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.

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Conflicts of interest

Authors declare there is no conflict of interest.

References

1. Liu M, Li H, Zeng Y. Facile Preparation of Efficient WO3 Photocatalysts Based on Surface Modification. *Journal of Nanomaterials*. 2015;502514:1–7.
2. Sacco O, Stoller M, Vaiano V, et al. Photocatalytic Degradation of Organic Dyes under Visible Light on N Doped Photocatalysts. *International Journal of Photoenergy*. 2002;626759:1–8.
3. Backes CW, Scheffer FR, Pereira MB, et al. Photosensitised Degradation of Organic Dyes by Visible Light Using Riboflavin Adsorbed on the Surface of TiO2 Nanotubes. *Journal of the Brazilian Chemical Society*. 2014;25(12).
4. Ullah R, Dutt J. Photocatalytic degradation of organic dyes with Manganese-doped ZnO nanoparticles. *Journal of Hazardous Materials*. 2008;156(1–3):194–200.
5. Xiong Z, Zhang LL, Ma J, et al. Photocatalytic degradation of dyes over graphene–gold nanocomposites under visible light irradiation. *Journal of Chemical Communication*. 2010.
6. Zhanga J, Yua K, Yub Y, et al. Highly effective and stable Ag_3PO_4/WO_3photocatalysts for visiblelight degradation of organic dyes. *Journal of Molecular Catalysis A: Chemical*. 2014;391:12–18.
7. Luo J, Yartym J, Hepel M. Photoelectrochemical Degradation of Orange II Textile Dye on Nanostructured WO_3 Film Electrodes. *Journal of New Materials for Electrochemical Systems*. 2002;5:315–321.
8. Bamwenda GR, Arakawa H. The visible light induced photocatalytic activity of tungsten trioxide powders. *Applied Catalysis A: General*. 2001;210(1–2):181–191.
9. Prabhu S, Nithya A, Mohan SC, et al. Synthesis, Surface acidity and photocatalytic activity of WO_3/TiO_2 nanocomposites – An overview. *Materials Science Forum*. 2014;781:63–78.
10. Ramos-Delgado NA, Gracia-Pinilla MA, Maya-Treviño L, et al. Solar photocatalytic activity of TiO_2 modified with WO_3 on the degradation of an organophosphorus pesticide. *Journal of hazardous materials*. 2013;263(1):36–44.
11. Seddigi JK. Removal of Alizarin Yellow Dye from Water Using Zinc Doped WO_3 Catalyst. *Bulletin of Environmental Contamination and Toxicology*. 2010;84(5):564–567.
12. Santhi K, Rani C, Karuppuchamy S. Degradation of Alizarin Red S dye using Ni doped WO_3 photocatalyst. *Journal of Materials Science: Materials in Electronics*. 2016;27(5):5033–5038.

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