Preparation and Performance of Composite Photocatalysts with Magnetic Particles

Xindang Bo[1], Fenglan Chai[1, *], Bin Huang[2]

[1]School of Chemical Engineering, Henan Technical Institution, Zhengzhou, China

[2]School of Chemical Engineering and Environment, Henan University of Technology, Zhengzhou, China

Email address:

553027275@qq.com (Xindang Bo), 965996899@qq.com (Fenglan Chai), 2753397061@qq.com (Bin Huang)

[*]Corresponding author

Abstract

The wastewater containing dyestuff, such as Methylene blue (MB), Methyl orange (MO), leads to serious environmental pollution and threatens to the safety of humans. Photocatalysis, as an environmentally friendly and highly efficient method for energy conversion and environmental remediation, has attracted widespread attention and research in recent years. Among the visible-light photocatalytic materials, Bi_2WO_6, with a band gap of about 2.80 eV, has attracted great interest of researchers because of its unique properties such as non-toxicity, high stability and low cost. However, Bi_2WO_6 has a high photogenerated carrier complex rate, unsuitable for recycling and reuse, and low photocatalytic activity, which limits its large-scale application. Magnetic composite photocatalysts are an attractive solution for organic pollutants in water, particularly due to the simple magnetic separation process. Straw carbon (SC), a charcoal prepared from straw, has much active groups such as hydroxyl and amino groups, and the advantages of high adsorption efficiency due to higher specific surface area. In this study, The ternary photocatalyst Bi_2WO_6@Fe_3O_4@SC was prepared using Fe_3O_4 and SC as carrier and characterized by BET, SEM, VSM, XRD and FTIR. The photocatalytic degradation performance of Bi_2WO_6@Fe_3O_4@SC for MB were investigated by using sunlight as light source. The ternary photocatalyst efficiently has removed MB from aqueous solution. The effects of different parameters such as catalyst dosage (0.05-0.2 g/100 mL), initial dyestuff concentration (10-100 mg/L) and contact time (5-60 min) on the degradation process was examined. The optimum conditions for degradation of MB are: the optimal molar ratio of the ternary photocatalyst to MB is 1:2, and the degradation rate of MB reached up to 99% within 60 minutes. The ternary photocatalyst can be easily recycled repeatedly by simply magnetic separation, and the catalytic activity of the recovered photocatalysts was essentially maintained. Therefore, the ternary photocatalyst offer a great promise for the removal of MB dyestuff from aqueous solutions because of the advantage of their producibility from a cheap source, high photocatalytic performance, easily recyclability and reusability.

Keywords

Photocatalysis, Straw Carbon, Methylene Blue, Magnetite Particles, Ternary Photocatalyst