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ACCEPTED MANUSCRIPT

Enhanced sonocatalytic degradation of organic dyes from aqueous solutions by novel synthesis of mesoporous Fe_3O_4-graphene/ZnO@SiO_2 nanocomposites

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Abstract

Fe_3O_4-graphene/ZnO@mesoporous-SiO_2 (MGZ@SiO_2) nanocomposites was synthesized via a simple one pot hydrothermal method. The as-obtained samples were investigated using various techniques, as follows: scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray diffraction (XRD), and specific surface area (BET) vibrating sample magnetometer (VSM), among others. The sonocatalytic activities of the catalysts were tested according to the oxidation for the removal of methylene blue (MB), methyl orange (MO), and rhodamine B (RhB) under ultrasonic irradiation. The optimal conditions including the irradiation time, pH, dye concentration, catalyst dosage, and ultrasonic intensity are 60 min, 11, 50 mg/L, 1.00 g/L, and 40 W/m^2, respectively. The MGZ@SiO_2 showed the higher enhanced sonocatalytic degradation from among the three dyes; furthermore, the sonocatalytic-degradation mechanism is discussed. This study shows that the MGZ@SiO_2 can be applied as a novel-design catalyst for the removal of organic pollutants from aqueous solutions.

Keywords: Fe_3O_4-graphene/ZnO@mesoporous SiO_2, Sonocatalytic degradation, Magnetic graphene, organic dye

Introduction

With the rapid development of industrial society, increasing environmental-safety threats posea major concern. Water pollution has become one of the most serious problems in the environmental fields. The textile industry is a water-consuming and heavily polluting industry. It is estimated that over 500 tons of various dyes are discharged into water bodies, and approximately 80 % of wastewater is from the textile industry. The remarkable characterization of the dye wastewater is potentially toxic and poorly biodegradable, which

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