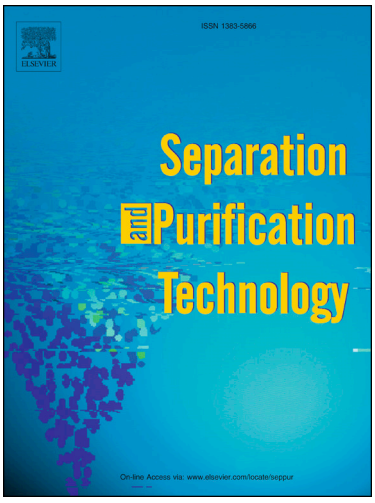

Investigation the photocatalytic activity of $CoFe_2O_4$/ZnO and $CoFe_2O_4$/ZnO/Ag nanocomposites for purification of dye pollutants

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Investigation the photocatalytic activity of $CoFe_2O_4$/ZnO and $CoFe_2O_4$/ZnO/Ag nanocomposites for purification of dye pollutants

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Abstract

Magnetically separable $CoFe_2O_4$/ZnO and $CoFe_2O_4$/ZnO/Ag nanocomposites were successfully synthesized using $CoFe_2O_4$ nanoparticle as core by a simple precipitate route. The structural, morphology and functionality of prepared samples were analyzed using X-ray diffraction, field emission scanning electron microscopy, transmission electron microscopy, Fourier transform infrared spectroscopy, diffuse reflectance spectroscopy, and vibration sample magnetometer. The micro-structural study approved that the synthesized nanoparticles have spherical morphologies with average particle size between 30-47 nm. The influence of nanocomposites on the acid violet and acid brown degradation was investigated under ultraviolet light. The $CoFe_2O_4$/ZnO nanocomposite showed enhanced photocatalytic activity, achieving acid violet and acid brown degradation efficiency of 76% and 63% respectively, rather than other samples. The increase in photocatalytic activity of $CoFe_2O_4$/ZnO hybrid may be associated with the formation of a suitable internal structure between $CoFe_2O_4$ and ZnO. Magnetic measurement indicated that $CoFe_2O_4$/ZnO is ferromagnetic with the magnetization saturation value of 25 emu/g, which is suitable for magnetic recovery by using an external magnetic field.

Keywords: Nanocomposite, ZnO, Ferrite, Photocatalytic activity, $CoFe_2O_4$/ZnO, $CoFe_2O_4$/ZnO/Ag

1. Introduction

Zinc oxide as a mineral semiconductor has a direct band gap around 3.3 eV as well as large exciton binding energy of 60 meV at room temperature. Due to its band gap, ZnO can be applied as a photocatalyst under ultraviolet irradiation [1]. Generally, in semiconductors, the main principle of photo-catalysis process is the movement of photo-generated electrons and holes that migrate to the surface [2]. This migration leads to the pollutant decomposition by reducing and oxidizing the adsorbed reactants [3]. Technically, it is important to have multifunctional