Synthesis, characterization, and photocatalytic activity of fe3O4@zno nanocomposite

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Abstrak

A magnetic Fe3O4@ZnO nanocomposite (NC) was successfully synthesized by a wet milling method using a high energy milling (HEM) machine. The magnetic Fe3O4@ZnO NC was characterized by an X-ray Diffractometer (XRD), scanning and transmission electron microscopes (SEM and TEM), and a vibrating sample magnetometer (VSM). X-ray diffraction results show that Fe3O4@ZnO NC consisted of ZnO and Fe3O4 phases. The microstructure analysis indicated that Fe3O4@ZnO NC presented a ZnO shell wrapped around the surface of a magnetic Fe3O4 surface. The average diameter of the aggregated Fe3O4 nanoparticle (NP) is 20 nm, while that of Fe3O4@ZnO NCs is nearly 30 nm. The Fe3O4 NP and Fe3O4@ZnO NC show typical superparamagnetic behavior with low coercivity. The saturation magnetization (Ms) of Fe3O4 NP was measured at about 66.26emu.g-1 and then declined to 34.79emu.g-1 after being encapsulated with a ZnO shell. The photoactivities of the Fe3O4@ZnO NC under UV irradiation were quantified by the degradation of a methylene blue (MB) dye solution. The result reveals that the photodegradation efficiency of Fe3O4@ZnO NC is favorable at pH neutral (pH = 7) reaching 100%. By increasing the MB dye concentration from 10 ppm to 40 ppm, the photodegradation efficiency decreases from 100% to 52%. The Fe3O4@ZnO NC can be easily collected by an external magnet. The magnetic Fe3O4@ZnO NC could be extended to various potential applications, such as purification processes, catalysis, separation, and photodegradation.