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Visible light photocatalytic degradation of methylene blue by $H_2O_2/NiFe_2O_4$ synthesized from wastewater

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ABSTRACT

In this study, a novel magnetic $NiFe_2O_4$ photocatalyst was produced from electroplating wastewater and pickling waste liquor via microwave hydrothermal method. It was shown that 99% of heavy metal ions (Fe^{3+} and Ni^{2+}) in the wastewater could be effectively removed through precipitation. And physicochemical properties of the material were characterized by several techniques, such as X-ray diffraction, scanning electronic microscopy and vibrating sample magnetometer. The values of saturation magnetization of magnetic $NiFe_2O_4$ was about 13.28 emu/g. In addition, photocatalytic degradation of methylene blue (MB) was studied using $NiFe_2O_4$ with H_2O_2 under visible light. The main influence factors (pH, the dosage of $NiFe_2O_4$ and concentration of MB) were investigated, which showed that the maximum MB removal efficiency could reach 99%. Degradation kinetics data followed the pseudo-first-order model. And there was a synergistic effect between $NiFe_2O_4$ and H_2O_2 in the visible light photocatalytic advanced oxidation process. H_2O_2 was activated by $NiFe_2O_4$ and generated hydroxyl radicals (·OH). Meanwhile, the mechanism of the reaction was also discussed in this paper.

Keywords: Heavy metal wastewater; Ferrite; Methylene blue; Hydroxyl radicals; Degradation

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