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Solvothermally synthesized spherical copper hydroxyfluoride (CuOHF) as an efficient heterogeneous Fenton catalyst for degrading organic pollutants

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ABSTRACT

Using $Cu(NO_3)_2{\cdot}3H_2O$ and NH_4NO_3 as raw materials, a series of copper hydroxyfluoride (CuOHF) catalysts were synthesized with various amounts of HF addition by the solvothermal method at 110°C. The products were characterized by X-ray diffraction, Fourier transform infrared, scanning electron microscopy. Their catalytic activity as heterogeneous Fenton catalysts was evaluated by using rhodamine B (RhB) as a simulated pollutant. The results showed that the amount of HF addition significantly affected the catalytic activity of the products. Their activity depended on not only the chemical composition but also the physical structure of the products. The spherical CuOHF synthesized under the condition of F/Cu = 1.7 showed the highest catalytic activity. The hierarchical structure of the spherical CuOHF may enhance the catalytic activity by providing more active sites. Using this CuOHF as the catalyst, the decolorization efficiency of 98% were reached for 50 mg/L RhB in 120 min under the condition of 40°C, pH 4.5, 20 mmol/L H_2O_2, and 0.15 g/L CuOHF. Under the same condition, the removal of TOC reached near 50%. This CuOHF also showed a wide usable pH range (3.5–9.5), high H_2O_2 utilization, and excellent stability. The highly oxidized $HO^{\bullet}$ generated by the spherical CuOHF activating H_2O_2 contributed to the degradation of the pollutant.

Keywords: Copper hydroxyfluoride; Solvothermal synthesis; Heterogeneous Fenton; Advanced oxidation

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