One-pot solvothermal preparation of ethylenediamine-functionalized nanochain and its adsorption-in situ degradation of 2,4,6-trichlorophenol


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A B S T R A C T

An ethylenediamine (EDA)-functionalized Fe₃O₄ magnetic nanochain (EDA@nFe₃O₄) was synthesized by one-pot solvothermal method. The EDA@nFe₃O₄ was characterized by elementary analysis, powder X-ray diffraction, Fourier transform infrared spectroscopy, transmission electron microscopy, and vibrating sample magnetometer. Its application for adsorption and degradation of 2,4,6-trichlorophenol (2,4,6-TCP) was investigated. The results show that the EDA@nFe₃O₄ has an average size of ~150 nm, and self-assembled to be a nanochain, with the saturation magnetization intensity of 46.8 emu/g. The adsorption capacity of EDA@nFe₃O₄ is found to be 902.5 mg/g when the initial concentration of 2,4,6-TCP at 1,000 mg/L. The adsorption processes fit the Freundlich isotherms well. The adsorption processes reach the equilibrium within 5 min and the kinetic data are well fitted to the pseudo-second-order model. The post-adsorbed material was added to Fe³⁺–H₂O₂ system. In situ degradation of 2,4,6-TCP via Fenton-like reaction under visible light can be realized. The results indicate that at pH 3.0–8.0, the degradation of 2,4,6-TCP with loading concentration at 6.20–122.2 mg/g can be reached to almost 100% within 5 min. EDA@nFe₃O₄ can be reused after regeneration. It is a potential effective and reusable material for adsorption and degradation of 2,4,6-TCP.

Keywords: Ethylenediamine (EDA)-functionalized nanochain (EDA@nFe₃O₄); 2,4,6-TCP; Adsorption; In situ degradation