Removal of phenol from aqueous solution using persulfate activated with nanoscale zero-valent iron

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ABSTRACT

In this study, the removal of phenol by persulfate (PS) activated with nanoscale zero-valent iron (nZVI) was investigated. The influence of operation parameters such as pH, nZVI dosage, PS concentration and the initial phenol concentration on the phenol removal was evaluated through a series of batch experiments. The generated nZVI particles were characterized by Fourier transform infrared spectro-photometer, X-ray diffraction, scanning electron microscopy and Brunauer–Emmett–Teller analyses. The combination of nZVI and PS was more effective for the removal of phenol in comparison to nZVI alone and PS alone. Phenol removal enhanced with increase of nZVI dosage from 0.1 to 0.4 g/L and PS concentration from 5 to 12.5 mM. Phenol and chemical oxygen demand (COD) removal decreased with increase of the initial phenol concentration. Phenol and COD removal of 92.4% and 61.3% were obtained under the following conditions: natural pH of solution, nZVI dosage of 0.4 g/L, PS concentration of 10 mM and phenol concentration of 50 mg/L. The first-order kinetics was applied to the data. It was found that phenol removal by combination of nZVI and PS fitted first-order kinetics. Radical quenching studies revealed that the dominant radical species was sulfate radicals (SO₄•⁻). The findings showed that the combination of nZVI and PS could be effective for phenol removal.

Keywords: Nanoscale zero-valent iron; Persulfate; Phenol removal; Sulfate radical