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Removal of lead ions from aqueous solutions using novel-modified magnetic nanoparticles: optimization, isotherm, and kinetics studies

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ABSTRACT

Lead pollution can cause a variety of environmental and health concerns. In this research, a novel sulfur-modified magnetic nanoparticle was synthesized and applied as an adsorbent for the removal of lead (Pb^{2+}) ions from aqueous solutions. The adsorbent was characterized by scanning electron microscopy, Fourier transform infrared spectroscopy, and thermogravimetric analysis. Effect of pH, adsorbent dosage, contact time, and initial concentration of Pb^{2+} on the removal efficiency were investigated and optimized. The equilibrium data were well fitted to the Langmuir isotherm model and the maximum monolayer capacity (q_m) was obtained 14.03 mg g^{-1}. Also, adsorption kinetic data were well explained by pseudo-second-order kinetic model. The desorption efficiency was approximately 98% which this desorption ability of the adsorbent can diminish operation costs and may indicate industrial applicability. Under optimum conditions, the applicability of the adsorbent in real wastewater sample was investigated by removal of lead from effluent wastewater from a battery factory wastewater treatment plant in which the removal efficiency was 76.72%.

Keywords: Lead; Health concerns; Magnetic nanoparticles; Adsorption; Removal

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