Adsorption of Fe(II) ions from aqueous phase by chitosan adsorbent: equilibrium, kinetic, and thermodynamic studies

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Received 6 November 2011; Accepted 11 July 2012

ABSTRACT

The aim of present study was to investigate the adsorption properties of chitosan for the removal of Fe(II) ions from aqueous phase in a batch equilibrium system. The effects of adsorbent dose, initial pH, concentration, and temperature of the solution on adsorption were investigated. Adsorption experiments were carried out at initial concentration range of 10–50 mg l⁻¹ in a temperatures range of 20–40°C. The adsorption isotherm data were well fitted with Langmuir–Freundlich model. The kinetics of Fe(II) on chitosan followed the nonlinear form of pseudo-first-order model and the model parameters were confidently recovered. The examination of kinetic data also revealed that the adsorption rate was dominated by intraparticle diffusion mechanism. The calculated negative values of standard Gibbs free energy and enthalpy changes confirmed the spontaneous and exothermic nature of Fe(II) adsorption on chitosan adsorbent. Finally, chitosan showed to be a good potential adsorbent for removing Fe(II) ion from aqueous solution with maximum loading capacity of 28.7 mg g⁻¹ with removal efficiency of 92.9%.

Keywords: Adsorption kinetics; Adsorption thermodynamics; Chitosan; Iron removal; Isotherm models

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