Desalination and Water Treatment
www.deswater.com

doi: 10.1080/19443994.2013.822633

52 (2014) 6453–6463
October

Taylor & Francis
Taylor & Francis Group

Ferric hydroxide: preparation, characterisation and fluoride removal studies from water

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Received 6 August 2012; Accepted 17 June 2013

ABSTRACT

The objective of this study is to investigate the fluoride removal efficiency of pure ferric hydroxide from aqueous solutions. The sample was synthesised through wet chemical route at optimised experimental conditions and was characterised by chemical, morphological and textural properties using transmission electron microscope, thermo gravimetry, X-ray diffraction, Brunauet–Emmett–Teller surface area and Fourier transform infrared spectroscopy techniques. Studied operational variables for batch adsorption were pH, contact time, initial F^- concentration, solution temperature and presence of foreign ions (chloride, sulphate, phosphate, arsenate, nitrate and carbonate in the concentration range of 0–25 mg/L). The kinetic data revealed that the adsorption of fluoride onto ferric hydroxide is a complex process involving surface adsorption along with ion exchange and interparticle diffusion as the rate-determining step. The equilibrium data fitted to both Langmuir and Freundlich isotherm models. The post-surface characterisation studies of fluoride adsorbed ferric hydroxide showed significant changes, and suggest the formation of new complexes on adsorbent surface. The regeneration (75–80%) and fluoride-contaminated groundwater treatment studies at natural pH are discussed in detail.

Keywords: Adsorption; Fluoride; Groundwater; Ferric hydroxide; Mechanism

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