Desalination and Water Treatment
www.deswater.com

doi: 10.1080/19443994.2014.910839

54 (2015) 3432–3443
June

Taylor & Francis
Taylor & Francis Group

Defluorination from aqueous solution by Ti(IV)-modified granular activated carbon

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Received 2 October 2013; Accepted 28 March 2014

ABSTRACT

Fluoride contamination of drinking water and groundwater is a worldwide concerned issue, and technologies are needed for the treatment of aqueous fluoride. In this study, Ti(IV) species-modified granular activated carbon (Ti(IV)-GAC) was prepared and tested for fluoride removal from aqueous solution. Batch experiments were performed to investigate the equilibrium, kinetics, and mechanism of fluoride adsorption onto the prepared Ti(IV)-GAC. The results showed that the spontaneous fluoride adsorption process followed the Langmuir isotherm model and the pseudo-second-order kinetic model. Fluoride adsorption onto the Ti(IV)-GAC was enhanced as the initial fluoride concentration and contact time increased. Alkaline pH and elevated solution temperature did not favor the adsorption of fluoride. Anion exchange between the fluoride ions and the hydroxyl groups of the adsorbents was the major adsorption mechanism. Both batch experiments and flowing column experiments demonstrated that the Ti(IV)-GAC adsorbent can effectively remove the aqueous fluoride with high efficiency, and bring down the fluoride concentration lower than the permissible limit of fluoride in drinking water in China (1.0 mg/L). Experiments also showed that the Ti(IV)-GAC material had favorable regenerability, and can be used as a versatile adsorbent for treating mixed contamination of fluorides and organic pollutants.

Keywords: Defluorination; Granular activated carbon; Adsorption; Ti(IV)

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