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Removal of fluoride ions by calcium hydroxide-modified iron oxides

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ABSTRACT

Untreated and modified iron oxides from steel pipes of a drinking water distribution system have been used to remove fluoride ions from water. In this work the behavior of fluoride ions in the presence of calcium hydroxide-modified iron oxides was evaluated to determine how the fluoride ions could be removed by this material. The adsorption of fluoride ions was studied in a batch system using hydroxide-modified iron oxides (CP-Ca), and the adsorption capacity was determined. The effects of pH, contact time, and the dose of sorbent on the adsorption of fluoride ions were considered. The point of zero charge (PZC) was 12.25; there were more basic sites than acid sites in the calcium-hydroxide-modified iron oxides. The adsorbent showed a maximum adsorption yield value of 76% from a 5 mg/L fluoride solution at pH 10 and a maximum adsorption capacity of 0.55 mg/g. The adsorption equilibrium was reached in 48 h, and the kinetic and isotherm data were adjusted to the pseudo-second order and Freundlich models, which indicated a chemisorption mechanism on a heterogeneous material.

Keywords: Fluoride removal; Iron oxides-calcium hydroxide; Surface precipitation; Adsorption; Desalination; Drinking water; Groundwater

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