Fluoride removal from aqueous solution by Purolite A520E resin: kinetic and thermodynamics study

Anis Ben Nasra,b, Catherine Charcossetb, Raja Ben Amar,a, Khaled Walhaa,*

aFaculté des Sciences de Sfax, Laboratoire des Sciences des Matériaux et Environnement, Université de Sfax, Route de la Soukra Km4, BP 1171, 3000 Sfax, Tunisia, Tel. +216 21803007; email: walha.khaled@yahoo.com
bLaboratoire d’Automatique et de Génie des Procédés, Université de Lyon, UMR 5007, CNRS, CPE, 43 bd du 11 novembre, 69100 Villeurbanne, France

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ABSTRACT

Fluoride in drinking water above permissible level causes dental and skeletal fluorosis. Fluoride removal operations have been conducted first on a “model” water solution (i.e. distilled) in which the fluoride concentration has been varied, and second on underground water (Louza 2) using the Purolite A520E resin. Batch sorption studies were carried out to determine the effect of initial fluoride concentration, agitation time, adsorbent dose, co-ions, and temperature on the removal of fluoride by the resin. The amount of fluoride ions removed per unit mass of Purolite A520E resin, at 30˚C from 5 mg L\(^{-1}\) fluoride ion solution, was estimated to be 2 mg g\(^{-1}\). The experimental data fitted well to the Langmuir and Freundlich isotherms. Thermodynamic parameters such as \(\Delta H^\circ\), \(\Delta S^\circ\), and \(\Delta G^\circ\) were calculated, indicating that the adsorption process was spontaneous and endothermic. The fluoride content was reduced to 1.20 from 3.39 mg L\(^{-1}\) by treating Louza 2 water with the Purolite A520E resin (2 g L\(^{-1}\), shaking time 30 min). The fluoride saturated resin was regenerated with sodium chloride solution. All the regeneration experiments were carried out at room temperature. Desorption efficiency of the resin was studied using 6% NaCl solution as eluent. It was observed that more than 98% desorption could be successfully made. The cost of the produced cubic meter of water is estimated to 0.25 €/m\(^3\).

Keywords: Drinking water; Defluoridation; Exchange resin; Purolite A520E

Corresponding author.

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