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Article *in* Desalination and water treatment · January 2019

DOI: 10.5004/dwt.2019.24775

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171 (2019) 270–280
December

Optimization of adsorption and sonocatalytic degradation of fluoride by zeolitic imidazole framework-8 (ZIF-8) using RSM-CCD

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Received 3 April 2019; Accepted 5 August 2019

ABSTRACT

Fluorine is found in high concentrations in the earth's crust and in the groundwater. In this research, fluoride adsorption at the concentrations of 1–10 mg/L in the aqueous solutions was optimized by response surface methodology using sonocatalyst process in a frequency of 30 kHz by zeolitic imidazole framework-8 (ZIF-8) in dosage between 0.01 and 0.09 g/L, and pH from 3 to 11. According to the results, optimum conditions with removal efficiency of 92.17% was found at the fluoride concentration of 1.2 mg/L, ZIF-8 dosage of 0.08 g/L, and pH 6.52. Experimental data were well fitted on the Freundlich model (R^2 = 0.99); therefore, the adsorption was multilayer with a favorable affinity between fluoride and ZIF-8. The maximum adsorption capacity of ZIF-8 was obtained to be 33.11 mg/g. Also, the pseudo-second order model had the best agreement with data (R^2 = 0.99). Finally, this study demonstrated that the sonocatalyst process in combination with ZIF-8 is a promising and efficient method for adsorption of fluoride from aqueous solutions.

Keywords: Fluoride; Aqueous solutions; Zeolitic imidazole framework-8 (ZIF-8); Central composite design (CCD); Groundwater

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