

Effect of temperature on the adsorption of fluorides, nitrates and sulfates onto modified AFN membrane

Fatma Guesmi*, Chiraz Hannachi, Islem Louati, Béchir Hamrouni

University of Tunis El Manar, Faculty of Sciences of Tunis, UR11ES17 Desalination and Water Treatment, 2092 Tunis, Tunisia, Tel. +216(71)871282, Fax +216(71)871282, email: guesmi_fatma@yahoo.fr

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ABSTRACT

Removal of fluoride, nitrate and sulfate ions from aqueous solutions is the principal objective of many studies concerning water treatment. In this work the modified AFN anion exchange membrane was evaluated for the removal of F^- , NO_3^- , and SO_4^{2-} anions from aqueous solution. The AFN membrane was modified by adsorption of polyethyleneimine (PEI) on its surface. Surface morphology of the modified AFN membrane was compared to the unmodified one using scanning electron microscopy (SEM). The sorption isotherms for fluoride, nitrate and sulfate ions on the modified AFN membrane were investigated in the range (0.05–1 mol L⁻¹) at 283, 288, 298, 303 and 313 K. Experimental data were analyzed using the Langmuir and Dubinin–Astakhov adsorption models. The adsorption parameters of the studied models were determined by non-linear regression. The equilibrium data obtained in this study were found to follow Dubinin–Astakhov adsorption isotherm. The effect of temperature on the adsorption of fluorides, nitrates and sulfates has been attempted. It was found that the adsorption of fluoride and sulfate ions increases with rise in temperature. Thermodynamic parameters of the adsorption process have been determined. Obtained results show that adsorption of fluoride and sulfate ions onto the modified AFN membrane is an endothermic sorption process while it is an exothermic process for the nitrate adsorption. The values suggest the affinity order for the modified AFN membrane. At 283K and 288K the affinity order is: $NO_3^- > F^- > SO_4^{2-}$ and $F^- > NO_3^- > SO_4^{2-}$ at 298 K, 303 K and 313 K.

Keywords: Modified AFN membrane; Adsorption isotherm models; Nonlinear regression; Polyethyleneimine (PEI); Thermodynamic parameters

*Corresponding author.

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