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N. Drouiche [a b] , S. Aoudj [a] , H. Lounici [b] , H. Mahmoudi [c] , N. Ghaffour [d] & M.F.A. Goosen [e]

[a] Silicon Technology Development Unit (UDTS) 2 , Bd Frantz Fanon BP140, Alger – 7, Merveilles , 16200 , Algeria Phone: +213 (21) 279880 ext 172 Fax: +213 (21) 279880 ext 172

[b] Laboratory of Environmental Biotechnologies , Ecole Polytechnique d'Alger , 10, Avenue Pasteur, El-Harrach , Algeria

[c] Laboratory of Water and Environment , Hassiba Ben Bouali University , Chlef , Algeria

[d] Water Desalination & Reuse Centre , King Abdullah University of Science and Technology (KAUST) , Saudi Arabia

[e] Alfaisal University, Office of Research , Riyadh , Saudi Arabia

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Development of an empirical model for fluoride removal from photovoltaic wastewater by electrocoagulation process

N. Drouiche[a,b]*, S. Aoudj[a], H. Lounici[b], H. Mahmoudi[c], N. Ghaffour[d], M.F.A. Goosen[e]

[a]*Silicon Technology Development Unit (UDTS) 2, Bd Frantz Fanon BP140, Alger – 7 Merveilles, 16200, Algeria*
Tel. +213 (21) 279880 ext 172; Fax +213 (21) 433511; email: nadjibdrouiche@yahoo.fr
[b]*Laboratory of Environmental Biotechnologies, Ecole Polytechnique d'Alger, 10, Avenue Pasteur, El-Harrach, Algeria*
[c]*Laboratory of Water and Environment, Hassiba Ben Bouali University, Chlef, Algeria*
[d]*Water Desalination & Reuse Centre, King Abdullah University of Science and Technology (KAUST), Saudi Arabia*
[e]*Alfaisal University, Office of Research, Riyadh, Saudi Arabia*

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ABSTRACT

Electrocoagulation experiments were conducted with bipolar aluminium electrodes to determine the optimum conditions for the fluoride removal from synthetic photovoltaic wastewater. A high fluoride concentration in community water supplies can cause fluorosis which has a detrimental effect on human health in particular on teeth and bones. A full 2^3 factorial design of experiments was used to obtain the best conditions of fluoride removal from water solutions. The three factors considered were initial fluoride concentration, applied potential, and supporting electrolyte dosage. Two levels for each factor were used; supporting electrolyte (0 and 100), applied potential (10 and 30 V), and initial fluoride concentration (20 and 25 mg/L). Results showed that the optimum conditions for fluoride removal from photovoltaic wastewater containing an initial fluoride concentration of 20 mg/L were a supporting electrolyte dose of 100 mg/L and an applied potential of 30 V. These gave a residual fluoride concentration of 8.6 mg/L which was below the standard discharge limit. A mathematical equation showing the relation between residual fluoride concentration and the effective variables was also developed.

Keywords: Photovoltaic wastewater; Electrocoagulation; Fluoride; Experimental design; Empirical model