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Optimization of arsenic removal from drinking water by electrocoagulation batch process using response surface methodology

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ABSTRACT

In this investigation, arsenic removal from drinking water using electrocoagulation (EC) in a batch mode was studied by response surface methodology (RSM). The RSM was applied to optimize the operating variables viz. current density (CD, A/m^2), operating time (t_{EC}, min) and arsenic concentration (C_o, μg/L) on arsenic removal in the EC process using iron electrodes. The combined effects of these variables were analyzed by the RSM using quadratic model for predicting the highest removal efficiency of arsenic from drinking water. The proposed model fitted very well with the experimental data. R^2 adjusted correlation coefficients (AdjR^2: 0.93) for arsenic removal efficiency showed a high significance of the model. The model predicted for a maximum removal of arsenic at the optimum operating conditions (112.3 μg/L, 5.64 A/m^2 and 5 min) after the EC process was 93.86% which corresponded to effluent arsenic concentration of 6.9 μg/L. The minimum operating cost (OC) of the EC process was 0.0664 €/m^3. This study clearly showed that the RSM was one of the suitable methods for the EC process to optimize the best operating conditions for target value of effluent arsenic concentration (<10 μg/L) while keeping the OC (energy and electrode consumptions) to minimal.

Keywords: Electrocoagulation; Arsenic removal; Drinking water; Response surface methodology; Optimization; Operating cost

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