*Desalination and Water Treatment*
www.deswater.com

doi: 10.5004/dwt.2020.24957

178 (2020) 240–253
February

# Combined influence of some cations on arsenic removal by an air-injection EC reactor using aluminum ball electrodes

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Received 21 February 2019; Accepted 22 September 2019

**ABSTRACT**

Combined effects of some cations such as calcium ($Ca^{2+}$), iron ($Fe^{2+}$), manganese ($Mn^{2+}$), and magnesium ($Mg^{2+}$) and operating time on the removal of arsenic by air-injected electrocoagulation (EC) reactor with aluminum (Al) ball electrodes were investigated. The operating conditions were optimized with the Box–Behnken design of response surface methodology (RSM). The response variables were selected from the program as removal efficiency, residual arsenic concentration, energy consumption and operating cost (OC) in the EC process. A total of 46 experimental run was performed. The removal efficiency of arsenic increased with an increase in iron concentration (0.5–4.5 mg/L). The rest of the cations showed no noticeable effect on arsenic removal efficiency. The maximum arsenic removal efficiency and minimum OC at the optimum operating conditions ($C_{Ca}$: 305 mg/L, $C_{Mg}$: 42 mg/L, $C_{Fe}$: 3.3 mg/L, $C_{Mn}$: 2.34 mg/L, initial pH of 7.5 applied current of 0.15 A, Al ball size of 7.5 mm, 5.0 cm of Al ball anodes height in the EC reactor, air-fed rate of 6.0 L/min and $t_{EC}$: 16.83 min) in the EC process were 99.9% and 0.0332 \$/$m^3$ for initial arsenic concentration of 200 μg/L, respectively. The removal mechanism of As(III) by EC seems to be oxidation of As(III) to As(V) and subsequent removal by adsorption/complexation with aluminum hydroxides generated in the process. The results showed that the air-injected EC reactor can be used effectively for arsenic and hardness removal simultaneously from real groundwater sources.

*Keywords:* Arsenic removal; Cation effect; Electrocoagulation; Al electrode; Optimization

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