



## Arsenic and boron removal from spring and groundwater samples in boron mining regions of Turkey by electrocoagulation and ion-exchange consecutive processes

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Received 6 March 2017; Accepted 12 April 2017

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### ABSTRACT

Boron (B) and arsenic (As) are two important contaminants detected in the spring and groundwater around the Bigadiç borate mines in Turkey which have the largest colemanite and ulexite deposits in the world. In this study, electrocoagulation (EC) process was used for the removal of arsenic from waters since EC was capable of removing arsenic to trace levels. The removal efficiencies of arsenic from spring and groundwater samples containing different arsenic concentrations of 36–1021 µg/L at 0.025–0.10 A and operating time of 0–60 min were achieved >97–99.9% at 2–16 min for Fe plate electrodes to meet the permissible level of arsenic effluent concentration of <10 µg/L. Energy and electrode consumptions for arsenic removal efficiency were 0.00429 kWh/m<sup>3</sup> and 0.00372 kg/m<sup>3</sup> for 0.025 A, 0.00529 kWh/m<sup>3</sup> and 0.00496 kg/m<sup>3</sup> for 0.05 A, and 0.00917 kWh/m<sup>3</sup> and 0.00992 kg/m<sup>3</sup> for 0.10 A. However, the EC was unsuccessful for the removal of B. B removal efficiencies at 0.025, 0.05, and 0.10 A were determined as 3.4, 3.9, and 4.6%, respectively. Effluent pH values were noticed to increase from 8 to 10 during the EC process and this was an advantage to remove B from the sample using ion-exchange process at pH 8–11. For that reason, Amberlite IRA-743 ion-exchange resin was selected to treat B in the effluents and effect of resin dosage (0.025–3 g) on the B removal efficiency was performed. A removal efficiency of 99–100% for B in the spring and groundwater samples was obtained. As the resin dosages were increased from 0.025 to 3 g, adsorption capacity was observed to decrease from 60 to 7.4 mg B/g resin. As effluent concentration of 1 mg/L was considered, amount of resin dosage for B removal was 0.75 g to reduce B concentration from 90.11 to 0.56 mg/L. The EC and ion exchange processes together were very successful for the removals of arsenic and boron from natural waters in the boron mining regions.

*Keywords:* Arsenic contamination; Spring and groundwater; Electrocoagulation; Boron removal

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Presented at the 3rd International Conference on Recycling and Reuse, 28–30 September 2016, Istanbul, Turkey