

## Application of Freeze Desalination for Trace elements Removal from Water

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**Abstract :** Trace element ions, such as Cr(VI) and F<sup>-</sup>, are of particular interest due to their environmental impact. Both ions exhibit an anionic nature in water that can show similar removal tendencies except for their significant differences in ionic radius. Accordingly, partial freezing was performed to examine freeze separation efficiencies of Cr(VI) and F<sup>-</sup> from aqueous solutions. Real groundwater and simulated wastewater were included to test efficiency of F<sup>-</sup> and Cr(VI), respectively. Parameters such as initial ion concentration, salt addition, and freeze duration were explored. Under optimal operating conditions, freeze separation efficiencies of  $90 \pm 0.12$  to  $97 \pm 0.54\%$  and  $58 \pm 0.23\%$  to  $60 \pm 0.34\%$  from 5 mg/L of Cr(VI) and F<sup>-</sup>, respectively, were demonstrated. The F<sup>-</sup> ion intercalation into the ice, initiating the decrement of freeze separation efficiency was observed in the salt addition processes. The influences of structuring-destructuring (kosmotropicity-chaotropicity) and the size-exclusion nature of ice crystals were used to explain the plausible mechanism in freeze separation efficiency trace elemental ions.

**Keywords :** Cr(VI), F<sup>-</sup>, partial freezing, size exclusion

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