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Advanced treatment options to remove boron from seawater

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ABSTRACT

Boron (B) is a unique nutrient essential for plant metabolic activities at low doses, while displaying toxic properties at high doses. The World Health Organization's recent guidelines recommend increasing the drinking water boron concentration limit to a maximum of 2.4 mg/L. The previous limit of 0.5 mg/L for drinking water sources (including seawater) was set by the agricultural sector seeking the unlimited irrigation of boron-sensitive crops. This review suggests a diverse view on the supply of desalinated tap water for irrigation purposes. Currently, there are no reports of B damage to humans at concentrations below 1.5 mg/L, routinely achieved on the first pass of a reverse osmosis (RO) membrane process. The proposed upper boron limit is evaluated based on technological advances and human health precautions, and can be especially useful for countries where desalinated water is directly used in irrigation. Further B reduction from 1.5 to 0.5 mg/L in irrigation water can be achieved not only by multistage RO, but also by electrocoagulation, electrodialysis, and adsorption-membrane filtration hybrid systems.

Keywords: Boric acid; Seawater desalination; High-pressure membrane; Distillation

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