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Ozone oxidation of desalinated seawater, with respect to optimized control of boron and bromate

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ABSTRACT

One of the two main objectives of this study is to use two pass membrane desalination system and to oxidize permeate of the first pass with ozone, as disinfection by products (DBPs) formed by ozone are rather limited. Second objective of this work; is to increase the pH levels to 10 in the permeate of the first desalination pass in order to promote dissociation of boric acid ($B(OH)_3$) to borate ($B(OH)_4^-$). Negatively charged borate can easily be removed by membrane systems because of the charge repulsion. Oxidation efficiency of ozone under pH 10 conditions and the buffer effect of borate were also focused on in this study. Double pass nanofiltration/reverse osmosis (NF/RO) membrane filtration systems were used for the desalination of model seawater. Permeate of the first membrane filtration was adjusted to pH 10 and oxidized with ozone for 30 mins. Oxidized permeate was then fed to the second membrane filtration in order to investigate boron removal and bromate formation and removal. Boron removal was improved effectively by all tested membranes at pH 10. Boron removal rates for NE70, NE90 and FL membranes increased from 4% to 7%, 11% to 28% and 37% to 84% respectively. Bromate was formed effectively with ozone oxidation at pH 10 and removed (>90%) by the RO membrane (FL) and (>75%) by one of the NF membranes (NE90) in the second pass.

Keywords: Desalination; Membrane filtration; Ozone oxidation; Boron removal; Bromate formation; Bromate removal

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