Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2017.20679

80 (2017) 11–17
June

Effect of chlorine dioxide (ClO_2) on polyamide-based RO membrane for seawater desalination process: exposure to high concentration of ClO_2

Jeong Ho Koh, Am Jang*

Graduate School of Water Resources, Sungkyunkwan University (SKKU), 2066, Seobu-ro, Jangan-gu, Suwon-si, Gyeonggi-do 16419, Korea, Tel. +82-31-290-7526; Fax: +82-31-290-7549; email: amjang@skku.edu

Received 6 October 2016; Accepted 16 December 2016

ABSTRACT

The most popular disinfecting agents used for biofouling control in the reverse osmosis (RO) system include oxidizing biocides such as chlorine, chloramines and chlorine dioxide. Among them, chlorine (Cl_2) is a traditional water disinfecting agent of choice, and it has been used effectively in cellulose acetate membrane systems. However, it has been informed that chlorine causes an irreversible deterioration on polyamide RO membranes in a very short time. As an alternative sanitizing agent, chlorine dioxide (ClO_2) is gaining interests in many disinfect processes including membrane systems, due to its different chemistry and reactivity to chlorine. In this study, therefore, the applicability assessment of chlorine dioxide in seawater reverse osmosis process was performed. Permeate flux, salt rejection and membrane structural analyses were conducted as membrane performance indicators after exposure to chlorine and chlorine dioxide. The results showed that chlorine dioxide-exposed membrane showed very excellent performance in terms of permeate flux and salt rejection, whereas chlorine-exposed membrane showed unstable permeate flux fluctuation and lower salt rejection with increasing time of exposure to chlorine in the soaking bath. From the attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR) results of chlorine-exposed membrane showing severe peak intensity decreases under chlorine existence and energy-dispersive X-ray spectrometer (EDS) results of increased chlorine atom ratio, it is suggested that flux fluctuation is a result of molecular structure deformation; chlorination. However, chlorine dioxide-exposed membrane is shown not to chlorinate but to modify polyamide structure, as shown by the results of ATR-FTIR and scanning electron microscopy/EDS analyses and permeate inclination aspect.

Keywords: Chlorine; Chlorine dioxide; Chlorination; Polyamide RO membrane

* Corresponding author.