Factors affecting the removal of isopropyl alcohol by reverse osmosis membranes for ultrapure water production

Hongju Lee, Suhan Kim*

Department of Civil Engineering, Pukyong National University, 365 Sinseonro, Nam-gu, Busan 608-739, Republic of Korea,
Tel. +82 51 629 6065; Fax: +82 51 629 6063; email: adonis592@daum.net

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ABSTRACT

Ultrapure water (UPW) is used in the electronic industry for the production of semiconductors, memories, and LCD displays. The two important pollutants for UPW production processes are ions and low-molecular weight (LMW) organic matters. To obtain UPW quality, several unit processes such as ion exchange, ultraviolet (UV) oxidation, and membrane filtration can be used together. Reverse osmosis (RO) which can remove LMW organic matters is one of the key treatment processes for UPW production. In this case, RO feed water contains very little materials such as ions, organic matters, and other pollutants. Thus, we investigated the factors affecting low-concentration LMW organic matter removal by RO membranes in deionized water to simulate the operation condition of RO process for UPW production system. Bench-scale experiments were carried out using four-inch RO elements from four different manufacturers. Isopropyl alcohol (IPA, molecular weight = 60.1) with concentrations less than 1 mg/l was used as a model LMW organic matter. The experimental results reveal that the possible mechanism for the IPA removal is steric hindrance of solutes by the pore structure of membrane. According to the mechanism, the IPA removal efficiency becomes higher at higher permeate flux and lower feed temperature, and RO membrane with higher salt rejection, and lower pure water permeability ensures the higher performance on the removal of IPA.

Keywords: Ultrapure water production; Reverse osmosis; Low-molecular weight organic matter; Isopropyl alcohol; Steric hindrance

*Corresponding author.

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