

Plugging Nanoscale Imperfections in the Polyamide Active Layer of Thin-Film Composite Reverse Osmosis Membrane to Inhibit Advective Solute Transport

Tasuma Suzuki

Department of Sustainable Environmental Engineering, Graduate School of Sciences and Technology for Innovation, Yamaguchi University

Summary

The objective of this study is to inhibit advective solute passage through reverse osmosis (RO) membranes by filtering a small volume of polyvinyl alcohol (PVA) aqueous solution to selectively plug nanoscale imperfections. The PVA plugging the nanoscale imperfections was stabilised by cross-linking with glutaraldehyde. Experimental data showed that PVA treatment with PVA concentrations of up to 20 ppm did not decrease the water permeability, but it improved the solute removal efficiencies significantly. Specifically, at an applied pressure of 2.0 MPa, the NaCl and Rhodamine-WT rejection improved from 97.4% to 98.8% (a 67% decrease in NaCl flux) and 99.74% to 99.96% (a 85% decrease in Rhodamine-WT flux), respectively. Experimental data also showed that the cross-linked PVA plugging the nanoscale imperfections was stable under repeated exposure to citric acid, sodium hydroxide, and ethylenediaminetetraacetic acid.