Aquaporin based biomimetic membrane in forward osmosis: Chemical cleaning resistance and practical operation

Aquaporin plays a promising role in fabricating high performance biomimetic forward osmosis (FO) membranes. However, aquaporin as a protein also has a risk of denaturation caused by various chemicals, resulting in a possible decay of membrane performance. The present study tested a novel aquaporin based biomimetic membrane in simulated membrane cleaning processes. The effects of cleaning agents on water flux and salt rejection were evaluated. The membrane showed a good resistance to the chemical agents. The water flux after chemical cleaning showed significant increases, particularly after cleaning with NaOCl and Alconox. Changes in the membrane structure and increased hydrophilicity in the surrounding areas of the aquaporin may be accountable for the increase in water permeability. The membrane shows stable salt rejection up to 99% after all cleaning agents were tested. A 15-day experiment with secondary wastewater effluent as the feed solution and seawater as the draw solution showed a stable flux and high salt rejection. The average rejection of the dissolved organic carbon from wastewater after the 15-day test was 90%. The results demonstrated that the aquaporin based biomimetic FO membrane exhibits chemical resistance for most agents used in membrane cleaning procedures, maintaining a stable flux and high salt rejection.

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