



Hyperbranched polyethyleneimine induced polycationic membranes for improved fouling resistance and high RO performance

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ABSTRACT

The study shows a new method for hyperbranched polyethyleneimine (HPEI) induced polycation membranes with an objective of achieving better fouling resistance and high reverse osmosis (RO) performance. Chemically crosslinked composite membrane (CCCM) was prepared with polyvinyl alcohol (PVA), maleic acid (MA) and Pluronic F127 via chemical crosslinking methodology. Polycation induced membranes were fabricated by surface coating of HPEI onto the CCCM (PVA/MA/PluronicF127) RO membranes. Functional group analysis, morphology and surface roughness of CCCM and HPEI-RO membranes were analyzed by Fourier transform infrared spectroscopy, scanning electron microscopy and atomic force microscopy respectively. The hydrophilicity and water permeability of CCCM and HPEI-RO were examined with water contact angle measurement and RO performance test. Optimum RO performance was obtained for HPEI-RO3 membrane with NaCl and MgSO₄, as for $R_{NaCl} = 96.1\%$, $J_{NaCl} = 58.2 \text{ L m}^{-2} \text{ h}^{-1}$ and $R_{MgSO_4} = 99.6\%$, $J_{MgSO_4} = 15.8 \text{ L m}^{-2} \text{ h}^{-1}$ (testing with 3.28 wt.% aqueous NaCl and MgSO₄ solution at 25 °C and 55 bar). Moreover, cetyl trimethylammonium bromide (CTAB) as standard foulants presented a smaller fouling tendency for the modified HPEI-RO3 membrane. HPEI-RO3 compared to the unmodified membrane, was able to decrease the stickiness of charged bacteria, Gram negative *Escherichia coli* and Gram positive *Staphylococcus epidermidis*. Therefore, the permeation flux, salt rejection and fouling resistant property of membrane (HPEI-RO3) were significantly improved with polycation induction into the membranes.

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