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RESEARCH ARTICLE

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Hydrophilic modification of feed spacer and its impacts on antifouling performance of reverse osmosis membrane

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Abstract

Feed spacers improve mixing and mass transfer in membrane modules. However, they also lead to foulant deposition in the vicinity of the spacer surface. In this paper, two hydrophilic monomers, namely, acrylic acid (AA) and 2-hydroxyethyl methacrylate (HEMA), are respectively coated on the surface of a commercial feed spacer via a plasma-enhanced chemical vapor deposition (PECVD) method. The resulting modified spacers are then evaluated alongside with a reverse osmosis (RO) membrane for its solute rejection, water permeability, and antifouling properties. Results show that the surface hydrophilicity of feed spacers has been enhanced upon the AA and HEMA deposition. During filtration test, the HEMA-modified spacer demonstrates higher flux recovery rate (94.17%) and salt rejection (95.78%) for the RO membrane. In contrast, the membrane with the unmodified spacer only shows 89.44% and 92.46%, respectively. Additionally, the membrane with the HEMA-modified spacer has a thinner fouling layer (200 nm) compared to the unmodified spacer (700 nm). The HEMA-coated spacer outperforms all the tested spacers, demonstrating that feed spacer modification with a hydrophilic monomer via the PECVD method can effectively reduce membrane fouling.

KEYWORDS

antifouling, coating, desalination, feed spacer, reverse osmosis

