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New spacer designs for the performance improvement of the zigzag spacer configuration in spiral-wound membrane modules

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ABSTRACT

The zigzag configuration of spacers appears to have more advantages compared to the so-called submerged configuration for improving the performance of the reverse osmosis process; however, spacers attached to membrane walls may promote fouling. A two-dimensional numerical model coupling fluid dynamics and mass transfer was developed to study the impact of new design spacers, such as ellipse and oval shapes to control concentration polarization and reduce pressure drop. To improve spacer performance, spacers considered here are "tilted" and their performance is compared with the reference spacers (circular). It is shown that elliptical and oval spacers lead to significant reduction of the pressure drop when compared to circular spacers. Based on numerical prediction, mass transfer is enhanced, pressure drop minimized, and the probability of fouling is decreased if oval spacers are tilted at 20° compared to the widely used conventional spacers.

Keywords: Concentration polarization; CFD; New spacer designs; Water treatment; Tilted spacers

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