Electrodialysis with Irregular Membrane Spacers: Which is the Right Choice?

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ABSTRACT

Membrane operations function well in turbulent conditions, requiring the use of a turbulence model. By increasing the velocity and generating eddies with membrane spacers, mass transport can be enhanced and permeability can be intensified while reducing concentration polarization. Spacers act as solid barriers for the bulk fluid and have been shown to facilitate mass transfer at channel thicknesses of 1 mm due to eddy promotion. Spacers are used in a variety of membrane processes including nanofiltration, reverse osmosis, electrodialysis, and membrane distillation. Membrane spacers can also be used for other applications such as membrane electrolysis, fuel cells, capacitive deionization, and electrodialysis with bipolar membranes. This work systematically reviews and compares irregular geometries of spacers, including Gyroid, tCLP, multilayered, crimped, and tortuous spacers. The review consistently concludes that the spacer geometrical properties are the primary determinants of the streamline effectiveness.

KEYWORDS

Channel hydrodynamics, Electrodialysis desalination technology, Ion exchange membranes, Membrane fouling/clogging, Pressure drop

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