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Novel Cylindrical Cross-Flow Hollow Fiber Membrane Module for Direct Contact Membrane Distillation-based Desalination

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Abstract

Direct contact membrane distillation-based desalination is attractive especially for high salt concentrations. We recently developed successfully a hollow-fiber membrane (HFM) based rectangular module with hot brine in cross-flow over the HFMs and obtained high and stable water flux under demanding scaling conditions. This module design with a low surface area/device volume is inadequate for larger-scale plants. A novel cylindrical cross-flow module containing high-flux composite hydrophobic HFMs is described for membrane surface areas, 0.15 and 0.6 m², using porous fluorosiloxane-coated porous polypropylene hollow fibers. This simple and easily-scalable module design packs four times membrane surface area/unit equipment volume compared to earlier design. Distilled water production rates from 1 wt% saline feed was studied over brine temperatures of 60-91°C. A model developed to describe the observed water production rates in dead-end feed introduction configuration appears to describe observed water production rates well. Model predictions were explored for a range of HFM lengths and larger HFM ID to compare with those from rectangular modules with shorter HFMs.

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