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Hydrophobic/hydrophilic PVDF/Ultem[®] dual-layer hollow fiber membranes with enhanced mechanical properties for vacuum membrane distillation

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ABSTRACT

Dual-layer hydrophobic/hydrophilic PVDF/Ultem[®] hollow fiber membranes with superior mechanical and water transport properties have been prepared via co-extrusion method for vacuum membrane distillation (VMD) of seawater. To fabricate such high-performance dual-layer hollow fibers consisting of two different materials, one must overcome the issues of delamination between the two polymer layers and dense interface morphology. The former would result in a defective membrane, while the latter could significantly increase the substructure resistance for vapor transport. By properly manipulating dope formulation and spinning conditions, we have overcome the first challenge and produced delamination free dual-layer fibers. The second problem is resolved by the addition of Al₂O₃ nanoparticles into the inner layer dope, which creates micro-porosity on the outer surface of the inner layer. The resultant dual-layer fibers show good mechanical properties, permeation flux and wetting resistance simultaneously under VMD operations. Comparing to the conventional single layer MD fibers, the newly developed VMD hollow fiber containing 15 wt% Al₂O₃ has 4.5- fold tensile strength

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