Electrospun Polyvinylidene Fluoride Membranes for Direct Contact Membrane Distillation

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***Abstract*—An estimated 1.1 billion people worldwide lack access to water and 2.7 billion people will find water scarce for at least a month of the year. With this, 2.4 billion people are exposed to water-borne diseases due to inadequate sanitation processes. The driving forces behind water scarcity are the growing uses of fresh water and the depletion of natural freshwater sources. About two-thirds of the world's population are expected to experience water shortages by the year 2025. Addressing this problem, several methods of water purification including reverse osmosis, multistage flash distillation, and direct contact membrane distillation have been explored. Of these options, Direct Contact Membrane Distillation (DCMD) has the lowest manufacturing and operating costs and seems the most promising technology. Current DCMD membranes are expensive and inefficient due to the lack of optimization of the membrane's desirable properties. To solve this, the fabrication method of free surface electrospinning was used, it allowed for the control of properties such as fiber diameter, pore size, and membrane thickness. Membranes were electrospun from a 22 wt% polyvinylidene fluoride (PVDF) solution with 78 wt% dimethylacetamide (DMAC), each being specifically chosen for their combined properties. Free surface electrospinning is achieved by using a rotating wire spindle partially submerged in the PVDF/DMAC solution. Over the 6.5 inch working distance, a 40 kV voltage was applied while the humidity and spin times were varied, 60-80% and 30-60 minutes respectively. A grounded rotating drum collected all the gelled fibers which solidified there. The produced membranes were then characterized by their thickness readings and scanning electron micrograph (SEM) images. Finally, a DCMD apparatus was setup to test the productivity of the membranes by distilling salt water through them. These productivity values were compared to those of commercially produced membranes, produced by phase-inversion, through the same DCMD setup.**