Free Surface Electrospun Polyvinylidene Fluoride Membranes for Direct Contact Membrane Distillation

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***Abstract*— The earth consists of 1% total potable water accessible to humans. The use of current technologies such as osmosis processes, filtration, and distillation support the production of purified water, however, direct contact membrane distillation (DCMD) has the potential to be a competitive process to these conventional methods. The current process for manufacturing DCMD membranes is inefficient, expensive, and poorly optimized; resulting in limited industrialization. Here, we consider membranes produced by free surface electrospinning, which produces DCMD membranes with desirable properties such as large pore size (1 -3 µm) and low membrane thicknesses (50- 200 µm). In this study, we produced DCMD membranes from a polymeric solution containing 22 % w/w Polyvinylidene Fluoride (PVdF) in Dimethylacetamide (DMAc). The free surface electrospinning setup consisted of a solution bath with a partially submerged rot! ating wire spindle. A high voltage, in excess of 30 kV, was applied to the wire spindle. The induced electric field causes charge to accumulate on the surface of the entrained solution, leading to the formation of electrohydrodynamic jets. Electrospinning experiments were performed in a controlled environment with relative humidity ranging from 40-80RH%. In the presence of high humidity (> 50%), the water absorbs into the polymeric jet causing the PVDF to phase separate. The gelled fibers were collected on a grounded rotating drum and left at room conditions to solidify over a period of 24 hours. The final morphology of the membrane was examined using scanning electron microscopy and the performance of the produced membranes was evaluated with an inhouse built DCMD apparatus.**