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Electrospun nanostructured membranes for desalination

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Nanofibrous materials exhibit important and interesting characteristics such as a very high surface area to volume ratio, good mechanical properties, tunable inter-fiber space and flexibility in surface functionalities. Various types of nanofiber based materials including beaded, ribbon, porous and core-shell were proposed. These materials are receiving extensive research interests in various fields of applications as optical and chemical sensors, antibacterial materials, reinforced nanocomposites, affinity membranes, etc. One of the commonly used techniques to prepare nanofibrous materials is electrospinning employing very high voltage in the range of kilovolts to synthetic polymer and biopolymer solutions as well as blends. Both the characteristics of the electrospinning solution (i.e. viscosity, electrical conductivity and surface tension) and the processing variables that include the electric potential, the flow rate of the electrospinning solution, the distance between the metallic needle tip and the collector, the ambient parameters (i.e. temperature and humidity in the electro-spinning chamber), the motion of the collector and heat-treatment, all affect the morphological nanostructure characteristics of the electro-spun fibers. During last six years my research group proposed the use of different types of nanofibrous membranes including mixed matrix membranes for desalination by the non-isothermal separation process membrane distillation (MD). Different types of nano-additives were considered. The effects of different system and process parameters on the nanostructure of electro-spun nanofibrous membranes were studied by means of different characterization techniques determining their mechanical and thermal properties as well as their void volume fraction, hydrophobicity, inter-fiber space and its distribution, etc. Some prepared nanofibrous membranes were used for desalination by MD [2-5]. The effects of various parameters on the MD desalination performance were systematically studied. The observed advanced MD performance and thermal efficiency of the nanofibrous membranes confirmed that these membranes are attractive for desalination by MD process.

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