Characterization of polymeric membranes for membrane distillation using atomic force microscopy

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Abstract

As membrane distillation (MD) is an under-developed separation process, specific membranes for MD applications are not yet commercially available. Therefore, microporous polymeric membranes made of hydrophobic materials fabricated for microfiltration purposes are usually used for MD applications. Characterization of such kind of membranes is important in order to achieve a better in-depth understanding of their performance and to fabricate specific membranes for MD process. One of the emerging characterization methods is atomic force microscopy (AFM) analysis. AFM is a newly developed high-resolution method that is useful for studying the surface topography of various types of membranes, and 3D images of the membrane surface can be obtained directly without special sample preparation. Consequently, a truer and clearer surface structure of a polymeric membrane can be observed. In this work, AFM method has been used for characterization of three hydrophobic membranes (polytetrafluoroethylene, polypropylene, and polyvinylidene fluoride) which are typically used for various MD applications. The membranes were characterized for their pore size, pore size distribution, surface roughness, and hydrophobicity. A sweeping gas membrane distillation apparatus was used for solute rejection evaluation of the applied membranes.

Keywords: Membrane distillation (MD); Hydrophobic membranes; Atomic force microscopy (AFM); Characterization

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