Desalination and Water Treatment
www.deswater.com

doi: 10.1080/19443994.2015.1026279

57 (2016) 8720–8729
April

Taylor & Francis
Taylor & Francis Group

Effect of alternation of polyamide selective layers in the formation and performance of thin-film composite membranes

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Received 24 June 2014; Accepted 28 February 2015

ABSTRACT

Polyamide thin-film composite membranes were prepared on a reinforced microporous polyethersulfone (PES) support by *in situ* interfacial polycondensation of amic acid diamines (AADs) with 1,3,5-benzenetricarbonyl trichloride and subsequent curing. Water soluble AADs were synthesized by reacting trimellitic anhydride chloride and cyclic/aromatic diamines in dimethylformamide at 5–10˚C. Polyamide ultra-thin barrier layer containing different structural modifications were isolated by dissolving the matrix PES support in dichloromethane and characterized for IR, NMR, and DSC techniques. Morphology of membranes by scanning electron microscopy showed the appearance of honeycomb-like structure on the polyamide skin surface and the cross section displayed the presence of nodular structure which arises from the dense polyamide skin. The performances of these membranes were measured by passing the feed solutions containing 2,000 ppm of NaCl and Na_2SO_4 in a reverse osmosis test kit. Membranes exhibited very broad range of separations for NaCl (35–85%) and Na_2SO_4 (40–89%) depending on the chemical nature of the AADs. The glass transition temperature (T_g) of composite membranes with aromatic diamine structures were >220˚C, indicating the higher stiffness nature of the polymer chain due to the presence of fully aromatic structural units.

Keywords: Thin-film composite membrane; Polyamide skin layer; Thermal analysis; Glass transition temperature

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