Desalination and Water Treatment
www.deswater.com

17 (2010) 183–192
May

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doi: 10.5004/dwt.2010.1716

Preparation and characterization of microporous PVDF membrane by thermally induced phase separation from a ternary polymer/solvent/non-solvent system

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Received 31 July 2009; Accepted 22 November 2009

ABSTRACT

Porous poly(vinylidene fluoride) (PVDF) microporous membranes were successfully prepared from a ternary system including PVDF, solvent and non-solvent via thermally induced phase separation (TIPS) process. Tributyl citrate (TBC) as solvent and di-(2-ethylhexyl) phthalate (DEHP) as non-solvent were used in this study. The effect of mixed diluent composition on PVDF/TBC/DEHP system phase diagram was studied. Phase separation mechanism changed from solid–liquid phase separation to liquid–liquid phase separation with the increase content of non-solvent DEHP. Effects of mixed diluent composition, polymer concentration, cooling condition on morphology, water permeability, porosity and pore size were studied. The membranes which formation controlled by L–L phase separation mechanism have narrow pore size. For the system of 30 wt/70 wt TBC/DEHP with L–L phase separation, bi-continuous morphology was observed. For the system of 90 wt/10 wt TBC/DEHP with S–L phase separation, spherulites structure was obtained. With the polymer concentration increased, the values of porosity, pure water permeability flux and mean pore radius all decreased. For the same polymer content, the membranes prepared from 30 wt/70 wt TBC/DEHP system have better performance. Membranes possessed nice performance prepared in the 20°C water bath.

Keywords: Poly(vinylidene fluoride); Thermally induced phase separation; membranes; Morphology; L–L phase separation

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