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Promoting Permeability-Selectivity Anti-Trade-Off Behavior in Polyvinyl alcohol (PVA) Nanocomposite Membranes

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ABSTRACT

Unique anti-trade-off behavior, i.e., the concomitant increasing of water permeability and water selectivity, was observed in the nanocomposite membranes developed from polyvinyl alcohol incorporated with poly(2-hydroxyethyl methacrylate)-grafted silica nanospheres (PVA/PHEMA-grafted SNSs). Under a certain temperature range (10-30 °C) for the pervaporation dehydration of acetone-water solution, increasing of the grafted-PHEMA amount promoted extensively the anti-trade-off behavior as raising temperature. This is because the grafted-PHEMA on SNSs significantly enhanced the water permeability while efficiently limited the permeability of acetone. The characterization of the membrane free volume obtained from PALS suggests clearly that the promoted anti-trade-off behavior in PVA/PHEMA-grafted SNSs nanocomposite membranes were achieved due to a combined effect from the water-selective free volumes and their increasing number. In other word, the former contributes particularly to the improvement of water selectivity while the latter attributes to the enhancement of the water permeability.

Keywords: Anti-trade-off; Nanospheres; Poly(vinyl alcohol); Poly(2-hydroxyethyl methacrylate), Pervaporation.

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