Title:

Hybrid membranes incorporated with star macromolecules with high pervaporation performance for ethylene glycol dehydration

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Abstract

Ethylene glycol is a key chemical product widely used in the production of polyester fiber, polyester film and antifreeze. The purity of EG should be very high (95.0 wt% and above). Thus, pervaporation has been recognized as an effective alternative process, especially at relatively low concentrations of water in the feed.

Polymers have been widely used as membrane materials due to the superior membrane-forming properties and good thermal and chemical stability. One of the efficient modification methods is creating hybrid material in order to overcome drawbacks of trade-off between flux and selectivity. Assembly of nanomodifiers with polymer matrix leads to changes in structure and physical parameters of materials that leads to desired transport properties.

In order to solve the issue of incompatibility between inorganic nanoparticles and polymer matrix, hybrid membranes on the basis of a low cost and mechanically strong polymer poly (2,6- dimethyl-1,4-phenylene oxide) (PPO) and a star-shaped macromolecules (SM) with a small branching center of fullerene C_{60} and six arms of polystyrene and six arms of poly- tert-butyl methacrylate were prepared

The membrane structure war characterized by scanning electron microscopy (SEM) and X-ray phase analysis (XRD). The thermal stability was analyzed by thermogravimetric analysis (TGA). Contact angles were measured by sessile drop method.

The PPO/SM membranes were then applied to the pervaporation process for the dehydration of ethylene glycol. The effects of the SM content and the operating parameters on the pervaporation performance of the PPO/SM were investigated. The membranes under study were high selective with respect to water, and show good transport properties. Membranes containing 2 and 5 wt.% of SM exhibited the best PV performance.