Second Interfacial Polymerization of Thin-film Composite Hollow Fibers with Amine-CDs for Pervaporation Dehydration

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Abstract

High performance thin-film composite (TFC) hollow fiber membranes have been developed for pervaporation dehydration by second interfacial polymerization (SIP) modification with 3 kinds of amine-functionalized β-cyclodextrin (amine-CDs), which were synthesized by modifying β-CD with ammonia, ethylenediamine (EDA) and tris(2-aminoethyl)amine, respectively. The chemical properties of amine-CDs and SIP-modified TFC membranes were characterized by various techniques. The effects of amine-CD type and SIP parameters (pH or concentration of CD-EDA solution) were studied systematically to acquire the optimized selective layer of TFC membranes for ethanol dehydration. Among all SIP-modified TFC membranes, the one with SIP by 2 wt% CD-EDA aqueous solution (pH=2) exhibited the most outstanding separation performance with a ultra-high permeation flux (3018.0±12.0 g/m2.h) and permeate concentration (98.7±0.2 wt% water) at 50 °C (equivalent to separation factor of 415), contributed by the effectively incorporated CD with rich hydrophilic functional groups and intrinsic nanocavities facilitating the passage of water molecules.

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