

Fabrication and characterisation of a polyamide thin-film composite membrane on a nylon 6,6 substrate for isopropanol dehydration

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ABSTRACT

Thin-film composite (TFC) is feasible for use in isopropanol (IPA) dehydration by pervaporation (PV) for its superior performance and strength. The hydrophobic substrate membrane allows the penetration of the diamine monomer into the pores, which leads to flux reduction. Furthermore, hydrophobic polymer is difficult for TFC deposition because of its strong and opposing characteristics. To solve this problem, hydrophilic nylon 6,6 (N66) was introduced as a substrate in this application because of the balanced characteristics such as small distribution pores, great interaction with polyamide layer, and high mechanical strength to overcome the swelling weakness. TFC membranes were prepared by interfacial polymerisation (IP) method between *m*-phenylenediamine (MPD) and trimesoyl chloride (TMC) monomer. The chemical and physical properties were characterised by scanning electron microscopy (SEM), Fourier-transform infrared (FTIR) spectroscopy, contact angle, and swelling test analyses. A fully aromatic polyamide group was detected at FTIR spectrum 1609–1610 cm⁻¹. Increasing the immersion time from 2 to 5 min in 2 wt % MPD and 1 min immersion in 0.1 wt % TMC solutions increased the thickness of the membranes from 40.0 to 56.3 μm. The contact angle decreased significantly from 50° to 35° after the modification, thereby obtaining better hydrophilic properties for interface to occur. In addition, continuous IPA sorption experiments for up to 24 h were carried out for pristine N66 and TFC membranes, using 60, 80 and 90 wt % IPA/water solutions. The degree of swelling increased with time as the water composition increased.

KEYWORDS

Interfacial polymerisation; Isopropanol; Nylon 6,6; Pervaporation; Polyamide; Thin-film composite

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