Evaluation of pervaporation condition and synthesis gels for NaA zeolite membranes

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ABSTRACT

NaA zeolite membranes were synthesized on the mullite supports. Effects of crystallization time and temperature on the membrane structure and performance of NaA zeolite membranes have been investigated. Molar composition of the starting gel of nano NaA membranes were SiO$_2$/Al$_2$O$_3$ = 0.8–3.2, Na$_2$O/Al$_2$O$_3$ = 1.6–4.6, and H$_2$O/Al$_2$O$_3$ = 50–200. X-ray diffraction patterns of the membranes exhibited peaks corresponding to the support and the zeolite. Morphology of the supports subjected to crystallization were characterized by Scanning electron microscopy. Separation performance of NaA zeolite membranes was studied for water–Ethanol mixtures using pervaporation in dead end and cross-flow method. The membranes showed good selectivity towards water in the water–ethanol mixtures. Water permeates faster because of its preferential adsorption into the nanopores of the hydrophilic zeolite membrane. The membrane exhibits a hydrophilic behavior, with a high selectivity towards water and a good flux. The best flux and separation factor of the membranes were 0.624 kg/m$^2$h and 10,000, respectively. Effects of operation condition (temperature, rate, and pressure) on the membrane performance have been investigated for NaA zeolite membranes grown onto seeded mullite supports.

Keywords: Nano; NaA; Pervaporation; Zeolite membrane; Synthesis parameters

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