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Permeation and separation characteristics of dimethylformamide/water mixtures by vapor permeation and vapor permeation with temperature difference methods through a sodium alginate-g-n-vinyl-2-pyrrolidone membrane

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ABSTRACT

The characteristics of separation of dimethylformamide (DMF)/water mixtures with sodium alginate-g-N-vinyl-2-pyrrolidone membranes were investigated by vapor permeation (VP) and vapor permeation with temperature difference (TDVP) methods. N-vinyl-2-pyrrolidone (NVP) was grafted on to sodium alginate (NaAlg) with benzophenon under atmosphere on N_2. The grafted NaAlg was characterized by Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and differential scanning calorimeter (DSC). The effects of the feed composition, operating temperature and temperature of the membrane surroundings on the separation characteristics (separation factor, permeation rate) were studied for the DMF/water mixtures. The separation factors decreased and permeation rates increased with an increase in permeation temperature for both VP and TDVP methods. With the TDVP method the separation factors increased and the permeation rates decreased as the temperature of the membrane surroundings decreased. The highest separation factor, 63, was obtained in TDVP for a 90 wt% DMF concentration in the feed. The activation energy of permeation was calculated to be 2.11 kcal/mol for 20 wt% DMF solution.

Keywords: Graft copolymers; Vapor permeation; Membrane; Dimethylformamide

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