Ammonia removal from saline water by direct contact membrane distillation

Abstract

Salts in wastewater can inhibit the biological treatment process when the microbes suffer from plasmolysis and become inactive. Membrane separation technology is an alternative method to remove dissolved ammonia from saline water, which is not affected by the presence of salt. In this study, flat porous membrane sheets made from polyvinylidene fluoride were fabricated by the phase inversion process and used to remove ammonia from saline water by direct contact membrane distillation (DCMD). Dimethylacetamide and sodium chloride were used as the solvent and a pore-forming additive, respectively. This study investigated the effect of adding varying sodium chloride concentrations, 0.00, 0.22 and 0.33 wt%, during membrane fabrication, on the resulting membrane porosity and pore size, as characterized by the gravimetric method and scanning electron microscopy, respectively. The additive increased the porosity of the membrane from 78% without additive to approximately 82 to 84%. The sodium chloride additive reduced the pore size of the porous membranes from 0.082 to 0.067 μm. The fabricated membranes were then applied in co-current DCMD for ammonia separation at 50oC. In the gas-liquid membrane separation, it was found that membranes that are highly porous were preferable because these membranes provide a low effective thermal conductivity, which results in a high flux. The greatest ammonia removal efficiency, approximately 20%, was achieved within two hours of operation when the membrane with a porosity of about 84% and a water-permeant system were used.