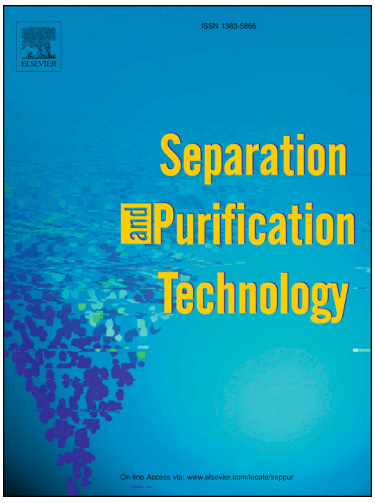

CO_2 separation with carbon membranes in high pressure and elevated temperature applications

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CO_2 separation with carbon membranes in high pressure and elevated temperature applications

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Highlights:

Carbon membranes testing at high pressure and elevated temperature

Single stage separation system for CO_2/CH_4 separation

Pore tailoring of carbon hollow fibers

Pilot scale-module construction of carbon hollow fibers

Abstract

Carbon hollow fibers (CHF) were fabricated by carbonization of deacetylated cellulose acetate precursor. To enhance membrane permeation properties, pore structure was tailored by means of an oxidation and reduction process followed by chemical vapor deposition with propene. Permeation properties using shell-side feed configuration of 70 modules (0.2-2 m^2) for both CHF and modified carbon hollow fibers (MCHF) were investigated for single gases, N_2 and CO_2 at high pressure (2-70 bar feed vs 0.05-1bar permeate pressure) and temperature from 25-120 °C. Maximum CO_2 permeance value for a MCHF module was recorded 50,000 times higher as compared to prior modification, and CO_2/N_2 selectivity was improved 41 times in comparison with CHF for the same module. Results indicated that carbon membranes are hardly effected by high pressure, but significant drop in CO_2 permeability was observed at elevated temperature. Simulations of CO_2/CH_4 separation by MCHF and polymeric membranes were conducted based on Aspen Hysys® integrated with ChemBrane,