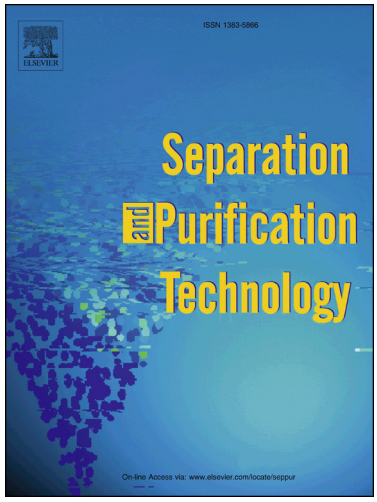

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Polysulfone porous hollow fiber membranes for ethylene-ethane separation in gas-liquid membrane contactor

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Abstract

Separation of olefin from paraffin having same carbon number is one of the most energy intensive separations in petrochemical processes. Employing gas-liquid membrane contactors for olefin/paraffin separation is very attractive. In the present work, the membrane contactor ethylene/ethane separation was investigated based on porous asymmetric polysulfone hollow fiber membranes having mesoporous (d_{av} ~ 2 nm) skin layer structure in contrast to conventional ultrafiltration membranes (d_{av} ~ 50-100 nm). Also, the membranes selective layer surface was modified to increase its hydrophobic properties expecting that pore size and surface properties tailoring prevents liquid absorbent penetration into membrane pores. The membrane contactor performance was studied under various operating parameters such as absorbent (aqueous $AgNO_3$) solution concentration and gas and liquid flow rates. Ethylene permeance value was 185 l/(m^2·h·bar), which is at the level of the best results available in literature for porous membranes, at ethylene recovery rate up to 39%, which is three times higher than that in literature. Modified membranes were characterized after membrane contactor experiments. SEM, EDX and XRD analysis as well as gas permeance measurements showed that silver nitrate crystals deposition in the membranes pore space occurs. However, no noticeable change of membrane contactor performance was observed during two months of experiments on ethylene/ethane separation.

Keywords: olefin/paraffin separation; membrane contactor; polysulfone; porous hollow fiber membrane; surface modification.