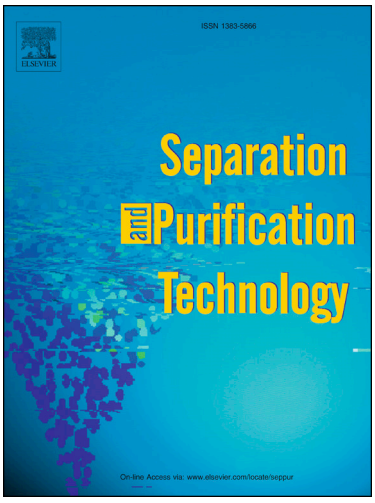

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Polyetherimide-montmorillonite mixed matrix hollow fibre membranes: Effect of inorganic/organic montmorillonite on the CO_2/CH_4 separation

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Abstract

Hollow fibre mixed matrix (HFMM) membranes with nano-filler embedded in polymer matrix offer an attractive route for the fabrication of high performance gas separation membranes. However, the quest to achieve high performance mixed matrix membranes remains a challenge without acquiring even filler distribution in polymer matrix. In this work, HFMM membranes comprising polyetherimide (PEI) with various inorganic and organic montmorillonite (*I*-MMT and *O*-MMT) loadings ranging from 1 to 4 wt. %, were developed via phase inversion method and coated with PDMS for CO_2/CH_4 separation. Morphological, filler distribution, dispersion, surface topology and gas separation studies were carried out for developed hollow fibres (HF) membranes. Pure gases (CO_2 and CH_4) were used at varying pressure of 2 to 10 bars at ambient conditions. In addition, mixed gas test at CO_2/CH_4 composition of 50/50 v/v % was carried out for selective membranes. Upon incorporation of *I*-MMT, the developed mixed matrix membranes (MMMs) showed decrease in CO_2/CH_4 gas separation performance compared to neat PEI membrane. In contrast, the performance of asymmetric membrane was enhanced by incorporating *O*-MMT in PEI matrix to form MMMs. Uniform dispersion, void-free morphology and reduced surface roughness were observed for the aforementioned membranes. Furthermore, an increasing trend in ideal selectivity was observed up to 2 wt. % *O*-MMT loading against all feed pressures. Thereafter, opposite trend was observed with increasing filler loading due to filler agglomeration. The maximum ideal selectivity achieved was 18.35 with 2 wt. % loading at 4 bar pressure which is 52.2 % higher than neat PEI hollow fibre membrane.

Keywords: Polyetherimide; Montmorillonite; Mixed matrix membrane; Hollow fiber; Gas permeation; Carbon dioxide separation.