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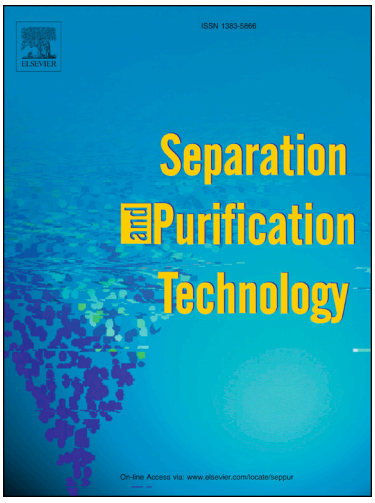

Enrichment of hydrazine from aqueous solutions by vacuum membrane distillation through microporous polystyrene membranes of enhanced hydrophobicity

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Enrichment of hydrazine from aqueous solutions by vacuum membrane distillation through microporous polystyrene membranes of enhanced hydrophobicity

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ABSTRACT

Hydrazine hydrate (HH) is synthesized by different chemical routes, which yield dilute aqueous solutions that need to be concentrated for further use. Separation of hydrazine is essential for its application as a rocket fuel. Conventional routes such as distillation prove to be hazardous due to the highly inflammable and explosive nature of hydrazine. Membrane distillation (MD) is an alternative but the highly safe process for dehydration of hydrazine since water can be vapourized thermally through a porous hydrophobic membrane. In this regard, proper selection of polymer is an important factor due to high alkalinity of hydrazine. A new solvent resistant, hydrophobic and mechanically robust microporous polystyrene (PS) membrane was prepared on a macroporous polyester fabric support using phase inversion technique and crosslinked with tetraethyl orthosilicate (TEOS) for MD based dehydration of HH. SEM and FTIR studies were performed to study membrane morphology and intermolecular interactions. Microporous polystyrene membranes were successful in separating feed mixture containing 50 wt % hydrazine by exhibiting a reasonable water flux of 5.03 kg/m^{2}h, with water concentration in permeate being 97.18% at 75 mmHg downstream vacuum. A two-dimensional model based on finite element method (FEM) was developed to predict the concentration profile within the membrane using computational fluid dynamics. This study proves that commercial grade hydrazine could be safely recovered from its aqueous reaction liquor by MD technique.

Keywords: Membrane Distillation; Polystyrene membrane; Hydrazine hydrate; Flux; CFD

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