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Deep Eutectic Solvent Coated Cerium Oxide Nanoparticles Based Polysulfone Membrane to Mitigate Environmental Toxicology

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Abstract

In this study, ceria nanoparticles (NPs) and deep eutectic solvent (DES) were synthesized, and the ceria-NP's surfaces were modified by DES to form DES-ceria NP filler to develop mixed matrix membranes (MMMs). For the sake of interface engineering, MMMs of 2%, 4%, 6% and 8% filler loadings were fabricated using solution casting technique. The characterizations of SEM, FTIR and TGA of synthesized membranes were performed. SEM represented the surface and cross-sectional morphology of membranes, which indicated that the filler is uniformly dispersed in the polysulfone. FTIR was used to analyze the interaction between the filler and support, which showed there was no reaction between the polymer and DES-ceria NPs as all the peaks were consistent, and TGA provided the variation in the membrane materials with respect to temperature, which categorized all of the membranes as very stable and showed that the trend of stability increases with respect to DES-ceria NPs filler loading. For the evaluation of efficiency of the MMMs, the gas permeation was tested. The permeability of CO2 was improved in comparison with the pristine Polysulfone (PSF) membrane and enhanced selectivities of 35.43 ((Formula presented.) CO2/CH4) and 39.3 ((Formula presented.) CO2/N2) were found. Hence, the DES-ceria NP-based MMMs proved useful in mitigating CO2 from a gaseous mixture. © 2023 by the authors.

Author Keywords

ceria nanoparticles; deep eutectic solvents; gas separation; interface engineering; membranes

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