

Activated carbon and halloysite nanotubes membrane for CO₂ and CH₄ separation

ABSTRACT

In this study, mixed matrix membranes (MMMs) were prepared where activated carbon and halloysite nanotubes with a loading of 1 wt% is incorporated into the polysulfone membrane, and the performance of each membrane was investigated. The morphological properties, mechanical strength and their correlations with the gas separation performance for CO₂ and CH₄ for halloysite-mixed matrix membrane (MMMs-HNT) and activated carbon-mixed matrix membrane (MMMs-AC) was studied by using Scanning Electron Microscopy (SEM-EDX), tensile test and gas permeation test. From the characterization of MMMs, SEM shows an increase of 30.77% on the thickness of the dense layer of MMMs-HNTs compared to neat membrane and MMMs-AC. The EDX results also showed that HNTs evenly distributed in the polymeric matrix without any sign of agglomeration. Elongation at the break for MMMs-HNTs also decreases to 11.38%. The gas separation performance for MMMs-HNTs increased by about 55.43% compared to MMMs-AC at 2 bar. Furthermore, MMMs-HNTs also showed an increase in the selectivity of membrane towards CO₂ and CH₄ from 0.82 to 15.83 at 2 bar. In conclusion, the addition of 1 wt% of HNTs into PSF polymeric matrix showed a better permeance of CO₂ and a greater selectivity compared to the neat membrane and the MMMs-AC and thus is the optimum inorganic filler for the mixed matrix membrane.