

Microporous 3D Aluminium Metal-Organic Frameworks in Chitosan Based Mixed Matrix Membrane for Ethanol/Water Separation

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Abstract : An effective approach to enhance the ethanol/water pervaporation of mixed matrix membranes prepared from three microporous aluminium based metal-organic frameworks (MOFs), [Al(OH)(BPDC)] (DUT-5), [Al(OH)(NDC)] (DUT-4) and [Al(OH)(BzPDC)] (CAU-8) have been synthesized by employing solvothermal reactions. Interestingly, all Al-MOFs showed attractive surface area with microporous 12.3, 10.2 and 8.0 Å for DUT-5, DUT-4 and CAU-8 MOFs which are confirmed through N₂ gas sorption measurements. All the microporous compounds are highly stable as confirmed by thermogravimetric analysis and temperature-dependent powder X-ray diffraction measurements. Furthermore, the synthesized microporous MOF particles of DUT-5, DUT-4, and CAU-8 were successfully incorporated into biological chitosan (CS) membranes to form DUT-5@CS, DUT-4@CS, and CAU-8@CS membranes. The different MOF loadings such as 0.1, 0.15, and 0.2 wt% in CS networks have been prepared, and the same were used to separate mixtures of water and ethanol at 25°C in the pervaporation process. In particular, when 0.15 wt% of DUT-5 was loaded, MOF@CS membrane displayed excellent permeability and selectivity in ethanol/water separation than that of the previous literature. These CS based membranes separation through functionalized microporous MOFs reveals the key governing factors that are essential for designing novel MOF membranes for bioethanol purification.

Keywords : metal-organic framework, microporous materials, separation, chitosan membranes

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