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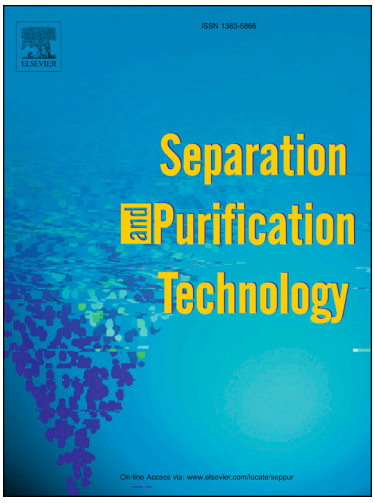

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ASYMMETRIC MEMBRANE CONTAINING ELECTROSPUN CU-BTC/POLY(VINYL ALCOHOL) FOR PERVAPORATION DEHYDRATION OF 1,4-DIOXANE

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ABSTRACT

In this study, an asymmetric membrane containing an electrospun copper benzene-1,3,5-tricarboxylate (Cu-BTC)/poly(vinyl alcohol) (PVA) pre-selective layer and a dense PVA separation layer (M_{CuBTC}) was fabricated. The existence of the electrospun Cu-BTC/PVA composite nanofibre layer coated on a dense PVA membrane was observed to significantly improve the separation performance and membrane permeability by serving as a hydrophilic pre-selective barrier during the application of the M_{CuBTC} membrane to the pervaporation dehydration of aqueous 1,4-dioxane solutions. The M_{CuBTC} membrane demonstrated improved pervaporation performance, with a total permeation flux of 87.69 g/m^2·h, a separation factor of up to 1852.32, a water permeance of 2102.87 gpu, and a water selectivity of 1365.96. It is interesting to note that due to the addition of the electrospun pre-selective layer, the permeation flux demonstrated by the M_{CuBTC} membrane was double of that of the dense PVA membrane, while the separation factor increased from 392.65 to 1852.32.

Keywords: asymmetric; electrospinning; Cu-BTC; dehydration; pervaporation

1. Introduction

1,4-Dioxane is commonly used as an organic solvent in the petrochemical and pharmaceutical industries. It is a colourless synthetic heterocyclic organic compound that is highly miscible with water in all proportions and forms an azeotropic mixture at a water-to-dioxane ratio of 18:82 by mass. In addition, 1,4-dioxane forms close boiling point mixtures with water at various compositions, as the boiling point of 1,4-dioxane (101°C) is close to that of water [1]. Although distillation is an efficient separation process widely used in industry, azeotropic and close boiling point mixtures cannot be separated via conventional methods such as distillation. Pervaporation has emerged as one of the most promising and economical separation techniques that can be used as an alternative to distillation. This is because of the high separation efficiency and potential savings in capital and energy that pervaporation offers. Over