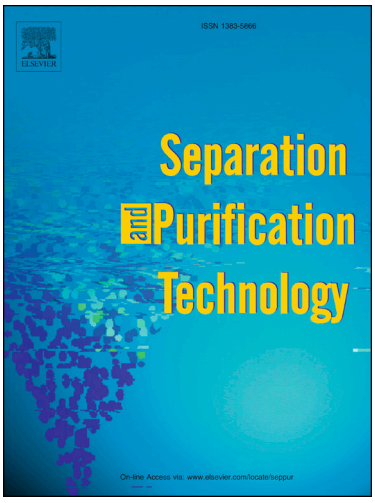

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PDMS modified membranes by 1-Dodecanol and its effect on ethanol removal by pervaporation

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Abstract

Hydrophobic polydimethylsiloxane (PDMS) membranes in pervaporation are used to remove ethanol compounds from aqueous solutions as fermentation broths. Conventional PDMS membranes, which have been extensively studied, have high fluxes but relatively low selectivities. A new technique to modified PDMS pervaporation membranes is proposed, where a high molecular weight and hydrophobic compound (1-dodecanol) is inserted in the PDMS polymeric layer at several concentrations. The effect of 1-dodecanol concentration in the PDMS layer on flux and selectivity for ethanol removal has been measured. The unmodified and modified PDMS layers were analyzed by SEM to study the membrane layer morphology. Also, TGA and DTG were performed to estimate the 1-dodecanol composition in the PDMS layer remaining after membrane deposition and curing. Pervaporation experiments were carried out at 31 °C for ethanol concentrations in aqueous solutions of 40, 80 and 170 g/L to identify the performance as a function of 1-dodecanol load in the separation layer. The separation factor increases with the concentrations of 1-dodecanol in the polymeric layer while total flux decreases. It is known that although PDMS is a hydrophobic material a high water permeation occurs due to swelling and the molecular interaction between ethanol and water during the ethanol mass transfer across the membrane. The high hydrophobicity of 1-dodecanol reduces this behavior. This new approach presents a strategy to obtain more selective polymeric membranes or with modified properties.

Keywords: Pervaporation, PDMS, membrane preparation, ethanol removal, polymeric membranes

1. Introduction

Pervaporation (PV) is a membrane process to selectively remove compounds from organic or aqueous mixtures [1]. Commonly, a polymeric pervaporation membrane is a dense and non-porous selective layer (hydrophobic) that allows the separation of organic compounds from an aqueous solution [2]. Ceramic porous membranes (hydrophilic) are commonly used to dehydrate mixtures, especially alcohols with a low amount of water [3].

Polymeric pervaporation membranes have been the center of interest due to their application to separate alcohols that work as bio-fuels [4,5]. This type of hydrophobic membranes is especially