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Self-diffusion of water–ethanol mixture in chitosan membranes obtained by pulsed-field gradient nuclear magnetic resonance technique

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Abstract

The self-diffusion of water and ethanol for crosslinked and uncrosslinked chitosan membranes have been investigated by pulsed-field gradient nuclear magnetic resonance (NMR) spectroscopy. It has been shown that during diffusion processes, water and ethanol are localized in different parts of the chitosan membrane. In the crosslinked membrane, the self-diffusion coefficient for water is higher, but that for ethanol is essentially lower, than those for the uncrosslinked membrane. For this reason, the mobility selectivity is essentially higher in crosslinked membrane as compared to the uncrosslinked. The sorption selectivity are the same for these two types of membranes. © 1998 Elsevier Science B.V.

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1. Introduction

Chitosan (Cs) is a natural polymer which has a very low cost and available in large quantities from the wastes of the sea food production. Cs has the same skeleton as cellulose except the substituent group on the alpha carbon atoms which is the amino group. On the basis of this structure characteristic, Cs can be thought as an ideal dehydration membrane material for pervaporation. The hydrophilic amino groups in the Cs molecular structure cannot only cause a preferential interaction with water but are also capable to form crosslinking by using polybasic acids.

The comparison of the performance between the crosslinked and uncrosslinked Cs homogeneous membranes has been reported in the previous works [1,2]. The Cs membranes which are treated in the aqueous solutions of H_2SO_4 are formed of a large amount of ionic group of $-NH_3^+$ and the crosslinked structures (with bonds of $-NH_3^+-SO_4^{2-}-NH_3^+$) have taken place and changed the intermolecular hydrogen bonding resulting in the increase of the amorphous region. The membrane crosslinked by sulfuric acid has higher separation factor than uncrosslinked membrane. There

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