POLITECHNIKA ŚLĄSKA

WYDZIAŁ CHEMICZNY

KATEDRA FIZYKOCHEMII I TECHNOLOGII POLIMERÓW

PRACA DOKTORSKA

„Badanie właściwości separacyjnych hybrydowych membran chitozanowych zawierających tlenki metali z przeznaczeniem do odwadniania alkoholu etylowego metodą perwaporacji”

"Study of separation properties of hybrid chitosan membranes with metal oxides for pervaporative dehydration of ethyl alcohol".

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SUMMARY OF DOCTORAL DISSERTATION

This study aimed to determine the possibility of using hybrid chitosan membranes containing metal oxides in the process of ethanol dehydration using the pervaporation method.

The research in the work was divided into two main stages. In the first stage, a polymer constituting the membrane matrix was selected, which was modified in such a way as to obtain a matrix with specific physicochemical and transport properties. In the second one, the influence of the type and amount of metal oxide on the separation properties of hybrid chitosan membranes in the process of ethyl alcohol dehydration using the pervaporation method was determined.

Based on the analysis of the test results, it was found that the molecular weight and degree of deacetylation of chitosan as well as the initial state of the membrane affect both the physicochemical and separation properties of the obtained materials. The selected material was cross-linked with seven cross-linking agents to modify the value of the permeate flux of the obtained chitosan membrane.

The obtained starting material was modified by introducing various amounts of inorganic filler, which were metal oxides. In total, fourteen metal oxides of block d were used in the work. The separation properties of the obtained materials were assessed in terms of their applicability in the process of ethanol dehydration by the pervaporation method.

For the obtained composite membranes, the physicochemical characteristics were performed, which included: the determination of the swelling degree in the mixture and pure solvents, determination of the contact angle of both sides of the membranes and the value of the breaking stress along with the elongation of the material at the break.

The materials were also subjected to the characteristics of the separation properties, which were assessed based on the obtained values: permeate flux, separation coefficients and selectivity, and the pervaporative separation index. As part of the work, transport parameters were also determined: the permeability, diffusion and solubility coefficients, based on which it was determined how the introduced modifications influenced the separation process.

The conducted research showed the possibility of using hybrid chitosan membranes in the ethanol dehydration process. The conclusions resulting from the work are the starting point for further research on the possibility of improving the properties of hybrid chitosan-based membranes or the use of metal oxides in other separation materials.