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MATHEMATICAL MODELLING OF MASS TRANSPORT THROUGH A PERVAPORATION MEMBRANE

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Abstract

This paper presents two different approaches of the solution-diffusion models which has been applied in order to describe mass transport through a pervaporation membrane, type Pervap 2201D manufactured by Sulzer Chemtech, Germany. This membrane is a cross-linked polymeric membrane, with an active layer of polyvinyl alcohol and a support layer of polyacrilonitrile. Two models have been elaborated to describe the experimental behavior of the membrane and further to allow optimization studies. The models that will be discussed in this paper are: the short cut model (SCM) and simplified solution diffusion model (SSDM). The effect of the operating temperature on permeation flux in pervaporation was analyzed. In the standard pervaporation processes, both the permeability coefficient of a membrane and the driving force for mass transport are influenced by temperature. The activation energy, Ej, conventionally obtained from natural logarithm of normalized vs. *I/T* plot is a complex parameter characterizing the overall temperature dependence on permeation flux. The activation energy for permeation, Ep, characterizing temperature dependence of membrane permeability should be evaluated from the ln of driving force-normalized flux ($J_i/\Delta a$) vs. *1/T* data. The evaluation of E_p can be made by substracting the molar heat of vaporization from Ej. Considering the parameters calculated with the proposed models it was observed that the first model (SCM) did not give accurate prediction of the permeate flux due to the swelling of membrane. The second model (SSDM) has been successfully applied to the correlation of experimental results.

Keywords: pervaporation, modeling, polymeric membranes, activation energy

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