

A BASIC STUDY ON CONCENTRATION OF SEA WATER DRIVEN BY PRESSURE DIFFERENCE

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Summary

Though an electrodialysis using the ion exchange membranes is an excellent technology to get salts from sea water, the method consumes a large amount of electric power in the process. As more effective separation of salts from sea water, a pressure dialysis is attractive in respect that the technique drives salts instead of a large quantity of solvent by using the pressure difference. Unfortunately, such a practical membrane suitable for the pressure dialysis has not been obtained to the present.

Our study aims to make a way to potential application through fundamental analysis of salt transport phenomena based on nonequilibrium thermodynamics.

In this work, 3 charged membranes, an amphoteric ion exchange membrane, a charged mozaic membrane and a cation exchange membrane which indicate the different charge morphologies within the membranes were investigated. Under the appropriate osmotic pressures which were generated by sucrose, the volume flux, J_v and salt flux, J_s were measured in the membrane-KCl salt solution system. The obtained J_v and J_s were analyzed by the practical phenomenological equation presented by Kedem & Katchalsky and the filtration coefficient, L_p , reflection coefficient, σ and solute permeability, ω which are characteristic of the membranes, were estimated. As an interesting result, σ in case of the charged mozaic membrane exhibited the negative value. This suggests that the membrane transports the salt in preference to the solvent. According to the detailed analysis with respect to the parallel array of two different charged groups within membrane, the membrane conductance, κ and the electroosmotic permeability, β were estimated. Furthermore, from electrochemical basis, ζ -potential generated in membrane pore were introduced. These parameters were discussed in relation to the salt and solvent transports.