THE DEPENDENCE OF CONCENTRATION OF EXTERNAL SALT SOLUTION ON THE PROPERTIES OF ION-EXCHANGE MEMBRANES

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Summary

If the transport number of counterions in a membrane is idealy unity, the composition of the membrane is nearly constant even if the concentration of the external salt solution changes. However, the mobility and the state of counterions in the membrane may change with changing the concentration of the external solution. Now, the dependence of the change in external salt solution on the properties of membranes is interested in this field. In this work, the dependence of the change in the external salt concentration on membrane resistance and bi-ionic potential(BIP) was studied using anion-exchange membranes which have various degree of cross-linkage and charge densities.

Test membranes STA-1～5 made of hydrocarbon(Asahi Chemical Industry, Co., Ltd.), Neosepta® AM-5(Tokuyama Soda Co., Ltd.), Tosflex® IE-DF 17(Tosoh Co.,Ltd.) and poly(4-vinylpyridine-co-styrene) membranes are used as anion-exchange membranes. The measurements of BIP were carried out for KCl/membr/KIO_3 systems. Membrane resistance was measured for KCl and KIO_3 solutions in the range of 5 to 1000 Hz using LF Impedance Analyzer 4192A(YHP Ltd.).

The absolute values of BIP increases with the increase of the external salt concentrations even though the transport number of counterions is unity. The value of BIP increases with the increase of fixed charge density, with the increase of the fraction of water in the membrane and with the increase of the fraction of hydrocarbon membrane matrix. The value of BIP for hydrocarbon-type membranes is greater than that for fluorocarbon-type membranes, if water content and fixed charge density are nearly equal to each other. The contribution of the change in mobility ratio of counterions on BIP was estimated from measuring membrane resistance. It becomes clear that the change in the difference in the standard chemical potential plays also an important role in the concentration dependence on BIP.