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EFFECT OF AMPHOLYTE NATURE ON CURRENT-VOLTAGE CHARACTERISTIC OF ANION-EXCHANGE MEMBRANE

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HIGHLIGHTS

I-V curves of an AMX membrane in phosphate and tartrate solutions are compared

There are two limiting currents in the case of monosodium hydrophosphate solution

The first limiting current is absent in the case of potassium hydrotartrate solution

Difference is due to the ratio of the ampholyte dissociation constants

ABSTRACT

Current-voltage characteristics (CVCs) of a Neosepta AMX membrane are studied in NaH_2PO_4 (pH=4.7, C=0.02 mol/L) and $KC_4H_5O_6$ (pH= 3.6, C=0.02 mol/L) solutions. It is shown that in the case of NaH_2PO_4 there are two plateaus in the CVC, which correspond to achievement of the first, i_{lim}^{I}, and second, i_{lim}^{II}, limiting currents. i_{lim}^{I} occurs when the NaH_2PO_4 salt diffusion to the membrane surface is saturated, i_{lim}^{II} refers to the saturation of the proton flux when the membrane is almost completely converted into the HPO_4^{2-} form. In the case of potassium hydrotartrate, there is no state corresponding to i_{lim}^{I}. The difference in CVC for two ampholytes is due to the difference in the ratio between the dissociation constants related to the first (K_{a1}) and second (K_{a2}) steps of ampholyte dissociation. In the case of NaH_2PO_4, where pK_{a1} and pK_{a2} differ greatly, a solution of this salt contains nearly exclusively the singly charged phosphate form. However, a $KC_4H_5O_6$ solution contains, together with the $C_4H_5O_6^-$ anion, about 15% of the doubly charged tartrates, which take part in charge transfer. Approximate analytical expressions are obtained for i_{lim}^{I} and i_{lim}^{II} in the case of monosodium hydrophospate solution. Their