THE STUDY OF ACTIVITY AND ACTIVITY COEFFICIENTS OF AQUEOUS MIXED ELECTROLYTES USING A GALVANIC CELL WITH CATION EXCHANGE MEMBRANE

BY

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ABSTRACT

In the present work the galvanic cell

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\begin{array}{c|c|c|c}
\text{Ag|AgCl} & \text{Cation Exchange} & \text{MCl+MY} & \text{AgCl|Ag} \\
C_{M}=0.1M & \text{Membrane} & C_{M}=0.1M & \\
\end{array}
\]

is investigated experimentally. For the electrolyte solutions MCl and MY, M is the metallic cation \(K^+, Na^+ \text{ and } Mg^{2+}\). Y is the anion \(NO_3^- \text{ and } SO_4^{2-}\). The cation exchange membrane used is the homogeneous Nepton CR 61 AZL 065.

The systems studied in the present work are

(i) \(KCl - K_2SO_4 - H_2O\)
(ii) \(KCl - KN03 - H_2O\)
(iii) \(NaCl - NaN03 - H_2O\)
and (iv) \(MgCl_2.6H_2O - MgSO_4.7H_2O - H_2O\).

The emf of the cell is measured against pure 0.1M MCl as the reference solution as a function of composition equivalent percent of MCl in the various electrolyte composition mixtures. The composition of electrolyte mixtures vary from 5%MCl + 95%MY to 95%MCl + 5%MY.

The theoretical approach based on irreversible thermodynamics is used to obtain the equation of emf.
used to calculate the activity and activity coefficients of MCl in MY for each composition mixture from the emf data. In this approach unmeasurable quantities such as single-ion activities are avoided.

The mean activity coefficients of KCl and NaCl in the systems KCl - KNO₃ - H₂O and NaCl - NaNO₃ - H₂O respectively obeyed Harned's rule while the mean activity coefficients of KCl and MgCl₂ in the systems KCl - K₂SO₄ - H₂O and MgCl₂.6H₂O - MgSO₄.7H₂O respectively did not.