

Effects of monovalent ions on membrane potential and permselectivity of polymer based zirconium aluminophosphate composite membrane

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Poly (vinyl chloride) (PVC) with zirconium aluminophosphate (ZrAIP) employed as additive was prepared as composite by sol-gel method. This composite membrane was characterized by FT-IR, XRD, TG-DTA and SEM. The influence of polymer ratios on stability of the membrane was investigated and was found to show greater stability with 25% polymer. The porosity and water uptake properties were also observed. The membrane potential was observed for different monovalent electrolyte solutions with varying concentrations (1–0.001 was found to follow the trend as $\text{LiCl} > \text{NaCl} > \text{KCl} > \text{NaNO}_3 > \text{KNO}_3$

and attributed to the different sizes of ions. The membrane potential increased with the decrease in cation size. For anions, differences found are according to the size, mobility ratio and strong interaction with the membrane matrix. Small size and higher mobility of Cl^- ion shows greater value of membrane potential whereas NO_3^- ion shows lower value because of its large size and strong interaction with the membrane matrix. The potential shows positive values with decrease in electrolyte concentrations confirming the membrane to be cation selective. The prepared membrane also shows highest permselectivity for Li^+ counter-ion while lowest for K^+ , as potassium counter-ion shows strong interaction with the fixed charge groups on the polymer, thereby, decreasing the value. Co-ion (NO_3^-) with higher hydrated radii and lower charge density also tended to result in low membrane permselectivity. Thus, the composite membrane can be efficiently used in various electro-membrane processes.

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