Conclusion
CONCLUSION

The chapter "Charge Density of Membranes" is also a part of study of characterising the membranes. In this work, parchment supported membranes made of nickel phosphate and cobalt phosphates by the method of interaction used to observe membrane potential values \(E_m\) across both the membranes. When they are used to separate electrolyte solution of different concentrations, indicate the presence of charge on membrane matrix. The change of \(E_m\) values in reverse order of electrolyte concentrations suggests the reversal of membrane charge and selectivity of phosphate membranes which is not seen in our earlier findings. However, it is an interesting indication for both nickel and cobalt phosphate membranes that the membranes are cation selective when separating dilute solutions and anion selective while separating concentration solutions.

On the other, the transference number \(t_-\) of co-ions through the membranes increases from high to lower concentration of electrolytes indicates the preferential salt adsorption which is in fact, the charge distribution on membrane sites in turn. Simultaneously, the apparent transference number \(t_{-\text{app}}\) approximately similar to \(t_-\) for co-ions are seen important factors for the evaluation of effective fixed charge density \(X\) values the estimation of permselectivity \(P_s\) values with the support of \(t_-\) and \(t_{\text{app}}\) both, were seen very effective towards \(X\) determination. At the last, the thermodynamically fixed charge density \(X\) values of both the membrane system individually by using
different methods were found low, which indicated that both the membranes have stable fixed charge distribution in their phase.

Transport phenomena under the head of "Diffusion of electrolytes" were found very much challenging to recently burning problems. After the fabrication of the parchment supported inorganic precipitate membranes of nickel and cobalt phosphate separately, membrane potential and membrane resistance were observed experimentally at different temperatures after definite intervals of time in order to study of permeation of electrolytes as cations/anions across both the membranes with the help of recently developed theories. The membrane resistance $R_m$ for both the membranes at any given time for metal ions and alkali earth metal ions in sequence as : $\text{Li}^+ > \text{Na}^+ > \text{K}^+$ and $\text{Ba}^{++} > \text{Ca}^{++} > \text{Mg}^{2+}$ and also for aluminum ion refers that very few cations are in membrane phase. On the other hand, the effect of charge on cation is seen an important factor towards the mobility of cations across both the parchment supported membrane. Besides of the membrane potential, the sequence of monovalent cations i.e. $\text{Li}^+ > \text{K}^+ > \text{K}^+$ and di-valent/tri-valent cations i.e. $\text{Al}^{3+} > \text{Ba}^{++} > \text{Ca}^{2+} > \text{Mg}^{2+}$ also points towards the adsorption of these ions on membranes matrix. The slight changes of membrane potential ($E_m$) and membrane resistance ($R_m$) are considered due to the nature of ions and membrane effected during the adsorption.

The values of diffusion rate $\frac{dQ}{dt}$ for various cations of both the membranes calculated from the values of membrane potential ($E_m$) and
membrane resistance ($R_m$) are found slower than in free solution which is the attribution of intraction of diffusing species with the fixed charge groups on the membrane matrix. The diffusion rate sequence of cations diffusing through both the membranes was $K^+ > Na^+ > Li^+$ and $Mg^{2+} > Ca^{2+} > Ba^{2+} > Al^{3+}$, which on the basis of Eisenman Sherry model of membrane selectivity can be seen, because of weak field strength of charge groups attached to the membrane matrix. However, use of absolute reaction rate theory towards the evaluation of thermodynamic membrane parameters in which negative values of entropy change, $\Delta S^r$, indicate the mechanism of flow of coions /counter ions as interstitial permeation of the membrane (Minimum Chain loosening) with immobilization in the membrane (small zone of disorder). Here, both membranes show same behaviour towards the diffusion of different electrolytes. Hence, it is concluded that membrane solution interface is the rate limiting step for permeation.

The last one, that is, chapter IIIrd a "Bi-ionic Potential Studies" also adds some facts regarding the characterization of both the parchment supported nickel and cobalt phosphate membranes in the light of bi-ionic potential (BIP) theories. Since bi-ionic potential (BIP) is a measure of selectivity of a membrane for ions of the same sign. Upon the application of recently derived equation by Toyoshima and Nozaki for BIP and Membrane potential on the basis of non equilibrium thermodynamics, using appropriate assumptions for the mobilities and activity coefficients of small ions in membrane phase to our
system of parchment supported membranes, the theoretical values of BIP were evaluated with the help of thermodynamic parameters. However, the effective fixed charge density (X) values of the membranes obtained by various methods, on one side represent the membrane character while on other side contributes in the evaluation of theoretical values of BIP. The interesting result which is seen here is that, the experimentally observed values of BIP for both the membranes have good agreement with the theoretical values. As a result, both the parchment supported phosphate membranes turn to be effective for enrichment of desalination, separation processes etc. on the behalf of these findings.