CHAPTER IV

| Figure No. | Caption to Figures | Pg. No. |
|------------|---|---------|
| 4.1 | Experimental set up for impedance measurements. Two Ag/AgCl | 190 |
| | electrodes are used as CEs, and potential across the membrane | |
| | (BM) is measured with two REs using Haber–Luggin capillaries | |
| | salt bridges (HLC). The solution flux (SF) is directed to the | |
| 4.2 | Schemetic discrements and seture used for motal ion | 102 |
| 4.2 | transport studies | 193 |
| 4.3 | Schematic experimental set up for the determination of | 194 |
| | membrane permselectivity by membrane potential measurements | |
| 4.4 | ATR Spectra of (A) ZrT particle (B) Cross linked ZrTETA-55 membrane | 206 |
| 4.5 | ¹ H-NMR spectrum of ZrTETA-55 membrane | 206 |
| 4.6 | Schematic structure of ZrTETA-55 membrane | 206 |
| 4.7 | SEM images of ZrT gel particles | 206 |
| 4.8 | SEM image of cross section of ZrTETA-55 membrane | 206 |
| 4.9 | SEM image of cross section of ZrTETA-55 membrane | 206 |
| 4.10 | DSC of ZrTETA-X membranes | 207 |
| 4.11 | DMA curves for ZrTETA-X membranes | 207 |
| 4.12 | Adsorption capacity of ZrTETA-55 membrane for different metal ions | 207 |
| 4.13 | Diffuse reflectance spectrum (DRS) for ZrTETA-55 membrane before and after Cu ²⁺ chelation | 207 |
| 4.14 | Proposed structure for Cu ²⁺ chelated ZrTETA-55 membrane | 207 |
| 4.15 | WXRD pattern of ZrTETA-55 and Cu ²⁺ Chelated ZrTETA-55 | 207 |
| | membrane | |
| 4.16 | EDX of ZrTETA-55 membrane | 208 |
| 4.17 | EDX of Cu ²⁺ chelated ZrTETA-55 membrane | 208 |
| 4.18 | Membrane conductivity data in equilibration of different metal salt solutions (0.01 M) | 208 |
| 4.19 | i-v characteristics for ZrTETA-X membranes in equilibration with 0.10M NaCl solution | 208 |
| 4.20 | t_i^m values in equilibration with 0.1M metal ion solutions across ZrTETA-X membranes | 208 |

| 4.21 | Variation of electro osmotic flux (J_v) with applied voltage for different ZrTETA-X membranes | 208 |
|------|--|-----|
| 4.22 | Electro-transport flux for different metal ions (J) (0.10 M) across ZrTETA-X membranes at 10 mA/cm ² applied current density | 209 |
| 4.23 | Ionic flux data across different ZrTETA-X membranes for various metal ions (0.10M) under 10 mA·cm ⁻² applied current density | 209 |
| 4.24 | Separation factor (SF) of different equi-molar metal ion mixtures (0.10 M) for ZrTETA-X membranes under 10 mA·cm ⁻² applied current density | 209 |
| 4.25 | Effect of pH on Cu ²⁺ adsorption towards crosslinked ZrTETA-55 hybrid membrane | 215 |
| 4.26 | Effect of contact time on the adsorption of Cu ²⁺ at different concentrations using ZrTETA-55 hybrid membrane | 215 |
| 4.27 | Effect of Cu ²⁺ concentration on adsorption (%) using crosslinked ZrTETA-55 hybrid membrane at pH 7.0 | 215 |
| 4.28 | Effect of adsorbent dose for Cu ²⁺ (50mg.L ⁻¹) adsorption using crosslinked ZrTETA-55 hybrid membrane | 215 |
| 4.29 | Vant Hoff plot [log K _c vs. 1/T] | 215 |
| 4.30 | Pseudo first order plots for Cu ²⁺ adsorption on crosslinked ZrTETA-55 hybrid membrane at different concentration | 215 |
| 4.31 | Pseudo second order plot for Cu ²⁺ adsorption on crosslinked ZrTETA-55 hybrid membrane at different concentration (pH 7.0) | 216 |
| 4.32 | Freundlich plots for Cu ²⁺ adsorption on crosslinked ZrTETA- 55 hybrid membrane under different experimental conditions | 216 |
| 4.33 | Langmuir plot for Cu ²⁺ adsorption on crosslinked ZrTETA-55 hybrid membrane under different experimental conditions | 216 |

| Table No. | Caption to Tables | Pg. No. |
|-----------|---|---------|
| 4.1 | Properties of commercial ion exchange membranes [1-7] | 180 |
| 4.2 | w, $_{H2O}$, IUC, r(Å), X_m , and w values for different ZrTETA-X membranes | 210 |
| 4.3 | Oxidative and Hydrolytic Stabilities for ZrTETA-X Chelating Membranes | 210 |
| 4.4 | Characteristic values of i-v curves for ZrTETA-X membranes in equilibration with 0.10 M NaCl solutions | 210 |
| 4.5 | Thermodynamic parameters and correlation coefficients (R^2) at different temperatures for the adsorption of Cu ²⁺ on crosslinked ZrTETA-55 hybrid membrane at pH 7.0 | 217 |
| 4.6 | Pseudo-first- and second-order kinetic constants and correlation coefficients (R^2) for Cu ²⁺ adsorption at pH 7.0 using ZrTETA-55 hybrid membrane | 217 |
| 4.7 | Freundlich and Langmuir constants and correlation coefficients (R^2) for Cu ²⁺ adsorption on ZrTETA-55 hybrid membrane at pH 7.0 | 217 |
| 4.8 | Langmuir correlation coefficients (R_L) for Cu^{2+} adsorption at different concentration on ZrTETA-55 hybrid membrane at pH 7.0 | 217 |