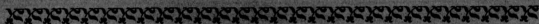
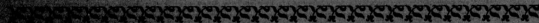


# CHAPTER

# 6



## ***SUMMARY AND CONCLUSIONS***



We have shown that the chitosan with the highest molecular weight has the highest electrical conductivity. This is due to the existence of more lone pair electron in the longer chain available. Electrical conductivity measurements on the plasticized chitosan acetate (AC) show that the ionic conductivity increase is much higher when EC is used as a plasticizer rather than PC. This could be due to the stronger ion-pair dissociation effect of EC. Moreover PC is known to react with its polymer host such as PEO [95]. Polymer-plasticizer-salt complexes have higher ionic conductivity up to  $10^{-4}$  S/cm. Conductivity-temperature studies indicate that the ionic transport is similar to that in ionic crystalline materials i.e. via hopping from one defect site to another. This is because the  $\ln \sigma T$  versus  $10^3/T$  plot is a straight line and therefore obeys Arrhenius rule from which the activation energy can be calculated. The value of activation energy decreases with increasing ionic conductivity and vice versa.

X-ray diffraction spectroscopy reveals that plasticizers disrupts the crystalline nature of the chitosan and converts them into an amorphous phase. This explains the increase in conductivity. When the concentration of plasticizer exceeds the amount that contributes to the maximum ionic conductivity, a new crystalline phase is formed. This could be due to the formation of linkages within the plasticizer itself [69]. Diffractograms on salt added polymer complexes showed only one broad peak or the amorphous hump indicating that the sample has becomes amorphous. The dissolution of

the salts in chitosan form complexes and enhance amorphous nature of the material. These amorphous regions through which the mobile ions conduct contain the dissolved salt. The degree of crystallinity increases when the concentration of salt exceeded the amount that gave the highest ionic conductivity. This decrease in ionic conductivity is due to the formation of ion-pairs between the salt itself [64]. These can be inferred from the existence of new crystalline peaks in the diffractrogram.

Infrared spectroscopy confirms the complexation between the polymer and the salt. This evident from the shift in peaks observed at wavenumbers  $1590 \rightarrow 1575 \text{ cm}^{-1}$ . X-ray photoelectron spectroscopy (XPS) further confirms the occurrence of complexation between the polymer and salt. The peak of N1s binding energy (BE)  $\sim 54.0 \text{ eV}$  in the lithium signal envelope and the peak at BE  $403.1 \text{ eV}$  in the nitrogen signal envelope are conclusive evidences for the Li-N complexation. Transference number measurements in this work gives quite the same results as done by other workers for the lithium ion transference number. In this work the value is  $\sim 0.3$ .

We have successfully shown that the chitosan film can be used as an electrolyte to make solid state polymer cells. However work need to be carried out to improve the battery performance. Perhaps the use of special conducting binders could be used to improve adherence of the electrodes to the electrolyte.

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