Conductivity and Electrical Properties of Chitosan - Methylcellulose Blend Biopolymer Electrolyte Incorporated with Lithium Tetrafluoroborate

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This work focuses on the structural and electrical properties of solid biopolymer blend electrolytes based on chitosan and methylcellulose incorporated with lithium tetrafluoroborate (LiBF₄). The polymer electrolyte films were prepared by solution casting technique. The polymer blend comprised of 75 wt.% chitosan and 25 wt.% methylcellulose, the most amorphous blend composition are used as the host matrix. Fourier transform infrared (FT-IR) spectroscopy analysis demonstrated the interactions between biopolymer blend and LiBF₄. The highest value of electrical conductivity at ambient temperature $3.74 \times 10^{-6} \text{ S cm}^{-1}$ was obtained for the sample containing 40 wt.% LiBF₄. All electrolyte samples were found to obey the Arrhenius rule. The magnitude of activation energy decreases with increasing electrical conductivity and vice-versa. Rice and Roth model was applied to analyze the electrical conductivity enhancement. The temperature dependence of the frequency exponent (s) shows that the conduction mechanism depends on the salt concentration, the appropriate model for low concentration was found to be correlated barrier hopping (CBH) model, while for high salt concentration samples follow the non-overlapping small polaron tunneling (NSPT) model.

Keywords: polymer electrolyte; lithium tetrafluoroborate; conductivity; FTIR; conduction mechanism

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