Proton conducting biopolymer membrane electrolytes based on kappa carrageenan doped NH_4Br: structural and ionic conductivity study

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Since the introduction of solid polymer based electrolytes by Fenton and co-workers in 1973, numerous polymers are particularly interesting especially bio-polymer have been investigate. The main interest in developing solid-state polymer electrolyte lies in the hope that such systems will avoid many of the problems encountered when using electrochemical devices with liquid constituents. The costly and rare raw materials that are required, along with expensive materials processing, make for steep barriers to overcome when it comes to power source development. The increasing interest in green energy storage materials for electrochemical devices with the development of biopolymer as electrolytes candidate has attracted great attention which can offer a number of high-value opportunities, provided that lower costs can be obtained besides environmental friendly. In arrears to the fact given, the development of biopolymer membrane electrolytes (BMEs) has been accomplished in this work by incorporating various composition (0 - 35 wt. %) of NH_4Br with kappa carrageenan (KC) via solution casting method. The biopolymer–salt complex structural formation and ionic conduction of the BMEs have been analyzed through infrared spectroscopy, X-Ray Diffraction and impedance measurement. The ionic conductivity at room temperature for the pure KC based BMEs system was achieved at 1.92×10^{-8} S cm^{-1} and was improved to optimum value at 3.89×10^{-4} S cm^{-1} when 20 wt. % NH_4Br was added. It is believed that the conducting elements in this work are predominantly due to proton (H^+) of [NH_4^+] substructure in NH_4Br with the coordination interaction taking place at KC structure as proven from FTIR study. In addition, the amorphousness of the BMEs sample increase with increased wt. % of NH_4Br and the results shown that the conductivity of the KC

BMEs system was found to be dependent on the protonation (H^+) and changes in amorphouness behavior.

Keywords: protonation (H^+), solid polymer electrolytes, ionic conductivity, Grotthuss mechanism

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