CHARACTERIZATION OF PLASTICIZED CMC-NH_4BR BASED BIOPOLYMER ELECTROLYTE AND ELECTROCHEMICAL STUDIES ON THE SOLID-STATE BATTERIES

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Much research has been devoted to the preparation of solid polymer electrolytes made of various materials. Some of the well-known are synthetic polymer materials (petroleum resources) but these polymers are high in cost and the depletion of petroleum resources coupled with increasing environmental regulation. For these reasons, a lot of effort has been made to develop the electrolytes using natural biopolymer materials. The increasing interest in green energy storage materials for electrochemical devices with the development of polymer as electrolytes candidate has attracted great attention recently. It can offer a number of high-value opportunities, provided that lower costs can be obtained besides environmental friendly. Due to this matter, the development of plasticized biodegradable polymer electrolytes (BPEs) has been accomplished in this work by incorporating various composition of EC with carboxy methylcellulose doped NH_4Br via solution casting method. The plasticized polymer–salt complex formation and ionic conduction of BPEs have been analyzed through infrared spectroscopy and impedance measurement. Plasticization using EC in BPEs system helps the enhancement of NH4Br dissociation and therefore increases the protonation process in the system. The highest ionic conductivity obtained for CMC−NH_4Br containing with 25 wt. % NH_4Br was achieved at 1.12 x 10^{-4} S cm^{-1} and enhanced to 3.31 x 10^{-3} S cm^{-1} with addition of EC. The conductivity-temperature for BPEs system obeys the Arrhenius relation where the ionic conductivity increases with temperature. The electrochemical cell were fabricated with the configuration of Zn + $ZnSO_4.7H_2O$ | BPEs system | MnO_2 for the highest conductivity and produced a maximum open circuit voltage of 1.48 V at ambient temperature and showed good rechargeability.

Keyword: biopolymer electrolytes; protonation (H^+); rechargeability

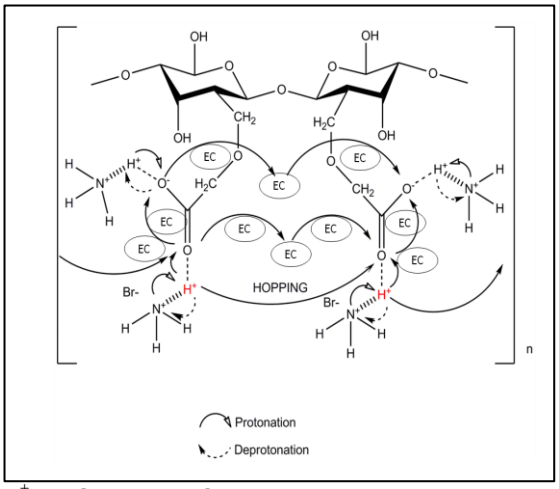

Figure 1: H^+ conduction mechanism in CMC–NH4Br–EC BPEs system

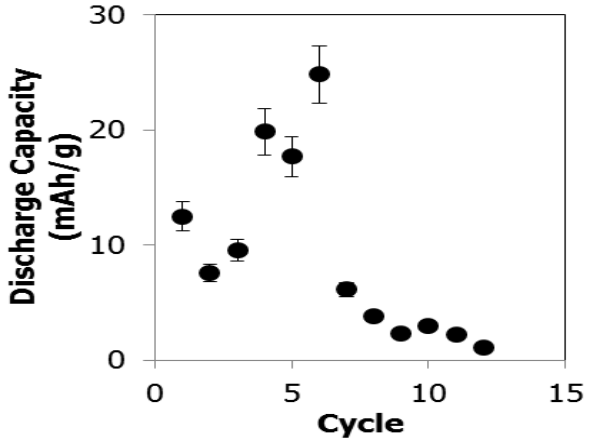

Figure 2: Discharge capacity for BPEs solid-state battery.

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