Enhancement on amorphous phase in solid biopolymer electrolyte based alginate doped NH4NO3

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ABSTRACT

The present work deals with the development of solid biopolymer electrolyte (SBE) system using a promising biopolymer, namely, alginate doped with various amount of ammonium nitrate (NH_4NO_3). The SBE system has been successfully prepared via the solution-casting method. The Fourier transform infrared (FTIR) analysis carried out suggests that interaction has occurred between alginate and NH_4NO_3 via COO^-. The X-ray diffraction analysis (XRD) also discloses that the addition of NH_4NO_3 affects the alginate SBE system by reducing the crystallinity and transforming it to an amorphous phase. The ionic conductivity of SBE system has been measured using electrical impedance spectroscopy (EIS), and it was found to achieve a maximum value of 5.56×10^{-5} S cm^{-1} at ambient temperature (303 K) for a sample containing 25 wt.% NH_4NO_3. The SBE system was found to obey the Arrhenius behavior where the system is thermally activated, and the differential scanning calorimetry (DSC) analysis demonstrated the decreased in glass transition temperature (T_g) upon the addition of the dopant. The mobility (μ) and diffusion coefficient (D) were found to affect the ionic conductivity trend as observed via IR-deconvolution approach. The alginate–NH_4NO_3 SBE sample with the highest conductivity has a transference number t_{ion} of 0.97 which further indicates that the conduction species is a cation.

KEYWORDS

Polymer electrolytes; Amorphous phase; Ionic conductivity; Deconvolution approach