Solid-state double layer capacitors and protonic cell fabricated with dextran from *Leuconostoc mesenteroides* based green polymer electrolyte

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ABSTRACT

Glycerolized dextran-ammonium nitrate (NH_4NO_3) biopolymer electrolytes are prepared by solution cast technique. The addition of 20 wt% glycerol has increased the conductivity value from $(3.00 \pm 1.60) \times 10^{-5}$ S cm^{-1} to $(1.15 \pm 0.08) \times 10^{-3}$ S cm^{-1}. The study of ionic conductivities at high temperature is carried out from 298 K to 353 K and found that the conductivities harmonized with the Arrhenius rule. Results from dielectric analysis have proved that the dielectric constant of the electrolytes has increased as the glycerol concentration is increased. The trend of dielectric analysis follows the conductivity pattern at high temperature. Transference number of the highest conducting electrolyte is found to be 0.97, which proves that ion is the dominant conducting species. From conduction mechanism analysis, the electrolytes obey the correlated barrier hopping (CBH) model. Linear sweep voltammetry (LSV) confirms that the highest conducting electrolyte is suitable to be applied in electrochemical devices with potential stability up to 1.75 V. The fabricated supercapacitor is stable over 1000 cycles with the highest specific capacitance (C_s) of ~15.7 F g^{-1}. The open circuit potential (OCP) for the fabricated protonic cell is ~ (1.40 ± 0.01) V with capacity of 11.6 ± 0.5 mAh.

KEYWORDS

Dextran; Ammonium nitrate; Glycerol; Protonic cell; Biopolymer

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