

***Commiphora mukul* derived natural resin-based biopolymer electrolytes for rechargeable sodium-ion batteries**

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Abstract

Even though sodium-ion batteries (SIBs) are one of the important battery chemistries heavily investigated these days, a primary challenge for their commercial level production is the synthesis of suitable electrolytes with sufficient room temperature ionic conductivities. In this research study, an attempt has been made to synthesize quasi-solid-state electrolytes with *Commiphora mukul* derived natural resin (NR) based biodegradable biopolymer host. After thorough purification process of NR, biopolymer host matrix and NaClO₄ ionic salt were dissolved in 1:1 wt% of Ethylene Carbonate: Propylene Carbonate (EC:PC) plasticizer/solvent mixture to synthesize these quasi-solid-state electrolytes. Among several compositions studied in this work with different ether oxygen to Na⁺ ion ratio, the best conducting composition; NR-NaClO₄-EC-PC (20:30:25:25 wt%); showed a room temperature ionic conductivity of 2.6 mScm⁻¹. As expected, σ vs $1/T$ variation showed Arrhenius behaviour with almost constant activation energies of 0.12 eV for all the compositions studied. DC polarization test clearly exhibits that these NR based electrolytes are dominantly ionic conductors with negligible electronic conductivity; a pre-requisite for a better electrolyte. Cyclic voltammetric studies on best conducting composition showed that the electrolyte is electrochemically stable for a voltage window of 8 V (- 4 to + 4 V). This best conducting composition shows very good promise as a potential candidate for practical applications in rechargeable SIBs.

Keywords: Sodium-ion batteries, Natural resins, Biopolymer electrolytes, Electrochemical impedance spectroscopy and Ionic conductivity

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