Polymer Bulletin
https://doi.org/10.1007/s00289-021-03676-z

ORIGINAL PAPER

Study on novel biopolymer electrolyte *Moringa oleifera* gum with ammonium nitrate

R. Chitra[1] · M. Vengadesh Krishna[2] · S. Selvasekarapandian[2,3]

Received: 1 September 2020 / Revised: 17 February 2021 / Accepted: 20 March 2021

Abstract

A new class of environmental friendly bio-based electrolytes has been synthesized from natural tree gum of *Moringa oleifera* by solution casting technique. An ionic salt of ammonium nitrate (NH_4NO_3) of varying compositions from 0.2 to 0.6 wt % has been used as an additive to optimize the ionic conductivity of Moringa gum (MG) based biopolymer membranes. X-ray diffractograms affirm the enhancement in amorphous nature of the membranes with the addition of salt, and the high degree of amorphous nature is exhibited by the composition of MG (1 g) with 0.5 wt % NH_4NO_3. Complex formation between MG and salt has been studied by Fourier transform infra-red (FTIR). Thermal behavioural study by differential scanning calorimetry (DSC) authenticates the flexibility of the prepared MG-based membrane with NH_4NO_3 by low glass transition temperature. The obtained solid polymer electrolyte MG (1 g) with 0.5 wt % NH_4NO_3 achieved an ionic conductivity as high as 2.66×10^{-3} S cm^{-1} at room temperature and the high ionic transference number of 0.98 is observed for the same. Primary proton cell has been fabricated with the optimum conducting polymer membrane (with a configuration Zn: $ZnSO_4.7H_2O$:Cll MG :0.5 wt % NH4NO_3 Membrane || PbO2: V_2O_5) exhibits an open cell potential of 2.19 V and 1.88 V when shunted through the load resistance of 100 KΩ. Natural tree gum of *Moringa oleifera* as an electrolyte in the primary proton cell has provided a considerable open cell potential of 2.19 V which authenticates the utility of MG as a successful electrolytic material.

Keywords Moringa gum · Biopolymer · Conductivity · Proton battery · Impedance

✉ S. Selvasekarapandian
sekarapandian@rediffmail.com

1 Department of Physics, Kongu Arts and Science College, Erode, Tamilnadu, India

2 Materials Research Center, Coimbatore, Tamilnadu, India

3 Department of Physics, Bharathiar University, Coimbatore, Tamilnadu, India

Published online: 29 March 2021