Journal article volume 80, Issue 9 Polymer Bulletin pages 9437 – 9450

Synergistic effect of agarose biopolymer gel electrolyte with modified TiO2 for low-cost electrochemical device applications

Abstract

The effect of different concentrations of agarose gel electrolyte in a low-cost fabrication of DSSC system was investigated. The modified DSSC was fabricated by a sandwiched method using ITO glass plates as substrates. TiO2-Graphene-coated glass plate was used as the working electrode while PANI-GO-coated glass plate works as a counter electrode, respectively. Both electrodes were separated by agarose gel mixture with KI solution as gel biopolymer electrolyte. The FTIR result showed that peaks of agarose are well observed in the KI-agarose spectra. In the XRD analysis, the combination of KI-agarose has reduced the crystallinity of agarose which was good for ionic conductivity value. The addition of agarose in KI solution also produced a fine channel to facilitate the ionic transfer in electrolyte. The behaviour of electrochemical properties of the system was observed using AC impedance spectroscopy based on the Nyquist plot. From the plot, three semicircles were observed as the responses at different frequencies. It was observed that the 5 wt% agarose electrolyte in DSSC system was selected as the optimum loading exhibiting the lowest resistivity ensuring the faster electron transfer and giving the ionic conductivity of 9.04 × 10−1 S/cm. The ionic conductivity of the system was dropped at 2.21 × 10−1 S/cm as the percentage of agarose was increase to 6 wt%.