Synthesis of highly efficient copolymer based quasi solid electrolyte: Electrochemical and photovoltaic properties

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The quasi or solid polymer electrolyte have recently attracted electrolyte materials owing to their advantages including high ionic conductivities which are achieved by "trapping" a liquid electrolyte in polymer cages formed in a host matrix, good contacting and filling properties of the nanostructured electrode and counter electrode. In this work, the copolymer of Polybutyl acrylate (PBA) and polyacrylonitrile (PAN) was prepared by thermal polymerization of butyl acrylate and acrylonitrile monomers at 80^{o}C under vacuum condition. The prepared PAN-co-PBA was further heated at 100^{o}C to avoid any impurities in the copolymer and used as gel polymer electrolyte for dye sensitized solar cells (DSSCs). Importantly, the presence of carboxylate group in copolymer was acted as superabsorbent to organic liquid/solvent in the redox electrolyte which significantly improved the physical, mechanical and ionic conductivity properties of gel polymer electrolytes. From Raman analysis, the prepared PAN-co-PBA gel electrolyte obtained the larger generation of I_3^- ions in the redox electrolyte. The obtained gel polymer electrolyte presented the highest ionic conductivity of 3.86 x 10^{-3} S/cm, resulting in the good support in the charge transportation from electrolyte layer and conduction layer of cells and improved the interfacial contact with working electrode to electrolyte layers. The fabricated DSSCs with PAN-co-PBA gel electrolyte showed reasonably high conversion efficiency of 4.5% which is much comparable value to other polymer electrolyte based DSSCs. The enhanced photovoltaic performance attributed to the high thermal, improved morphological, ionic conductivity and gelation properties of gel PAN-co-PBA electrolytes.