

Polyacrylonitrile grafted cassava starch and its chemical modification with hydroxylamine hydrochloride

ABSTRACT

The graft copolymerization of acrylonitrile (AN) onto cassava starch (CS) with sodium bisulphite and potassium persulphate (KPS) as initiators was prepared. AN was grafted with gelatinized cassava at 70°C via redox method. The monomer ratios and reaction temperature were varied to obtain the maximum grafting efficiency and high grafted yield. The maximum grafting efficiency (91%) and grafted yield (93%) were attained at 50°C with ratio AN:CS 3:1 in 3 h. Poly(AN-grafted (g)-CS) was then modified with hydroxylamine hydrochloride (NH₂OH.HCl) to convert the nitrile group into absorbing characteristic properties. The poly(AN-g-CS) and amidoxime-modified poly(AN-g-CS) were characterized by Fourier transform infrared (FT-IR) spectroscopy, scanning electron microscopy, thermal gravimetric analysis (TGA) and Brauner-Emmet-Teller. The IR spectra proved that the grafting of AN onto CS was successful and the poly(AN-g-CS) was successfully modified with NH₂OH.HCl. It was shown that the specific surface area, pore volume and average pore diameter of CS were increased from 54.75 m².g⁻¹, 245.39 m².g⁻¹, 0.336 cm³.g⁻¹ to 0.843 cm³.g⁻¹ and 3.95 nm to 13.02 nm, respectively. TGA analysis proved that poly(AN-g-CS) and amidoxime-modified poly(AN-g-CS) are thermally more stable compared to CS.

Keyword: Cassava starch; Acrylonitrile; Graft copolymerization; Chemical modification; Hydroxylamine hydrochloride