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Thermal and mechanical properties of graphene oxide nanocomposite hydrogel based on poly (acrylic acid) grafted onto amylose

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Abstract

In the present study, a nanocomposite hydrogel was synthesized based on poly (acrylic acid) grafted onto amylose (PAA-g-amylose) which was containing different loadings of graphene oxide (GO) nanosheets. The structural properties of optimized sample were characterized by X-ray analysis (XRD) and Fourier transform infrared spectroscopy (FTIR). The thermal and mechanical behaviors of synthesized hydrogel were investigated by thermal gravimetric analysis (TGA), differential scanning calorimetry (DSC) and tensile testing. XRD and scanning electron microscopy study demonstrates the formation of highly exfoliated GO layers and its homogenous dispersion throughout the polymer matrix with 3 and 5wt% GO. However, the intercalated structure is predominant with 5wt% GO. The homogenous and the strong interaction of the GO layers and the PAA-g-amylose hydrogel matrix induced the significant improvement in thermal and mechanical properties of the nanocomposite hydrogel. The tensile strength and elastic modulus of the nanocomposite hydrogel increased by 124% and 26%, respectively with 3wt% GO loading. The thermal stability improved by 67°C and T_g shifted higher temperature by 53°C at 5wt% GO loading, compared to the pristine hydrogel matrix.

Keywords: PAA-g-amylose, GO, hydrogel, thermal stability, mechanical properties, nanocomposite

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