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Development and characterization of environmentally friendly high performance polymeric nanocomposite blends of cellulose acetate, poly(lactic acid) and polyurethane

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The discovery of biopolymers, several years ago have received great interest as biodegradable-biocompatible material for several applications. Cellulose acetate, poly(lactic acid) and polyurethane are widely employed biopolymers owing to their interesting characteristics. However, CA and PLA exhibit poor mechanical properties. Nanoreinforcement is incorporated into CA/PLA and CA/PU matrices in order to overcome their brittle nature and to improve their properties. This research focused studying the effect of blending PLA and PU with CA at different ratios to form new CA/PLA and CA/PU blend using solvent casting method. The second aspect of this study is studying the incorporation of nanoreinforcement material, functionalized graphene nanoplatelets, at different ratios to form new CA/PLA/0.5 wt% GNPS-COOH and CA/PU/0.5 wt% GNPS-COOH nanocomposites using solvent casting method. All prepared samples were investigated through stress- strain measurements, FT-IR, DSC, TGA, SEM and dry thermal degradation. GNPS- COOH nanocomposites exhibited the best mechanical behavior for all samples. TGA analysis revealed a slight improvement in the thermal stability. DSC analysis showed no effect on thermal stability. SEM showed uniform distribution of the nanofiller in the matrices. The biodegradation of the nanocomposites when placed in an oven at 100 oC was investigated and it was observed that complete degradation occur at day 14.

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