

PREPARATION AND CHARACTERIZATION OF BIODEGRADABLE POLYMER BLENDS NANOCOMPOSITES WITH FUNCTIONALIZED TiO₂ AS A FILLER

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ABSTRACT

The purpose of this study was to investigate the morphology, thermal, mechanical and thermo-mechanical properties of biodegradable polymer blends of Polylactic acid (PLA)/poly(3-hydroxybutyrate-co-3-hydroxyvalerate)(PHBV) at 70/30, 50/50 and 30/70 w/w ratios and nanocomposites with Amino propyl trimethoxy silane (APTMS) and toluene diisocyanate (TDI) functionalized titanium dioxide (TiO₂) (1, 3 and 5 wt%). The samples were prepared using Brabender Plastograph at 170 °C at a speed of 50 rpm over a time period of 10 minutes. They were further extruded with a single screw extruder at 50 rpm and temperature profile of 160, 165, 170 and 170 °C to get thin films. The synergistic effects of APTMS and TDI functionalized TiO₂ on the properties of polymer blends were characterized using different techniques.

The morphology, dispersion and localization of the functionalized nanofillers were investigated using Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), contact angle measurements and Melt-flow tester. The effect of the addition of functionalized nanofillers in the PLA/PHBV blends glass transition, melting, enthalpies, degree of crystallinity and crystallization behavior at different filler content were investigated using Differential scanning calorimetry (DSC).. The thermal degradation, stability and thermal degradation volatilization during thermal analysis were investigated using Thermogravimetric analysis (TGA) and TGA coupled with Fourier transform irradiation spectroscopy (FTIR). Thermomechanical, and mechanical properties of the samples were studied using Dynamic mechanical analysis (DMA) and Tensile testing.