

PREPARATION AND CHARACTERISATION OF BIODEGRADABLE PLA/PHBV, PLA/PCL AND PHBV/PCL POLYMER BLENDS AND THEIR NANOCOMPOSITES WITH TiO₂ AS FILLER

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ABSTRACT

Poly(lactic acid (PLA)/poly(hydroxybutyrate-co-valerate (PHBV), poly(lactic acid(PLA)/poly(ε-caprolactone (PCL), and poly(ε-caprolactone (PCL)/poly(hydroxybutyrate-co-valerate (PHBV) blends containing small (1, 3, 5%) amounts of TiO₂ nanoparticles were investigated. The blends and nano-composites were prepared by melt mixing using a Brabender plastograph at 170 °C at a speed of 60 rpm. The PLA and PHBV were pre-dried in an oven at 80 °C for four hours prior to mixing to remove any absorbed water. The blends were prepared at 90/10, 70/30, 50/50, 30/70, 10/90 concentrations. TiO₂ nanoparticles (functionalised and unfunctionalised) were used as a filler. The effect of blending of these biodegradable polymers and the presence of the nanoparticulate filler for each system was investigated using different techniques.

The morphologies of the blends and nanocomposites were studied using scanning electron microscopy (SEM), and Fourier-transform infrared (FTIR) spectroscopy. The miscibility of the samples was investigated using differential scanning calorimetry (DSC), and the thermal degradation and stability of the samples were investigated using thermogravimetric analysis (TGA) together with TGA-FTIR techniques. The mechanical and thermo-mechanical properties were studied using tensile testing and dynamic mechanical analysis (DMA). Different biodegradability test methods were used to investigate the biodegradability of the different blends and nanocomposites.