STRUCTURE AND PROPERTIES OF PLA/PCL BLEND NANOCOMPOSITES WITH $Mg(OH)_2$ AND APTMS-TiO_2

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ABSTRACT

Biodegradable polymer blends of polylactic acid (PLA) and polycaprolactone (PCL) containing small amounts of magnesium hydroxide ($Mg(OH)_2$) (1, 3, 5, 10%) and (3-aminopropyl)trimethoxysilane functionalized titania (APTMS-func-TiO_2) nanoparticles (1, 3, 5%) as fillers were investigated. Preparation of the blends and nanocomposites was done through melt mixing, using a Brabender Plastograph at 190 °C at a speed of 60 rpm. Prior to mixing, the materials were stored at 50 °C over a period of 24 hours, to remove any residual water. Various ratios (70/30, 50/50 and 30/70) were used to prepare the blends, as well as the nanocomposites. The effects of $Mg(OH)_2$ and APTMS-func-TiO_2 nanoparticles as fillers on the properties of PCL and PLA blends were investigated using different techniques.

The morphology of the blends and blends nanocomposites, together with the distribution, localisation of $Mg(OH)_2$ and APTMS-func-TiO_2 nanoparticles were investigated using scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier Transform infrared (FTIR), contact angle measurements, and melt flow testing. Differential scanning calorimetry (DSC) was used to study the miscibility and any changes in crystallinity of the blends and blends nanocomposites, with the presence of $Mg(OH)_2$ and APTMS-func-TiO_2 nanoparticles. The thermal stability of all the blends and nanocomposites was investigated using thermogravimetric analysis (TGA) and degradation volatilization was monitored using TGA-FTIR. The thermomechanical and rheological properties were determined using Dynamic mechanical analysis (DMA).