

Rheological and Morphological Studies of Polylactide/Clay Nanocomposites Blown Film

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Poly(lactic acid) (PLA) is a highly versatile biodegradable polymer derived from 100% renewable resources. Three types of PLA nanocomposites containing 1, 3 and 5 phr of nanoclay were compounded in a co-rotating twin screw extruder, to study the effect of nanoclay content on film processability of composites as well as properties of blown films. During compounding, film blowing processing conditions such as temperature, rpm, feed rate, air pressure and nip roll speed were optimized. Differential scanning calorimetry (DSC) data showed that the cold crystallization and melting temperatures were influenced by the presence of nanoclay. The thermogravimetric analysis (TGA) showed increase in the decomposition temperature for all the nanocomposites. The measurement of rheological properties of Polylactide/nanoclay helped in understanding the processability as well as structure-property relationship in nanocomposites. Temperature dependent (DMTA) and Frequency dependent (Oscillatory shear Rheology) viscoelastic spectra showed an increase in the storage and loss moduli with the increase of the organoclay content. Wide angle X-ray diffraction (WAXD) and Transmission electron microscopy (TEM) were used to determine the degree of intercalation and exfoliation as a function of nanoclay content of nanocomposites. XRD data showed complete exfoliation in the film at lower nanoclay content. On increasing the nanoclay content the exfoliated and partially intercalated structure were obtained. Nanocomposites blown film specimen showed the improvement in barrier and mechanical properties.