Preparation and characterization of polyhydroxybutyrate/polycaprolactone/Mg-Al layered double hydroxide nanocomposites

ABSTRACT

Anionic clay Mg-Al Layered double hydroxide (Mg-Al LDHs) of Mg/Al-NO3 - with M2+:M3+ (3:1) ratio was synthesized by co-precipitation method from nitrate salt solutions were used with continuous agitation at constant pH 9. Beside, modification of nitrate anions by stearate anions between the LDH layers had carried out through ion exchange reaction. Polyhydroxybutyrate (PHB)/Polycaprolactone (PCL)/stearate Mg-Al Layered Double Hydroxide (LDH) nanocomposites were prepared via solution casting intercalation method. FT-IR spectra showed the presence of carboxylic acid (COOH) group indicates that stearate anions were successfully replacing the nitrate anions in the interlayer Mg-Al LDH. The XRD results showed that increasing basal spacing from 8.66 to 32.97 Å in modified stearate Mg-Al LDH. Additional of 1.0 wt % stearate Mg-Al LDH resulting higher basal spacing where polymer chain intercalated into interlayer LDH and TEM results revealed that the 1.0 wt % stearate Mg-Al LDH layers are homogeneously distributed in the PHB/PCL polymer blends matrix. TGA characterization proven that 80PHB/20PCL/1stearate Mg-Al LDH has lower weight loss and higher thermal stability. Enhancement in 300% elongation at break and 66% tensile strength in the presence of 1.0 wt % of the stearate Mg-Al LDH as compare with PHB/PCL blends. Scanning electron microscopy (SEM) proved that clay improves compatibility between polymer matrix and the best ratio 80PHB/20PCL/1stearate Mg-Al LDH surface was well dispersed and stretched before it breaks.