ABSTRACT:

The environmental aging behaviour of montmorillonite (MMT) filled polylactic acid (PLA) nanocomposites (PLA/MMT) and linear low density polyethylene (LLDPE)-toughened PLA (PLA/LLDPE ratio = 90/10) nanocomposites (PLA/LLDPE/MMT) were investigated in this study. The nanocomposites were subjected to water absorption, hygrothermal degradation and soil burial analysis. Both PLA/MMT and PLA/LLDPE/MMT nanocomposites were immersed in distilled water at three different temperatures (room temperature, 60, and 90 °C) and the weight difference before and after immersion was calculated. The kinetics of water absorption for both nanocomposites followed the Fick's second law of diffusion, where a linear relationship exists between the initial moisture absorption at any time t and t 1/2 (the square root of time), followed by a horizontal plateau (saturation). The equilibrium moisture content (M m ) and diffusion coefficient (D) of PLA nanocomposites increased with the addition of MMT (2 phr) and LLDPE. However, the D values of both nanocomposites decreased by increasing MMT (4 phr). The M m for PLA/MMT and PLA/LLDPE/MMT nanocomposites increased by increasing immersion temperature (60 °C) and prolonged immersion resulted in hygrothermal degradation of both nanocomposites. The hygrothermal degradation studies showed that PLA degrades much faster at 90 °C as compared to 60 °C in both the nanocomposites. The addition of MMT and LLDPE improved the hygrothermal stability of PLA in both nanocomposites. Soil burial test revealed deterioration of impact strength in all samples while the rate of biodegradation was retarded in the presence of MMT and LLDPE.