

Abstract

Low density polyethylene (LOPE) is an important industrial material because it's durable, light-weight, easily processed and characteristically inert, but its everyday use is hazardous to the environment. The solution to this seems to lie in modification of the structure through blending with biopolymers. LOPE/starch blends have undesirable properties; they have weak structural rigidity, very low thermal stability and high diffusivity. Cellulose is linear, rigid and has a higher thermal stability and diffusivity hence effective in reinforcement of high density polyethylene and polypropylene. This research studied the properties of LOPE/cellulose blends and the effects of inoculating these blends with *Aspergillus niger* on their mechanical, diffusion and thermal degradation properties in order to evaluate their biodegradability. Compression molded blends were exposed to *Aspergillus niger* for 60 days. Diffusion measurements were done at room temperature and mass difference monitored every 7 days for 42 days. Thermal degradation analysis was carried out within a temperature range of 25 to 550°C at a heating rate of 5°C/min. Dynamic mechanical analysis was carried out in the frequency range from 1 to 30 Hz and temperature range from -30 to 90°C. Creep measurements were performed at 30, 40, 50 and 60°C. The samples were displaced for 12 minutes and allowed to recover for another 12 minutes. Water intake increased with cellulose loading. Diffusion behavior was Fickian and diffusion coefficients increased from 1.24×10^{-8} to 1.79×10^{-8} cm²/s with cellulose loading, and further to 2.01×10^{-8} cm²/s on inoculation. Two decomposition stages corresponding to low density polyethylene and cellulose decomposition were observed. Thermal stability of the blends decreased with cellulose loading (thermal activation energy decreased from 86.42 to 33.52 kJ/mol) and further on inoculation (27.4kJ/mol). Two relaxation zones (a and ~) were observed. The a process was a main chain motion and was well described by the Vogel Fulcher Tamman model. while B process was a local process due to interlamellae shearing. Intensities of the storage and loss modulus increased with cellulose loading and decreased on inoculation. Creep performance of the samples improved with cellulose loading (from 10 GPa to 13 GPa at 60°C) and deteriorated on inoculation to 0.065GPa. Time temperature superposition was used to predict creep behavior of the samples up to 106 s. William Landel Ferry model was obeyed by the shift factors. Blending Low density polyethylene with cellulose improves its structural rigidity, hydrophilicity and lowers its thermal stability. When the blends are inoculated, their rigidity and thermal stability decreases while hydrophilicity increases, indicating improved biodegradability. Use of cellulose as a biofiller in packaging

membranes and plastics based on LOPE as well as their inoculation with *Aspergillus niger* before disposal or incineration should be adopted to minimize environmental pollution.