Effects of Poly(Dimethyl Siloxane) on the Water Absorption and Natural Degradation of Poly(Lactic Acid)/Oil-Palm Empty-Fruit-Bunch Fiber Biocomposites

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ABSTRACT

Composites were fabricated with poly(lactic acid) and oil-palm empty-fruit-bunch (EFB) fibers with extrusion; this was followed by an injection-molding technique. Before compounding, the surface of the fiber was modified through ultrasound and poly(dimethyl siloxane) (PDMS). The influences of the ultrasound and PDMS on the water absorption and biodegradability of the composites were investigated. Additionally, the composites were buried under soil for 6 months, and their biodegradability was assessed through different characterization techniques, such as tensile testing and weight loss and diffussability measurement. The changes on the surface of the fibers due to treatment were examined by scanning electron microscopy analysis, and the influences on the biodegradability of the composites were observed. Functional group analysis and possible changes before and after degradation were also examined by a Fourier transform infrared spectrophotometric technique. The results analyses revealed that the treatment of fibers improved the density of the fibers and reduced the water uptake of the composites. The overall weight loss due to soil burial testing was found to be maximum for the untreated-fiber-based composites (6.8%), whereas the ultrasound- and silane-treated composites showed the minimum value of weight loss (3.7%). The deterioration of the tensile strength due to degradation was found to be at a maximum for the untreated-fiber-based composite (27%), whereas the ultrasound- and silane-treated-fiber-based composites showed a minimum value of 8%.

KEYWORDS: biodegradable; composites; extrusion; fibers; properties and characterization

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