Mechanical, interfacial, and fracture characteristics of poly (lactic acid) and Moringa oleifera fiber composites

Islam, M.R.[a] , Isa, N.[a], Yahaya, A.N.[a], Beg, M.D.H.[b], Yunus, R.M.[b]

Abstract

Three different processing techniques, extrusion, injection, and compression, were followed to fabricate poly (lactic acid) (PLA) and Moringa oleifera fiber (MOF) based composites. Chopped fibers of length 3-5 mm were used for the extrusion followed by injection molding, whereas long-length fibers (~100 mm) were used for compression molding process. For compression molding, long-length fibers were spread in single and double layers. The interfacial shear strength of the composites was evaluated by fiber pull-out testing. Composites were characterized for fracture behavior and mechanical properties. Additionally, surface morphology was also observed by scanning electron microscopy, whereas crystalline properties were evaluated by X-ray diffraction analysis. Analyses revealed that compression molding with double layers of long-length fibers reinforcement showed better properties than other samples. Tensile strengths of extruded and compression processed samples (double-layered) were 75.5 and 81.1 MPa, which are approximately 33% and 44% higher respectively than neat PLA (56.5 MPa). The crack generation of PLA during applied load was observed and found eliminated for the double-layered sample processed via compression molding. It was found that compression molding with double layer can be considered as easy and less time-consuming method for composite preparation, with nearly 8 wt.% of less fiber consumption compared with extrusion/injection molding. © 2017 Wiley Periodicals, Inc.

Author keywords

Compression molding; Extrusion molding; Injection molding; Moringa oleifera fiber; Poly (lactic acid)