Natural fiber-reinforced hybrid polymer nanocomposites: effect of fiber mixing and nanoclay on physical, mechanical, and biodegradable properties

ABSTRACT

Combining two kinds of fibers is a potential way to improve the essential properties of natural fiber-reinforced hybrid polymer composites. Biocomposites produced from natural resources are experiencing an increase in interest due to their high demand in the market for manufacturing, in addition to environmental and sustainability issues. In this study, natural fiber-reinforced hybrid polymer nanocomposites were prepared from coir fiber, wood fiber, polypropylene, and montmorillonite nanoclay using a hot press technique. The effects of fiber mixing and montmorillonite on their physico-mechanical and biodegradable properties were subsequently investigated. Before being used, both the wood and the coir fibers were alkali-treated to reduce their hydrophilicity. The mechanical properties of the fabricated composites were measured using a universal tensile testing machine and found to be enhanced after fiber mixing and nanoclay incorporation. Fourier transform infrared spectra indicated that the characteristic peaks of the composites shifted after fiber mixing. A new peak around 470 cm-1 was observed in the case of the nanocomposites, which confirmed the interaction between the fiber, polymer, and montmorillonite (MMT). Scanning electron microscopic analysis revealed that MMT strongly improved the adhesion and compatibility between the fiber and polymer matrix. The combining of fibers improved the biodegradability and water absorption properties, while MMT addition had the reverse effect on the same properties of the composites.

Keyword: Fiber mixing; Hybrid nanocomposites; Mechanical strength; FTIR; SEM; Biodegradability