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Tensile, thermal properties, and biodegradability test of paddy straw powder-filled polyhydroxybutyrate-3-valerate (PHBV) biocomposites: Acrylation pretreatment

Abstract

The mechanical, thermal, and biodegradability properties of paddy straw powder (PSP)-filled polyhydroxybutyrate-3-valerate (PHBV) biocomposites were investigated. The impacts of chemical alteration of PSP via acrylic acid treatment were examined as well. The outcomes of the study portrayed a decrease in the elongation at break and tensile strength when the filler loading increased; however, the modulus elasticity of composites could be seen to increase. Chemical alteration of PSP via acrylic acid enhanced modulus elasticity of the biocomposites and tensile strength; nevertheless, the elongation at break was decreased. Thermogravimetric analysis demonstrated the enhancement of thermal stability of the biocomposites via PSP compared to neat PHBV. The thermal stability of the biocomposites was positively affected by chemical alteration of PSP. Meanwhile, DSC analysis proved that the melting temperature (T m) of the biocomposites was not altered when the filler was added. Treated biocomposites demonstrated higher crystallinity (30.18%) compared to the untreated composites (26.24%). Biodegradability test showed the strains from both Aspergillus species have the potential to degrade PHBV/PSP biocomposites. The weight loss of biocomposites after undergoing fermentation with Aspergillus fumigatus strain SGE57 and Aspergillus niveus isolate A17 was 2.42% and 3.65%, respectively.

Keywords

Acrylic acid; Biocomposites; Biodegradability; Paddy straw powder; PHBV