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Thermal-chemical and biodegradation behaviour of alginic acid treated flax fibres/ poly(hydroxybutyrate-co-valerate) PHBV green composites in compost medium

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Abstract

In this study, thermal-chemical and biodegradation behaviour of green composites based on flax fibres untreated and treated with alginic acid treated, and poly hydroxybutyrate-co-valerate (PHBV) were studied under composting conditions. The biodegradability of PHBV composites and neat PHBV were assayed by monitoring CO2 production from polymeric carbon under controlled aerobic composting conditions as per ASTM D5338 standard. During the biodegradation process, PHBV composites thermal-chemical and morphology properties were characterized by thermogravimetric analysis (TGA), fourier transform infra-red (FT-IR) and scanning electron microscopy (SEM) techniques. The ultimate biodegradation (mineralization) study results showed alginic acid treated flax/PHBV composites has higher rate of degradation than untreated flax/PHBV composite and neat PHBV. TGA analysis indicated that an increased t-onset temperature for alginic acid treated flax fibres/PHBV composites which was mainly due to the influence of 2% sodium alginate treated with flax fibres. FTIR results showed the increased degradation of PHBV composites was due to the hydrolytic chain scission mechanisms influenced by presence of alginic acid and flax fibres as compared to neat PHBV matrix. Morphological SEM analysis showed PHBV composites biodegradation were readily attacked by fungus but rather PHBV degradation by bacteria. This study found that the incorporation of flax fibres into PHBV matrix provides a benefit to the green composites with enhanced biodegradability.