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Evaluation of mango byproduct as a low-cost filler for poly(3-hydroxybutyrate-co-3-hydroxyvalerate) biocomposites

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The global awareness with environmental and sustainable issues has increased the demand for bio-based and/or biodegradable products. Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) has attracted much attention as biocompatible and biodegradable thermoplastic with potential application in several fields, such as agriculture, food packaging and medicine. PHBV-based biocomposites are investigated in order to improve PHBV thermal and mechanical properties and to reduce its production cost. Brazil is one of the eight largest producers of mango in the world. However, mango´s agribusiness generates a large amount of by-products (peels and seeds), which represents approximately 40-60% of total weight of the fruit. The goal of this work was to evaluate polymer-filler interaction in compression molded PHBV/mango by-product films aiming to use this agroindustrial by-product as filler for PHBV bioplastics. PHBV films containing 0, 5 and 10%wt mango by-product (PHBV0, PHBV5 and PHBV10, respectively) were prepared and characterized by thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), scanning electron microscopy (SEM) and low-field nuclear magnetic resonance (NMR) relaxometry, by measurement of hydrogen spin-lattice relaxation time (T1H). The addition of filler increased the thermal stability of PHBV films. DSC analysis indicated that the by-product may have acted as nucleating agent of PHBV and that the film loaded with 5%wt by-product presented the highest crystallinity. NMR relaxometry analysis verified the presence of PHBV-filler intermolecular interaction, which promoted good dispersion and distribution of the filler in the polymeric matrix. The results indicated that mango by-product is a suitable filler for compression-molded PHBV films. Then, the manufacture of PHBV/mango by-product-based bioplastics may be a potential strategy for the reuse of this agroindustrial waste.