EVALUATION OF THERMAL BEHAVIOR IN POLY(3-HYDROXYBUTYRATE)/HYDROXYAPATITE NANOCOMPOSITES FOR BIOMATERIAL APPLICATIONS

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Abstract: Poly(3-hydroxybutyrate) (PHB) is a biopolymer synthesized by bacterias. This polymer presents some interesting properties that are important to tissue engineering as biodegradability, bioabsorbable, non-toxicity and it also decomposes to 3-hydroxybutyric acid, a common constituent of human blood. On the other hand, PHB presents some disadvantages as low compressive modulus and degradation rates, as well as poor bioactivity. There were some attempts to improve the PHB bioactivity and some of its mechanical properties with the addition of ceramic materials, as hydroxyapatite. It is known that hydroxyapatite is the ceramic most like the mineral part of the bone, and due to that fact, it can present a good osteogenic activity. The aim of this work was to obtain nanocomposites based on hydroxyapatite and poly(3-hydroxybutyrate) by solution casting method. Thermal behavior of three different amounts of hydroxyapatite nanoparticles and neat PHB (0, 0.05, 0.20 and 0.50 wt%) were investigated by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). The TGA was used to analyze the influence of hydroxyapatite nanoparticles in the PHB thermal stability and the DSC was used to evaluate the changes in the thermal transitions and PHB crystallization. The data obtained by TGA shows that the incorporation of hydroxyapatite nanoparticles seems to catalyze the decomposition of PHB in the range of 10 °C for 0.05 wt% and as concentration increases the thermal stability is improved. The DSC results showed that the nanoparticles acted as nucleant agent for all compositions and this corroborates the increase in the crystallinity degree. The materials also presented modifications in the characteristics of the crystals formed.

Keywords: Poly(3-hydroxybutyrate), Nanohydroxyapatite, Bionanocomposites, Thermal properties