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Effect of the Erucamide-Montmorillonite nanocomposite (EU/MMT) on the mechanical properties and on the friction coefficient of the High-Density Polyethylene/Hydroxyapatite Nanoparticle composite (HDPE/HA)

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Polymeric composites containing hydroxyapatite have been applied for the manufacture of bone joint prostheses due to the advantages offered by the polymeric matrices, such as chemical stability, non-toxicity and good mechanical properties, and due to the biocompatibility of hydroxyapatite, which favors the osseointegration process. For these composites, one of the great challenges has been to reduce the coefficient of friction of their surfaces, with the main objective of increasing the mechanical resistances when applied as joint prostheses and, therefore, increasing the useful life of the elements manufactured with these materials. Considering these challenges, this work aimed to obtain and characterize a composite made of High-Density Polyethylene (HDPE) and Hydroxyapatite (HA) with a nanocomposite made of erucamide and montmorillonite (EU/MMT). The incorporation of the nanocomposite aimed to make the HDPE matrix compatible with the EU, considering that the EU is applied to reduce the friction coefficient of the polymer. In this process, it was considered that montmorillonite is a compatibilizer of erucamide molecules with the hydroxyapatite and HDPE phases. In the studies, the effects of the nanocomposite concentration on the friction coefficient and on the mechanical properties when subjected to tensile and bending stresses were evaluated. Thermal analysis, infrared spectroscopy and analysis with scanning electron microscopy and atomic force microscopy, were applied to carry out more detailed studies regarding the properties of the EU/MMT nanocomposite and the surface characteristics of the specimens. The results indicated that it is possible to reduce the friction coefficient of the HDPE/HA composite with the use of the nanocomposite, without impairing the mechanical properties. These results enhance the use of HDPE/HA as a material that can be applied to the manufacture of bone joints, even replacing traditional polymeric composites for this purpose.