Development of Polylactic Acid Incorporated Hydroxyapatite Composite for Bio-medical Applications

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Hydroxyapatite (HA) is one of the extensively used materials for bone replacements and tooth fillings because of its chemical and structural similarity to the main mineral component of human bone and teeth. However, poor mechanical properties such as load bearing ability limits the applications of pure hydroxyapatite. Developing new composite materials incorporating polymer into porous pure hydroxyapatite could significantly improve the mechanical properties of HA enabling it to be used in more load bearing applications. Polylactic acid (PLA) is a widely used biopolymer in biomedical engineering due to its excellent biocompatibility and biodegradability. In this study, we have developed a polymer-HA composite by incorporating PLA into hydroxyapatite matrix derived from Sri Lankan rock phosphate. This was done at room temperature. PLA was dissolved in dichloromethane and mixed with hydroxyapatite by constant stirring. Then the mixtures were left for drying at room temperature for 24 hrs. The developed material was then characterized by Fourier Transform Infrared (FTIR) spectroscopy, XRay diffraction (XRD) and Differential Scanning Calorimetry (DSC). FTIR results indicated that PLA has successfully incorporated into the HA matrix to form a stable composite. XRD spectra confirmed that the PLA-HA composite has a crystalline structure. DSC analysis showed that the developed PLA-HA composite has a higher thermal stability. The composite developed in this study has the potential of using in various biomedical applications and would bring more economic value to Sri Lankan rock phosphate.

Keywords: Hydroxyapatite, Polylactic acid, FTIR, XRD, DSC