PRODUCTION OF HYDROXYAPATITE NANOPARTICLES FOR BIOMEDICAL APPLICATIONS

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The Hydroxyapatite (HAP, $Ca_{10}(PO_4)_6(OH)_2$) is one of the most attractive materials for bone implant due to its compositional and biological similarity to native tissues, therefore it has been extensively studied and applied in various fields. Bone is an inorganic–bioorganic composite material consisting mainly of collagen proteins and HAP, and its properties depend intimately on its nano-scale structures. The biomaterials scientists are especially interested in the structure, surface roughness, chemistry, and mechanical properties of biomaterials with biological matter. The mineral in bone is comprised of nanosized crystals that are smaller than in dental enamel, so that many of the constituent ions occupy surface, or near-surface positions. The result is that there are greater uncertainties about the crystal structure of bone mineral, compared with dental enamel. The physical structure of a biomaterial is now known to be a key factor that determines cellular responses and hence the range of biomedical applications suitable for a material.

The production of HAP samples were doing as follows: a 50 m of $Ca(NO_3).4H_2O$, 0,167M, solution were slowly (1,5 m /min) mixed to a 50 m of $(NH_4)_2HPO_4$, 0.1M, solution under continuos stirring. The pH control was maintained at 10.4 during the mixture using a solution of NH_4OH. Two different temperatures of the reactions were tested, 25ºC and 15ºC and after the total mixture, the ending solution was kept at room temperature during different maturation times (5, 25, 50, 100, 150 and 960hs). The obtained gels were washed with distilled water, filtered and dried. The calcinations step was done at 550ºC for 2hs, using a heating rate of 10º C/min.

XRD analysis of HAP samples was carried out with a RIGAKU PC-DMAX diffractometer using Cu*K* radiation at 40 kV and 40 mA. The samples were scanned from 10 -70 degrees in steps of 0.02 degree with 5s of counting time per point,. These XRD patterns were compared with the International Centre of Diffraction Data (ICDD) files. The crystal structure of the samples was refined using the Rietveld method in the DBWS software.The AFM images were obtained in the contact mode in a CP Research, Thermoscope – Veeco SPM microscope.

Using the occupation factor of the Ca and P sites, it is possible to calculate the [Ca]/[P] ratio for each sample and the results are shown the ratios ranged from 1.699 to 1.833 and the expected [Ca]/[P] ratio was 1.67, according to the chemical formula of HAP.

For the image of AFM (figures 1) confirmed who the agglomerates were HAP particles in nanometer scale, with average size in ~32,65 nm.