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Determination of the Structural Parameters of Calcium Phosphate for Biomedical Use

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Abstract : Calcium phosphate ($Ca_5(PO_4)_3(X)$) is widely used in orthopedic applications and is widely used as powder and granules. However, their presence in bone is in the form of nanometric needles 60 nm in length with a non-stoichiometric phase of apatite contains CO_3^{2-}, Na^+, OH^-, F^-, and other ions in a matrix of collagen fibers. The crystal size, morphology control and interaction with cells are essential for the development of nanotechnology. The structural results of calcium phosphate, synthesized by chemical precipitation with crystal size of 22.85 nm are presented in this paper. The calcium phosphate powders were analyzed by X-ray diffraction, energy dispersive spectroscopy (EDS), infrared spectroscopy and FT-IR transmission electron microscopy. Network parameters, atomic positions, the indexing of the planes and the calculation of FWHM (full width at half maximum) were obtained. The crystal size was also calculated using the Scherer equation $d(hkl) = c\lambda/\beta\cos\Theta$. Where c is a constant related to the shape of the crystal, the wavelength of the radiation used for a copper anode is 1.54060Å, Θ is the Bragg diffraction angle, and β is the width average peak height of greater intensity. Diffraction pattern corresponding to the calcium phosphate called hydroxyapatite phase of a hexagonal crystal system was obtained. It belongs to the space group P63m with lattice parameters a = 9.4394 Å and c = 6.8861 Å. The most intense peak is obtained $2\Theta = 31.55$ (FWHM = 0.4798), with a preferred orientation in 121. The intensity difference between the experimental data and the calculated values is attributable to the temperature at which the sintering was performed. The intensity of the highest peak is at angle $2\Theta = 32.11$. The structure of calcium phosphate obtained was a hexagonal configuration. The intensity changes in the peaks of the diffraction pattern, in the lattice parameters at the corners, indicating the possible presence of a dopant. That each calcium atom is surrounded by a tetrahedron of oxygen and hydrogen was observed by infrared spectra. The unit cell pattern corresponds to hydroxyapatite and transmission electron microscopic crystal morphology corresponding to the hexagonal phase with a preferential growth along the c-plane was obtained.

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