EFFECT OF Mn DOPING ON HYDROLYSIS RATE AND DISSOLUTION OF ALPHA-TRICALCIUM PHOSPHATE

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Calcium phosphates (CPs) are the main constituents of bones and teeth and play an essential role in human life. Due to the similarity to the mineral phase of bones and excellent biocompatibility, different synthetic CPs have been widely applied as biomaterials for bone repair [1]. α-Tricalcium phosphate ($Ca_3(PO_4)_2$, α-TCP) is one of the representative biomaterials, which finds an application in bone cements due to its excellent resorbability and osteoconductivity [2]. α-TCP crystallizes in the monoclinic crystal system with the space group $P2_1/a$ and lattice parameters a = 12.887 Å, b = 27.280 Å, c = 15.219 Å, and β = 126.20°. The unit cell contains 312 atoms, where the number of crystallographically inequivalent sites is 18 for Ca, 12 for P, and 48 for O [3; 4]. The solubility of α-TCP is intermediate between orthophosphates, however it is much more reactive in aqueous solutions and easily hydrolyzes with a formation of calcium deficient hydroxyapatite ($Ca_{10-x}(PO_4)_{6-x}(HPO_4)_x(OH)_{2-x}$), which is similar to bone hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$, HA) [5].

It is well known that doping at even very low levels can drastically affect physical and morphological properties of different materials, including TCP [6; 7]. At the same time surface properties such as microporosity, grain size and therewith-related surface area have been shown to play a determinant role in the process of osteoinduction of biomaterials [8]. Therefore, partial substitution of Ca^{2+} ions in CP matrix by biologically active inorganic ions is a promising strategy to improve bone defect healing.

In the present work we report on the influence of Mn doping on hydrolysis rate and dissolution of α-TCP. α-TCP samples with Mn doping level from 0 to 1 mol% were synthesized by wet precipitation method. The phase purity and structure of synthesized compounds were evaluated using X-ray diffraction (XRD) analysis and Fourier-transform infrared spectroscopy (FTIR). Scanning electron microscopy (SEM) was used for the characterization of morphological features of initial powders and hydrolized products. Chemical composition of the synthesized compounds and ion release were analyzed by inductively coupled plasma optical emission spectrometry (ICP-OES).

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