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SYNTHESIS AND CHARACTERIZATION OF IRON DOPED CALCIUM PHOSPHATE WITH WHITLOCKITE STRUCTURE

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Calcium phosphates (CaP) are the family of materials, which are widely used in regenerative medicine due to their excellent biocompatibility and osteoconductivity [1]. There is a variety of applications of different CaP phases including medical, environmental, optical etc. Human hard tissues mostly consist of calcium hydroxyapatite (HAp) which is the most stable CaP phase around neutral pH [2]. The second most abundant CaP phase in human body is whitlockite. Magnesium whitlockite is a member of CaPs family, where part of calcium ions are substituted by smaller magnesium ions, chemical formula of magnesium whitlockite is $Ca_{18}Mg_2(HPO_4)_2(PO_4)_{12}$ [3].

Doping of CaPs with other metal ions may result in the appearance of new physical and biological properties, which can be used for wider application. Iron is an essential microelement in bones and teeth, it is a micronutrient essential for various biological processes and an important component of several metalloproteins [4]. It is known that Fe-doped HAp not only demonstrates antibacterial properties, but also exhibits strong ferromagnetic properties, whereas undoped HAp is diamagnetic [5]. Due to these properties, this material can be applicable in medicine, drug delivery or in bone transplantation. The main aim of this work was to synthesize and characterize phase-pure Fe^{2+}-doped CaP with whitlockite structure.

The results of powder X-ray diffraction analysis (XRD), Fourier-transform infrared spectroscopy (FTIR) and Raman spectroscopy confirmed that synthesized Fe-doped CaP has whitlockite structure. It was demonstrated that optimal reaction temperature is 230 °C, at this temperature single-phase whitlockite powder can be obtained. Optimal pH range was determined to be from 6.1 to 6.3. Neighboring crystalline phases were observed at lower temperatures and higher/lower pH of the reaction medium. Also, it was found that optimal reaction time is only about 1 hour. Investigation of magnetic properties showed that synthesized material is paramagnetic in the temperature range from 5 to 300 K. Thermal stability studies revealed that iron whitlockite is thermally unstable and decomposes upon a heat treatment.

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