Calcium phosphates powders synthesized in non-aqueous media

Dmitry Larionov, Maria Kuzina

engineer, student

Department of Materials Science, Lomonosov Moscow State University, Moscow, 119991,

dmiselar@gmail.com

The manufacture of nano-sized bioceramic particles poses an interest for the development of novel bone implants. The researchers have accepted the idea of highly resorbable material usage which demands the synthesis of calcium phosphates with Ca/P ratio < 1.5. The usage of non-aqueous medium for the calcium phosphate synthesis is motivated by the several reasons. Firstly, phase transitions caused by high basicity of ortophosphate ion in aqueous environment lead to the impurities in the material. Secondly, pyro- and polyphosphate ions inhibit the crystallization of the material. Using non-aqueous solvents one can eliminate water influence and get more control on the material. Hence, the main goal of the work was the obtainment of calcuim phosphates in non-aqueous medium.

The key object of the research was calcium orthophosphate. It has been obtained using two methods. According to the first method, calcium oxide or calcium carbonate solution was mixed with calcium hydrophosphate or octacalcium phosphate suspension in solvent (ethanol, diethylene glycol and ethylene glycol) under high temperature for a long time. For the second method pure calcium was dissolved in preliminary dehydrated ethylene glycol forming calcium glycolate. Calcium orthophosphate was obtained by adding hot calcium glycolate solution to acid solution in ethylene glycol. On purpose to eliminate water influence a new method of crystal orthophosphoric acid synthesis was developed.

In conclusion, the most optimal method of non-aqueous calcium phosphate synthesis is the reaction of calcium glycolates and different phosphoric acid solutions in ethylene glycol. X-ray diffraction (XRD) and scanning electron microscopy (SEM) data after annealing show presence of pure calcium orthophosphate phase. Other results showed that even trace amounts of water in the reaction medium significantly affected the results and led to the formation of hydroxyapatite and monetite phases instead of calcium orthophosphate.