Bioceramic Calcium Phosphate granules and their properties

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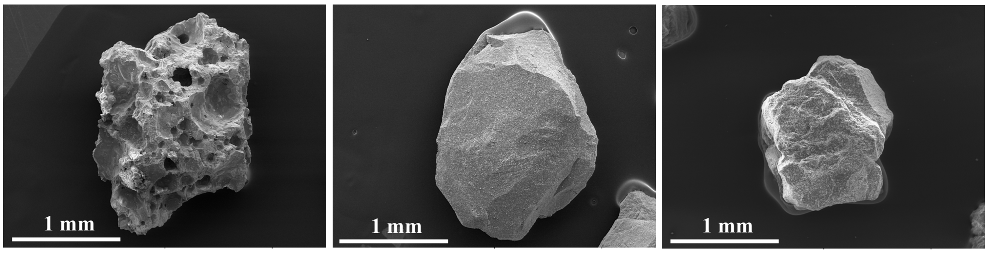
Calcium phosphate (CaP) bioceramics are popular implant material for bone repair, substitution or augmentation in orthopaedic and maxillofacial surgery. CaP materials exhibit biocompatibility with hard tissue and promote bone regeneration proceses by release of calcium and phosphate ions. This material is widely used in several clinical applications in different forms, for instance, granules, porous or dense blocks and powders [1-3]. The advantage of granulated forms is the oportunity to fill irregular bone defects. They can be used also as drug carriers and sorption materilas. Phase composition, size, surface properties and morphology of the grains affect the nature and rate of new bone formation. There are various techniques to produce calcium phosphate granules: crushing of sintered blocks, dripping, gelcasting and stirring mixtures of immiscible liquids [1-4].

Calcium phosphate powder or precipitates were obtained using wet precipitation method between $Ca(OH)_2$ suspension and H_3PO_4 solution. In current research multiform CaP granules are made through three different techniques: (1) by foaming as-recieved CaP powder, (2) by crushing of dried blocks, (3) by crumbling of wet precipitates, followed by sintering at 1150^{o}C for 2 hours. Obtained granules were divided into two fractions (0,5<d<1,0 mm and 1,0<d<1,4 mm) and bulk density was determined for each fractions. Morphology of grains was observed by scanning electron microscopy (SEM).

Obtained granules have significantly different shapes (see Figure below). SEM images showed different microstructure affected by processing technology. Granules produced through foaming process have macro- and microporosity, while crushing and crumbling technology leads to formation of only microporosity.



Bulk density depends on the producing technology, fraction and microstructure and ranges from 0.7 g/cm^3 to 1.4 g/cm^3.

In this work, developed methods can be used to produce different bioceramic granules depending on the medical applications or sorption proceses. All of mentioned techniques enables to gain various size and shape of the granules. The granules with lowest bulk density can be obtained through foaming technique. The highest bulk density can be recieved by crumbling of wet precipitates.

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