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Preparation and antimicrobial activity of the porous hydroxyapatite nanoceramics

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Abstract

Calcium hydroxyapatite porous nanoceramics (ncHAP) were prepared in the form of granules utilizing raw, high purity HAP nanopowder and methylcellulose (MC) in ratio of 60/40 weight% with the final moulding at high temperature (800-1000°C). The ncHAP's were studied by means of XRD, TEM, SEM techniques for structural and morphological characterizations. BET method was used in order to estimate the surface area, pore diameter and volume as well as the average particle size. It was found that particle size of raw material and nanoceramic prior heating (with MC) was 33 nm whereas ncHAP's size has significantly increased with sintering temperature from 136 nm up to 955 nm. X-ray diffraction clearly showed that all materials were crystallized and under given process parameters the HAP underwent dehydratation event as the content of β-TCP (tricalcium phosphate) has increased along with temperature up to 24%. The presence of β-TCP in porous nanoceramic material, might be advantageous since both phosphates have different solubility in biological media thus it is possible to affect the resorption speed. The antimicrobial activity of raw materials and nanoceramics against *Pseudomonas aeruginosa* as a representative of the Gram-negative bacteria has been determined *in vitro* and *in vivo* on *Galleria mellonella* larvae model. The results confirm that definitely nanobased biomaterials of calcium hydroxyapatite are very promising compound with high potential in biomedical applications.

Keywords: Nanocrystalline hydroxyapatite; Nanoceramics; Porous materials; High specific surface area; Antimicrobial activity.

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