GREEN - HYDROTHERMAL MICROWAVE SYNTHESIS AND CHARACTERIZATION OF HAP NANOPARTICLES FOR BIOMEDICAL APPLICATIONS

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Introduction
Hydroxyapatite (HAP, $Ca_{10}(PO_4)_6(OH)_2$) is an inorganic component of bones and teeth. Hydroxyapatite possesses exceptional biocompatibility and bioactivity properties with respect to bone cells and tissues, probably due to its similarity with the hard tissues of the body. Nowadays hydroxyapatite is one of the most often applied bio-nanomaterials, e.g. in bone implants, scaffold layers, drug delivery agent, dental materials [1,2].

Materials and Methods
Hydroxyapatite nanopowder was synthesized by hydrothermal synthesis using microwave reactor MSS2 (Microwave Solvothermal Synthesis) [1,3]. The starting materials include pharmaceutical-grade substrates: calcium hydroxide $Ca(OH)_2$ and orthophosphoric acid H_3PO_4 as substrates to obtain ceramic nanoparticles. Nanopowder has been characterized by several methods: X-ray diffraction (Phase Purity), SEM (morphology), BET (Specific Surface Area) and helium pycnometry (Skeleton Density).

Results and Discussion
The unique, green process of microwave synthesis with strict control of the size of hydroxyapatite (GoHAP™) nanoparticles in the range of 10±1 to 42±4 nm have been shown. The control of synthesis parameters such as time, pressure and temperature allowed to control the particle size in a narrow distribution. The characteristics of GoHAP™ nanoparticles were compared with natural hydroxyapatite obtained from natural bones and tooth enamel. The high similarity of GoHAP™ nanoparticles to natural hydroxyapatite has been demonstrated.

Conclusions
Microwave synthesis allows easily and precisely control the grain size of nanoparticles. The size control of HAP nanoparticles gives the possibility of a better selection of the material properties for various applications. Particles of 40 nm show high similarity to HAP contained in dental enamel, so it can be successfully used in dentistry. GoHAP™ particles of 10 nm are almost identical to HAP particles contained in bones, therefore their use in bone tissue regeneration is proposed.

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References
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