Synthesis of nanohydroxyapatite using microwave energy

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Hydroxyapatite (HAp) with the chemical formula of Ca_{10}(PO_4)_6(OH)_2 is an inorganic component of hard tissues such as 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. It has been used extensively for biomedical applications, because of osteoinductive and osteoconductive properties and biocompatibility with human body. Hydroxyapatite is using in regenerative medicine e.g. bone implants for regeneration of bone defects.

Nanohydroxyapatite were synthesized by hydrothermal synthesis using microwave reactor MSS2 (Microwave Solvothermal Synthesis). We used calcium hydroxide Ca(OH)\textsubscript{2} and orthophosphoric acid H\textsubscript{3}PO\textsubscript{4} as substrates to obtain ceramic nanoparticles. The water is the only by-product. Microwave energy allows easily and precisely control the grain size of nanoparticles. Obtained nanoparticles were in the range of 8 - 45 nm grain size. Phase purity was checked using X-ray diffraction. Scanning electron microscopy (SEM) gave information about the morphology of produced nanohydroxyapatite. The skeleton density and specific surface area was determined using respectively helium pycnometry and Brunauer–Emmett–Teller (BET) method.

We obtained six types of hydroxyapatite GoHAP\textsuperscript{TM} with different crystallinity degree and grain size by changing the synthesis parameters. Crystallinity and grain size is higher with increasing synthesis time. Wide variety of GoHAP\textsuperscript{TM} can be used in many applications (e.g. implants, scaffold layers). The Laboratory of Nanostructures is able to synthesize innovative nanoparticles similar to the natural hydroxyapatite. Thanks to a wide variety of grain size crystallinity it can be used in different application depending on desired resorption time of hydroxyapatite. GoHAP\textsuperscript{TM} could be a perfect component of the medical implants.

References


Figures

Figure 1. XRD patterns of bioapatite, as well as HAp Type 1 and Type 6 nanopowders.