Bioceramics Development and Applications
ISSN: 2090-5025
Oktar et al., Bioceram Dev Appl 2017, 7:1
DOI: 10.4172/2090-5025.1000e108
Editorial Open Access

Editorial- Novel Hydroxyapatite (HA) Production from Synthetic and Natural Sources

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Editorial

With increasing of ageing and accidental causes throughout the European community, bioceramics gain a big role not only in orthopaedic treatments, but also in dentistry and cosmetic surgery applications. The most used bioceramic is hydroxyapatite (HA). There are two common routes for the obtaining of these bioceramics: synthetically and naturally.

The classical way of obtaining synthetic HA is working with expensive reagent chemicals. Those synthetic routes involve laborious and time-consuming work also (i.e., main production techniques: precipitation or solgel).

Natural HA's can be produced from bone and teeth structures of human, bovine, sheep, camel, goat and also from fish bones. The real golden standard is taking HA material from humans own body (autografts). This method needs also an extra surgery. However, bovine and pig bones are much preferred as HA source. For instance, bovine bone freeze dried method is generally used as a safe production method. Otherwise, very infectious diseases like mad cow disease namely bovine spongiform encephalopathy (BSE) can be easily transmitted [1]. Calcination method with heating application at 800°C to 850°C is another way for production of safe natural HA. The procedure is simple and not any disease can survive at this high application temperature. Additionally, simple calcination method allows producing natural plasma spray powders obtained from human [1] and bovine bones [2]. Oktar et al. [3] had also used successfully high temperature calcinated human enamel and dentine HA as plasma spraying powder material using a simple blade grinder and sieving and washing process. Normally, AMDRY 6021 (Sulzer Plasma Technic Inc., MI, USA) were used on previous market at commercial dental and orthopaedic implants as commercially synthetic HA plasma powder. In this study, the first bond-coating material, Al_2O_3/TiO_2 (60/40 in wt.%) under enamel HA (EHA) and dentine HA (DHA) plasma coating applied and very promising results were reached in the past [3].

In addition to the calcination of bone and teeth structures, some new generation natural HA bioceramics can be produced from calcitic-aragonite marine sources (mussel shells–*Ostrea edulis* [4], cuttlefish bones–*Sepia officinalis* [5], corals, sea snail shells, sea limpet shells, sea urchin shells and etc.) and from calcitic land sources (chicken and ostrich (*Struthio camelus*) [6] egg shells, land snail shells) with uncomplicated and simple methods. One of those methods is using a mechano-chemical method (by using simple ultrasonic equipment–with heater) or chemical method (by using a simple hotplate stirrer–with heater). Here, first differential thermal analysis (DTA) must be performed for calculation of finding the exact phosphoric acid (H_3PO_4) amount during titration, in ordering for adjusting the stoichiometric ratio of Ca/P equal to 1.667 for HA bioceramics and 1.5 for ß-TCP (tricalcium phosphate) bioceramics production. These prepared batches are sintered at 850°C for producing HA. TCP batches are sintered at 450°C for getting TCP structures [7]. At the end of the reaction, it is possible to obtain nano-structural HA and ß-TCP bioceramics from marine and land sources. Macha et al. [8] were able to produce monetite (also called as di calcium phosphate) from a local calcitic source namely Mediterranean Mussel (*Mytilus galloprovincialis*). Monetite is precursor material for calcium phosphate bioceramics and can be used as a main constituent for β-TCP and HA sintered products and bone cements. Those productions of such bioceramics from calcitic-aragonitic marine structures and land structures are more advantages by giving out less carbon print in comparison to the other sources.

As a conclusion, on one hand, production from the natural sources seems much simple than synthetic sources for HA and related bioceramic phases production. On the other hand, it must not be forgotten, that HA production from calcitic source gives us nano-HA production possibility for various applications.

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Received September 02, 2017; **Accepted** September 04, 2017; **Published** September 08, 2017

Citation: Oktar FN, Yetmez M, Gunduz O (2017) Editorial- Novel Hydroxyapatite (Ha) Production from Synthetic and Natural Sources. Bioceram Dev Appl 7: e108. doi: 10.4172/2090-5025.1000e108