

*Biomimetic citrate-coated nano-apatites for biomedical and industrial applications*

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Calcium orthophosphates are widespread in Nature. In geological scenarios they are mostly found as deposits of apatites (mainly fluor-apatites), and phosphorites (a sedimentary rock). In biological systems, many organisms, ranging from bacteria and isolated cells to invertebrates and vertebrates, synthesize calcium orthophosphates. In vertebrates nanocrystalline carbonate-apatites are the main inorganic component of hard tissues (bone and teeth). In addition, nanocrystalline apatites are involved in many pathological calcifications such as dental calculi, salivary stones, blood vessel calcification, etc. A great effort is devoted to prepare synthetic analogues, so-called "biomimetic", able to accurately mimic the physico-chemical features of biological apatite compounds found in biomineralization processes. Because of their excellent properties such as biocompatibility, bioactivity, lack of toxicity and high bioresorbability, these materials find applications not only in bone tissue engineering, but also in other fields such as nanomedicine [1]. Recent advances in the control of crystal growth of nanocrystalline apatites are related to the use of citrate as additive. The citrate represents around 5.5 wt% of the total organic fraction of bone, and has been found strongly adhered to the bone nanoapatite crystals. Its use as additive in the production of synthetic nanoapatites will improve their biomimetism and, in addition, will increase the knowledge of its role in bone biomineralization. An overview of the main advances on the research of citrate-coated biomimetic nanoapatite and its biomedical and industrial applications carried out by our research group is presented. It includes i) the mechanism forming the platy shape of nanoapatites from an amorphous precursor as well as the HRTEM evidences supporting that an oriented aggregation mechanism is likely acting during the first growth stages [2], ii) the preparation of multifunctional drug-loaded antibody-targeted nanoapatites to be used in active targeting therapies against cancer; iii) the preparation of citrate-coated fluoride-doped amorphous calcium phosphates (F-ACP) nanoparticles to be employed as filler in toothpaste, chewing gum, mouthwash, etc. [3]; and finally, iv) the crystallization of luminescent Europium-doped citrate-coated nanoapatites with potential applications ranging from cancer diagnosis to security printing. Acknowledgments: I kindly acknowledge the project Biomin-nanoapatite MAT2014-60533-R funded by Spanish MINECO and cofunded by FEDER.

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