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Controlled adsorption and release onto/from calcium phosphate materials for medical applications: The example of a bisphosphonate

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The surface reactivity of biological apatites has received major attention in the medical field during the last decades, mainly for their physicochemical and biological properties. Thus, numerous studies have been devoted to develop biomaterials based on calcium phosphates as carriers to deliver therapeutic agents in the skeletal systems. In this context, the present study reports on the in vitro basic binding and release of hydroxyapatite and a bisphosphonate molecule, in order to throw light on the main driving forces at the mineral surface. The adsorption from dilute solutions revealed that the uptake of risedronate was inhibited in presence of excess of phosphate species in solution, due to their competition for adsorbing sites on the apatite surface. Conversely, the uptake of the bisphosphonate molecule was accompanied by the release of phosphate ions in the solution. Besides, the molecules bound to apatite crystals were not removed by simple dilution of the equilibrium solution, while the adsorbed molecules can only be displaced by a reverse action of phosphate ions. These observations suggest that the uptake process can be described by an ion exchange mechanism, involving the functional groups of the molecules and the ionic groups at the apatite surface. Whoever, the interaction appears to be reactive for concentrated solutions and the adsorption reaction could then be described as a dissolution-reprecipitation phenomenon. Thus, the control of the uptake and release processes could be useful to develop ''smart delivery systems'' of therapeutic substances from apatitic biomaterials *in vivo*.

Biography

Allal Barroug has completed the bachelor of chemistry in 1979 from Mohamed V University of Rabat in Morocco, a third cycle doctorate in1982 on materials science from the National Polytechnic Institute of Toulouse in France and a PhD in1989 on chemistry of interfaces from the Catholic University of Louvain-La-Neuve in Belgium. He is the professor at Cadi Ayyad University of Marrakech in Morocco and his research interests focus on the surface properties of apatites materials and bio-composites. His awards from Harvard Medical School of Boston in USA took him as a senior research scientist to work on "Apatites as local delivery system for anti-cancer drugs". Allal Barroug published over 60 articles in peer reviewed journals and conferences proceedings, and he is serving as a reviewer of many reputed journals.

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