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PII: S0001-8686(16)30091-4
DOI: doi: 10.1016/j.cis.2016.03.006
Reference: CIS 1635

To appear in: *Advances in Colloid and Interface Science*

Received date: 21 September 2015
Revised date: 29 March 2016
Accepted date: 31 March 2016

Please cite this article as: Ridi Francesca, Meazzini Ilaria, Castroflorio Benedetta, Bonini Massimo, Berti Debora, Baglioni Piero, Functional calcium phosphate composites in nanomedicine, *Advances in Colloid and Interface Science* (2016), doi: 10.1016/j.cis.2016.03.006

Functional calcium phosphate composites in nanomedicine

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Abstract

Calcium Phosphate (CaP) materials have many peculiar and intriguing properties. In Nature CaP is found in nanostructured form embedded in a soft proteic matrix as the main mineral component of bones and teeth. The extraordinary stoichiometric flexibility, the different stabilities exhibited by its different forms as a function of pH and the highly dynamic nature of its surface ions, render CaP one of the most versatile materials for Nanomedicine. This review summarizes some of the guidelines so far emerged for the synthesis of CaP composites in aqueous media, that endow the material with tailored crystallinity, morphology, size, and functional properties. First, we introduce very briefly the areas of application of CaP within the Nanomedicine field. Then, through some selected examples we review some synthetic routes where the presence of functional units (emphasizing the role of small templating molecules like surfactants, or oligomers and polymers) assist the synthesis and at the same time impart the functionality or the responsiveness desired for the end-application of the material. Finally, we illustrate two examples from our laboratory , where CaP is decorated by biologically active polymers or prepared within a thermo- and magneto-responsive hydrogel, respectively.

Keywords. Calcium phosphate; hydroxyapatite; nanoparticles; functional nanocomposites; nanomedicine; transfection.