Magnesium, manganese and cobalt substituted nanocrystalline apatites obtained by hydrothermal transformation of biogenic calcium carbonate

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Fishery industry waste seashells represent an important environmental issue and imply the loss of potentially useful biomaterials [1]. They are composite materials made of $CaCO_3$ and an organic matrix (1-5 wt.%) formed mainly of proteins and polysaccharides. Fabrication of functional calcium phosphates (eg. doped nanoapatites) using this type of biogenic $CaCO_3$ as a calcium source may partially alleviate the ecological problem and be an alternative source of biocompatible materials intended for biomedical uses. In this work, the one-pot hydrothermal method [2] has been used in the preparation of biocompatible Mg^{2+}, Mn^{2+}, and Co^{2+}-doped apatites. These divalent transition metal ions fulfill different roles in skeletal metabolism and may stimulate bone tissue regeneration [3-5]. The experiments were performed in a hydrothermal multitube set-up as well as in an autoclave, using oyster shell calcium carbonate particles from the species *Crassostrea gigas*, the KH_2PO_4 as a P reagent (P/$CaCO_3$ 0,6), and temperatures from 25ºC to 200ºC. Full transformation of $CaCO_3$ was obtained at 160 ºC, yielding platy-shaped apatite nanoparticles doped with either 0.22 mol% Mg^{2+}, 0.012 mol% Mn^{2+}, or 0.16 mol% Co^{2+}, and sizes within the range 75-90 nm. All samples showed a high cytocompatibility/biocompatibility when incubated with human mesenchymal stem cells for 1 and 3 days, and a small decrease in cell viability after 7 days of incubation in a dose-dependent concentration. Overall, the method was demonstrated to be promising in the preparation of doped biocompatible apatite nanocrystals with osteogenic features, and the biogenic $CaCO_3$ a huge and unexplored calcium source for the preparation of apatite-based biomaterials.

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