Influence of BSA on formation of calcium phosphates and silver nanoparticles composites

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Due to their similarity with mineral component of bone tissue, calcium phosphates (CaP) attract special attention in the development of novel bone biomaterials.[1] As a way of improving their biological and mechanical properties, CaPs composites with nanomaterials and/or biomacromolecules are emerging.[2] As nanomaterials can have antimicrobial or magnetic properties, such composites can be considered truly multifunctional materials.[3] However, for such materials to be succesfully applied, the interactions between their components should be understood.

Motivated by this, in this study formation of CaPs in the presence of both nanomaterials, silver nanoparticles (AgNPs), and biologically active molecule, bovine serum albumin (BSA), was investigated. In the absence of both additives, CaP precipitated in two steps, as shown by potentiometric measurements. In the first step, amorphous calcium phosphate (ACP) was formed, which was transformed after 60 minutes into the mixture of poorly crystalline calcium-deficient hydroxyapatite (CaDHA) and a small quantity of octacalcium phosphate (OCP). Addition of BSA and/or differently coated AgNPs (citrate, polyvinyl pyrrolidone, and sodium bis(2-ethylhexyl) sulfosuccinate) inhibited ACP transformation, with BSA being dominant inhibitor. Powder X-ray Diffraction Patterns and Fourier Transform Infra Red Spectra confirmed that in the presence of AgNPs amount of OCP was decreased, while no BSA influence on composition of the formed precipitate was observed. TEM and SEM micrographs revealed influence of both additives on morphology of both ACP and crystalline precipitate.

Obtained results can contribute to development of low-temperature procedures for ternary composites synthesis.

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