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Biomimetic composites based on carbonatation, albumin and gelatin for biomedical applications

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Abstract

In the present work, biocomposites were obtained by the method of deposition from a prototype of a human biofluidic fluid with varying concentrations of albumin and gelatin. Materials synthesized from media with albumin and gelatin (<7 g/l) are represented by carbonate hydroxyapatite and biopolymer, and from solutions containing >7 g/l gelatin, include 10% by weight. It consists of crystallites of smaller size. It is shown that the presence of proteins in the model medium of less than 7 g/l does not affect the crystal-chemical parameters of the resulting aggregates. Such apatites are characterized by a mixed AB-type substitution of structural anions by carbonate groups. At maximum concentrations of biopolymers in solution (albumin – 12 g/l, gelatin – 10 g/l), the formation of predominantly A-type carbonate hydroxyapatite occurs. Thermochemical transformations of composites were studied. It is shown that the loss of mass of carbonate hydroxyapatite-albumin composites during annealing occurs due to an increase in the mass loss of protein and crystallization water and is independent of the albumin content in the model solution at ≤ 7 g/l. It is noted that the most heat-stable are gelatin-containing samples. The thermal stability of carbonate hydroxyapatite-gelatin composites decreases with increasing biopolymer content in the solid phase. It was found that the presence of proteins results in the deposition of composites with a lower degree of crystallinity and a specific surface area. The kinetics of dissolution of composites in neutral and weakly acidic media was studied. It is established that the resorption in 0.9% NaCl of biocomposites does not depend on the nature of the biopolymer, nor on its concentration in solution. Powders obtained from viscoelastic media dissolve at a higher rate in the acetate buffer solution. The most soluble in weakly acidic conditions are samples that precipitate from a medium containing more than 10 g/l albumin and 7 g/l gelatin.

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