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Hydroxyapatite-chitosan based bioactive hybrid biomaterials with improved mechanical strength

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Abstract:

Composites consisting of hydroxyapatite (HA) and chitosan (CTS) have recently been intensively studied. In this work, a novel inorganic-organic (I/O) HA/CTS materials in the form of granules were prepared through a simple solution-based chemical method. During the synthesis of these hybrids, the electrostatic complexes between positively charged, protonated amine groups of chitosan and the negative phosphate species (HPO_4^{2-} and $H_2PO_4^-$) were formed. Our biocomposites belong to the class I of hybrids, which was confirmed by FTIR studies. XRD analysis revealed that the obtained materials consisted of hydroxyapatite as the only crystalline phase. Homogeneous dispersion of the components in HA/CTS composites was confirmed. The use of 17 wt.% and 23 wt.% of chitosan resulted in approximately 12-fold and 16-fold increase in the compressive strength of HA/CTS as compared to the non-modified HA material. During incubation of the studied materials in SBF, pH of the solution remained close to the physiological one. Formation of apatite layer on their surfaces indicated bioactive nature of the developed biomaterials.

Keywords: hybrid granules, hydroxyapatite, chitosan, bone substitutes.