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Reinforcement of Freeze–Dried Chitosan Scaffolds with Multiphasic Calcium Phosphate Short Fibers

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Abstract

The composite scaffolds of the chitosan and multiphasic calcium phosphate (HW) short fibers were prepared by freeze drying and characterized by X-ray diffractometry (XRD), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM and FE–SEM). The mechanical properties of the scaffolds were assessed by compression test. The incorporation of HW fibers consisting three phases of hydroxyapatite (HA), beta-tricalcium phosphate (β -TCP) and calcium pyrophosphate (CPP) into the chitosan matrices was associated with an increase in pore size, density and compressive strength and modulus, and a decrease in porosity and swelling ratio of the scaffolds. The strongest composite scaffolds in this study with a chitosan: HW fibers weight ratio of 1:1 showed a mean porosity of 69% and a mean strength and modulus of 420 kPa and 3.87 MPa, respectively. The in vitro bioactivity of the composites was confirmed by the formation of a calcium phosphate rich layer on the surface of soaked scaffolds in simulated body fluid. The findings of this initial work indicate that the chitosan-multiphasic calcium phosphate short fibers may be a suitable material for bone scaffolding.

Keywords: Bone scaffold, Chitosan, Composite, Calcium phosphate short fibers, Mechanical reinforcement

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