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Fabrication of novel Si-doped Hydroxyapatite/Gelatine scaffolds by rapid prototyping for drug delivery and bone regeneration

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Keywords

Three dimensional printing; hierarchical porosity; composite scaffolds; vancomycin; tissue engineering

Abstract

Porous 3-D scaffolds consisting of gelatine and Si-doped hydroxyapatite were fabricated at room temperature by rapid prototyping. Microscopic characterization revealed a highly homogeneous structure, showing the pre-designed porosity (macroporosity) and a lesser in-rod porosity (microporosity). The mechanical properties of such scaffolds are close to those of trabecular bone of the same density. The biological behavior of these hybrid scaffolds is greater than that of pure ceramic scaffolds without gelatine, increasing pre-osteoblastic MC3T3-E1 cell differentiation (matrix mineralization and gene expression). Since the fabrication process of these structures was carried out at mild conditions, an antibiotic (vancomycin) was incorporated in the slurry before the extrusion of the structures. The release profile of this antibiotic was measured in phosphate buffered saline solution by High-Performance Liquid Chromatography and was adjusted to a first order release kinetics. Released vancomycin from the material was also shown to inhibit bacterial growth *in vitro*. The implications of the result showed in this study for bone tissue engineering applications are discussed.

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