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Amino Acid-grafted and *N*-acylated Chitosan Thiomers: Construction of 3D Bio-Scaffolds for Potential Cartilage Repair Applications

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Abstract

In this work novel three-dimensional (3D) scaffolds were developed with chitosan thiomer derivatives for potential soft tissue repair applications. Amino acid-grafted chitosan (cysteine, CHICys) and *N*-acylated chitosan (11-mercaptoundecanoic acid, CHIMerc) derivatives were synthesized by covalent coupling reaction and hydrogel scaffolds were produced by freeze-drying process. They were comprehensively characterized by swelling and degradation behaviors, NMR, FTIR and Raman spectroscopy, SEM and X-ray microcomputed tomography. The results demonstrated the synthesis of chitosan thiomers with distinct degree of thiol substitution (CHICys=5 % and CHIMerc=26 %), producing highly porous scaffolds (porosity > 80 %) with hierarchical interconnected 3D pore structures. Additionally, their physicochemical properties and architectural features were significantly tuned by the thiol-modifier, evidenced by the swelling degrees ranging from approximately 2300% (CHICys) to 1800 % (CHIMerc) and chemical stability against degradation. Moreover, they exhibited cytocompatibility based on *in vitro* bioassays, which hold promise as suitable platform in soft tissue engineering applications.

Keywords: Chitosan; Thiolated chitosan; Thiomers; 3D Scaffold; Cytocompatibility; Soft tissue biomaterial.

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