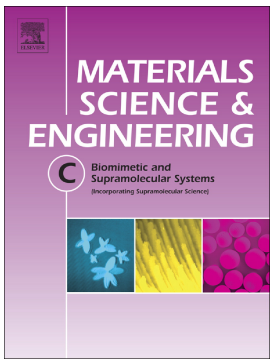

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Polymeric 3D scaffolds for tissue regeneration: evaluation of biopolymer nanocomposite reinforced with cellulose nanofibrils

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KEYWORDS

Nanoreinforcement, cross-linking, polymer blend, soft tissues.

ABSTRACT

Biopolymers such as gelatin (Gel) and cellulose nanofibrils (CNF) have many of the essential requirements for being used as scaffolding materials in tissue regeneration; biocompatibility, surface chemistry, ability to generate homogeneous hydrogels and 3D structures with suitable pore size and interconnection, which allows cell colonization and proliferation. The purpose of this study was to investigate whether the mechanical behaviour of the Gel matrix can be improved by means of functionalization with cellulose nanofibrils and proper cross-linking treatments. Blending processes were developed to achieve a polymer nanocomposite incorporating the best features of both biopolymers: biomimicry of the Gel and structural reinforcement by the CNF. The designed 3D structures underline interconnected porosity achieved by freeze-drying process, improved mechanical properties and chemical stability that are tailored by CNF addition and different cross-linking approaches. *In vitro* evaluations reveal the preservation of the biocompatibility of Gel and its good interaction with cells by promoting cell colonization and proliferation. The results support the addition of cellulose nanofibrils to improve the mechanical behaviour of 3D porous structures suitable as scaffolding for tissue regeneration.

1. Introduction

Tissue engineering emerged as a viable therapeutic solution to regenerate diseased tissues, anyway, the rapid restoration and function of damaged tissues is still a major challenge in surgery.