Synthesis and Characterization of Biodegradable Copolymers for Tissue Engineering

A. Papadopoulos,[1,*] M. Kaliva,[1,2] G. Kaklamani,[2] M. Vamvakaki[1,2]

[1]*Department of Materials Science and Technology, University of Crete, 710 03 Heraklion, Crete, Greece*
[2]*Institute of Electronic Structure and Laser, Foundation for Research and Technology, 711 10 Heraklion, Crete, Greece*

Polymers have been extensively used to fabricate scaffolds for tissue regeneration in order to repair or reconstruct damaged tissues *in vitro* or *in vivo* [1]. Chitosan (CS) and polycaprolactone (PCL) are among the most widely studied polymers. Chitosan (CS), a natural polysaccharide, is a biocompatible, biodegradable and non-toxic polymer, however, it exhibits low mechanical strength and also, due to its hydrophilicity, it can be slightly dissolved in an aqueous culture medium [2]. On the other hand, PCL is a biocompatible, biodegradable and nontoxic synthetic polymer, with excellent mechanical properties [3]. In this work CS-graft-PCL copolymers were prepared by grafting hydrophobic PCL polymer chains on the CS backbone to alter the solubility of CS and improve its mechanical properties. First, PCL functionalized with one carboxylic acid terminal group (PCL-COOH) was prepared by ring opening polymerization of e-caprolactone, using glycolic acid as the initiator and tin octanoate as the catalyst. Polymers of different molecular weights were obtained and were characterized by gel permeation chromatography and proton nuclear resonance (^{1}H NMR) spectroscopy. Next, the PCL-COOH chains were chemically grafted onto the CS backbone via the hydroxyl groups of CS (Fig. 1a) [4]. The purified products as well as the intermediates of the reaction were characterized by attentuated total reflectance Fourier transform infrared and ^{1}H NMR spectroscopies. Next, thin films of the CS-g-PCL samples were produced using the drop casting method and cellular compatibility of the materials was examined. The 2D scaffolds were seeded with NRK cells for 7 days and the viability of the cells was tested using live-dead staining (Fig. 1b) and MTT assay. The topographical characteristics of the cells attached on the polymer surface were visualized using SEM. After a week study the cellular behavior was enhanced showing an increased cell number, very good cell attachment and proliferation.

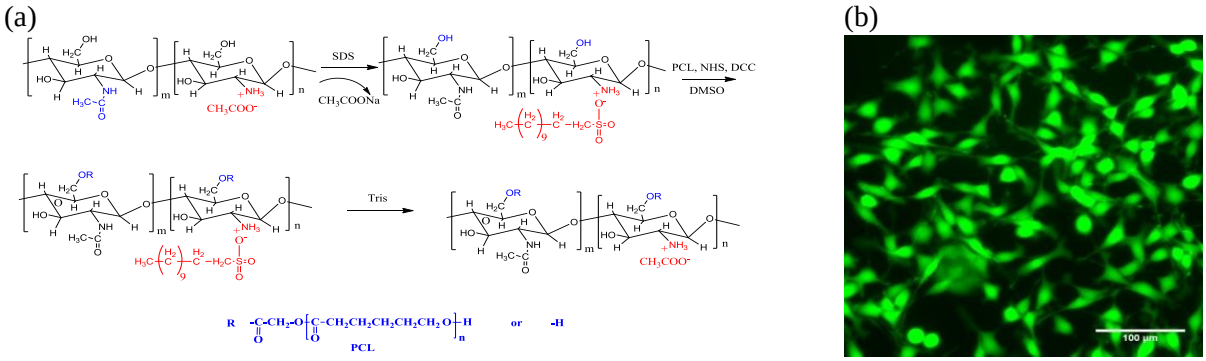

Figure 1: a) Synthetic procedure followed for the preparation of the CS-g-PCL copolymers and b) Cellular viability on a CS-g-PCL film on Day 3 of cell culture.

References

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* mst597@edu.materials.uoc.gr