Nanoscaffolds Loaded with Diclofenac Sodium

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Introduction

Nanotechnology will revolutionize our future devices. It is possible to produce nanofibers using methods like self assembly. However, simpler methods employ electrospinning. The objective of the current study was to evaluate electrospinning to produce diclofenac sodium (DS) loaded bioerodible nanoscaffolds.

Material and method

1-butanol hemiester poly(maleic anhydride-alt-2-methoxyethyl vinyl ether) (PAM14, MW 100 kDa) was prepared and characterized in the university of Pisa. A 5-10% polymer solutions (either in ethanol or in acetic acid) were prepared, half of them containing 2% DS. The solutions were then electrospun to produce nanofibrous structures that were subsequently characterized by using SEM.

Results

The minimum concentration of the polymer solutions that can be electrospun was 5%. Diameter of fibers was 160-950 nm in all specimens. Increasing polymer concentration increased the size of the fibers but reduced the number of beads, regardless of the type of the solvent and whether DS was used or not. In the specimens obtained from acetic acid solution, the addiction of DS resulted in a reduction in fiber diameter and in an increase of the distance between the beads. Corresponding ethanol solutions gave more homogeneous specimens as compared to acetic acid, having a lower number of beads. With the addiction of DS a reduction in fiber diameter was observed for the acetic acid specimens. In ethanol, adding DS resulted in increase in fiber diameter. Evaluations are underway to determine the location of drug particles in the nonofibrous scaffolds.

Conclusions

It is feasible to develop dicolfenac loaded bioerodible nanofibous scaffolds by using electrospinning that can have potential as pain-killer releasing devices. However further evaluation is needed both in-vitro and in-vivo.

Key words: Bioerodible, Electrospinning, nanotechnology, pain, drug release, tissue-engineering

Nanoscaffolds Loaded with Human Serum Albumin

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Introduction

In recent years, our understanding of tissue biomaterials has advanced. Being able to handle the interface on nanoscale, it is possible to develop more biomimitic scaffolds as proved in some studies with mesenchymal stem cells. In many occasions second generation scaffolds with bioactive agent releasing properties are needed. These include polypetides such as growth factors. The aim of the current study was to develop a polypetided loaded bioerodible nanoscaffolds using electrospinning.

Material and method: 1-butanol hemiester poly(maleic anhydride-alt-2-methoxyethyl vinyl ether) (PAM14, MW 100 kDa) was prepared and characterized in the university of Pisa. 8% (w/v) polymer was dissolved in either 30% or 40% ethanol solutions. Human Serum Albumin (HSA) from Sigma (St. Louis, MO, USA) was used as a polypeptide model and it was added to a final concentration of 1% or 2% (w/v). The pH was adjusted to 7. The solutions were then electrospun to produce nanofibrous structures that were subsequently characterized by using SEM.

Results

It was possible to produce 8% solutions of the polymer that contained 1-2% of albumin that were possible to electrospin. Their evaluation for their structure, diameter of fibres, inerdistances and peptide release are underway. More results will be presented.

Conclusions

It is feasible to electrospin albumin containing 8% solutions of bioerodible polymer (PAM).

Key words: bioerodible, electrospinning, nanotechnology, drug release, tissue-engineering

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Electrospun PCL-Starch (70:30) Blend Nano Fiber Based Constructs for Tissue Management

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Introduction

Recently, starch based polymers have been developed and introduced as novel material for tissue management. Electrospinning is one method to to manufacture highly porous 3D structures for tissue engineering.

Aim

To develop nanofiber-based constructs from Poly-ε-caprolactone:starch (70:30) blends (SPCL) using electrospinning.

Materials and Methods

SPCL was dissolved in acetic acid to form 14 w/v-% solution and stirred homogenous. About 0.1g of polymer in solution was electrospun onto substrate. The distance between needle tip and substrate was 15cm and electric field was 13kV/cm. Characterization of construct microstructure was performed using scanning electron microscopy (SEM).

Results

The electrospun nanoscaffolds were porous. SEM analysis showed that starch particles are connected by polycaprolactone fibres. The average size of the starch particles was about 6µm. Average diameter of nano-fibers was 150nm. More details will be presented.

Conclusions

It is possible to produce highly porous nano-fibre based constructs from SPCL using electrospinning. Such constructs may have applications in tissue construction, regeneration, and controlled healing.