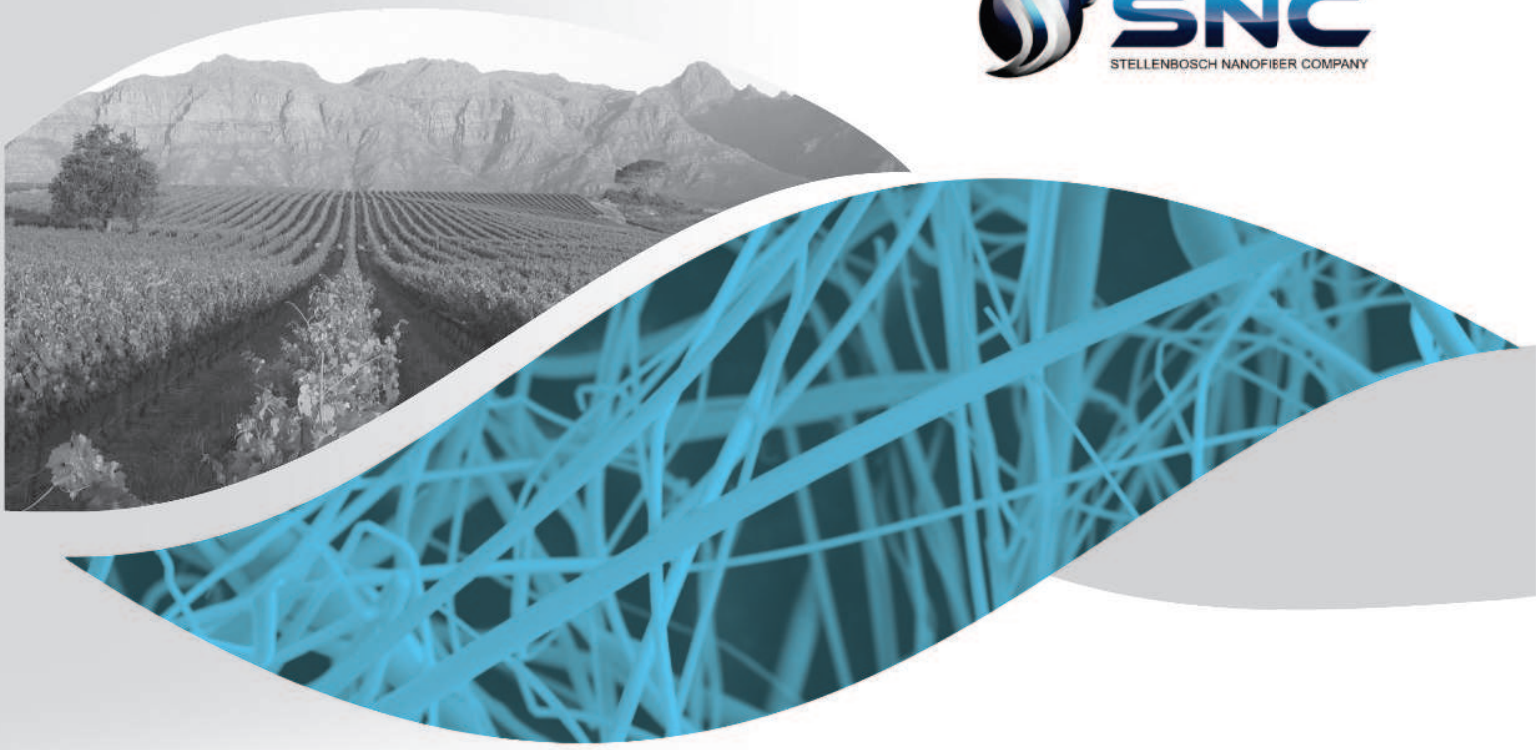

ELECTROSPIN2018
INTERNATIONAL CONFERENCE

16th to 18th January 2018

Wallenberg Research Centre at Stias

Stellenbosch, South Africa

Hosted by The Stellenbosch Nanofiber Company

CROSSLINKING OF BICOMPONENT NANOFIBRES FROM ALTERNATIVE SOLVENT SYSTEM

Judyta Dulnik, Paweł Sajkiewicz

Laboratory of Polymers and Biomaterials, Institute of Fundamental Technological Research, Polish Academy of Sciences; Pawińskiego 5B, 02-106 Warsaw, Poland
jdulnik@ippt.pan.pl, psajk@ippt.pan.pl

Abstract

Synthetic polymers exhibit good and tunable mechanical properties and can be easily processed, but they lack bioactivity that only natural polymers can provide. Combining the two types of polymers – synthetic and natural, when designing scaffolds for tissue engineering, can be an answer to this problem.

In our laboratory, we optimized the method of obtaining bicomponent nanofibers made of polycaprolactone (PCL) with an addition of gelatin, through electrospinning from a green, cheap and safe for the operator solvent system – a mixture of acetic and formic acid [1]. Unfortunately, further in vitro biodegradation studies showed fast biopolymer leaching from the fibres. With loss of gelatin in the fibre structure and on its surface the biofunctionality of a material decreases. It is reflected in its hydrophilicity and can be observed in scanning microscope images (SEM) [2].

The solution to this predicament is crosslinking of gelatin within the fibre. We decided to investigate a set of different chemical crosslinking methods to discern which is the optimal one. Four crosslinking agents were chosen: genipin, 1 -ethyl-3- (3-dimethylaminopropyl) carbodiimide hydrochloride (EDC), 1,4-butanediol diglycidylether (BDDGE) and transglutaminase. One material type, PCL with gelatin in 7:3 ratio underwent crosslinking with all these compounds. For each of the crosslinking agents a number of configurations of crosslinking conditions was applied with different concentrations in crosslinking solution, types of solvent, duration.

Crosslinking was then assessed by measuring the weight change of a sample (and by that the loss of gelatin mass) after crosslinking process and again after 24 hours of biodegradation test. SEM imaging and wettability measurements were also performed to determine how different crosslinking methods and conditions influence samples' morphology and surface properties. The results let as to optimize some of crosslinking conditions and decide which of those methods are more effective in preserving gelatin in bicomponent fibres.

Acknowledgement

This work was funded by the Polish National Science Center (NCN) under the Grant No.: 2015/17/N/ST8/02027.

[1] P. Denis, J. Dulnik, P. Sajkiewicz, "Electrospinning and Structure of Bicomponent Polycaprolactone/Gelatin Nanofibers Obtained Using Alternative Solvent System", International Journal Of Polymeric Materials and Polymeric Biomaterials, 64 (2015), 354-364.

[2] J. Dulnik, P. Denis, P. Sajkiewicz, D. Kołbuk, E. Choińska, "Biodegradation of bicomponent PCL/gelatin and PCL/collagen nanofibers electrospun from alternative solvent system" Polymer Degradation and Stability, 130 (2016), 10-21.