The Effect of Sodium chlorophyllin on Polyvinyl Alcohol Electrospun Nanofiber Web

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Keywords **– electrospinning, sodium chlorophyllin, nanofibersweb, polyvinyl alcohol.**

INTRODUCTION

The properties of the electrospun nanofibers ensure their usability for nanobiocomposites and medical applications [1], therefore acquisition methods that would be effective and successfully integrated not only in laboratories, but also in the production are investigated. Sodium chlorophyllin (analogues of food additive E 141 according to the Codex Alimentarius [2]) is a component of neutralized extractive substances derived from spruce foliage. Sodium chlorophyllin contains derivatives of "a" and "b" chlorophyll (chlorines, sodium salts of chlorophylline acids etc.), sodium salts of resinous acids (pimaric-, isopimaric-, abietic- and labdane types), sodium salts of fatty acids (mainly oleic-, stearic- and linoleic). Sodium chlorophyllin is used as active food additive and color, as well as in cosmetics (creams, deodorants etc.). The product shows bacteriostatic, regenerative and deodorant properties [3].

The effect of sodium chlorophyllin concentration ($C_{32}H_2CN_4N$) on polyvinyl alcohol (PVA) electrospun nanofiber web are discussed and interpreted by an attenuated total reflection Fourier transform infrared (ATR-FTIR) spectroscopy, atomic force microscopy (AFM), mechanical testing and microbiological test.

MATERIALS AND METHODS

In this study nanofiber composites of sodium chlorophyllin with the concentrations 1wt%, 3wt% and 5wt% were analyzed. PVA 8wt% spinning solution properties were also tested in order to evaluate the effects of added sodium chlorophyllin to the polymer solution.

Before subjection to electrospinning process following measurements of sodium chlorophyllin and PVA solutions were performed- viscosity was measured using HAAKE Viscotester 6 plus thermo, conductivity parameters were obtained using WinLab® Data Line Conductivity meter.

In order to evaluate properties of the electrospun nanofibers, following tests were performed: for chemical confirmation of presence of sodium chlorophyllin in nanoweb *Perkin Elmer, Spectrum One FT-IR Spectometer* was used, by scanning electron microscopy (SEM) method morphology of the samples were analyzed. Diameter measurements of the fibres were obtained using Atomic force microscopy (AFM). After measuring thickness of the samples, mechanical properties (tensile strength and elongation at break) were tested on Instron Universal Tester (Model 2519-107). For determination of the effect of sodium chlorophyllin on human dermal cells, laboratory scale microbiological tests were performed.

RESULTS

Investigation of pure sodium chlorophyllin and its solution spinnability in a concentration range from 1wt% to 15wt% had shown that sodium chlorophyllin concentrate without PVA matrix cannot be electrospun. Electrical conductivity of 10wt% and 15wt% sodium chlorophyllin/PVA matrix spinning solutions were too high preventing nanofibers from forming the even web on the substrate. Nanofibers web with 5wt% concentration showed better results, although it performed lower mechanical properties, compared to 3wt% concentration.

CONCLUSIONS

The sodium chlorophyllin effects such properties of the spinning solution as viscosity and electrical conductivity, the morphology of nanomats, diameter of nanofibers and also mechanical properties.

Future studies are needed to investigate composite concentration interval in the range from 0.25wt% to 10wt% in order to determine the critical point and to obtain nanofiber web with the highest possible concentration of sodium chlorophyllin.

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