EFFECT OF *IN VITRO* BIODEGRADATION ON THE STRUCTURE OF BNC IN THE ASPECT OF ITS USE AS A MATERIAL FOR THE CARDIAC IMPLANTS PRODUCTION

PAULINA DEDERKO*, MARTA WALCZUK, HANNA STAROSZCZYK, EDYTA MALINOWSKA-PAŃCZYK, ILONA KOŁODZIEJSKA

DEPARTMENT OF CHEMISTRY, TECHNOLOGY AND BIOTECHNOLOGY OF FOOD, GDANSK UNIVERSITY OF TECHNOLOGY, POLAND
*E-MAIL: PAUDEDER@STUDENT.PG.GDA.PL

[ENGINEERING OF BIOMATERIALS 138 (2016) 20]

Introduction

Bacterial nanocellulose (BNC), a polysaccharide synthesized by bacteria of the *Gluconacetobacter* genus, is a natural nanomaterial. In comparison with plant cellulose, contaminated with hemicelluloses and lignines, bacterial cellulose is characterized by high purity, high degree of crystallinity and polymerization, and good mechanical properties. BNC is also biocompatible, biofunctional and does not show mutagenicity and teratogenicity. Due to these unique properties, BNC membranes are used for wound dressings, and their potential for the production of cardiac implants is currently under study. Before using BNC as a material for cardiac implants, determination of BNC biodegrabillity in human condition should be examined.

Materials and Methods

The bacterial nanocellulose, obtained according to using the method described in patents PL 171952 and PL 212003, was supplied by Bowil Biotech Sp. o.o. The susceptibility to degradation by the microorganisms was carried out in the presence of *Staphylococcus aureus* PCM 2054, the yeast *Candida albicans* ATCC 10231 and *Aspergillus fumigatus var. fumigatus* ATCC 96918. BNC membranes were stored for six months at 37°C in sterile PBS and SBF fluids, in the absence and presence of microorganisms. Then, changes in the structural properties of the material, determined at selected intervals, were tested by Fourier transform infrared (FTIR) spectrophotometry and X-ray powder diffraction techniques. Changes in the thermal properties of the material were determined by thermogravimetric analysis (TGA), and changes in its surface morphology - by scanning electron microscopy (SEM). The samples were freeze-dried and conditioned prior to analysis for seven days in a P_2O_5.

Results and Discussion

Incubation of the BNC membranes both in sterile simulated human plasma fluids and in the presence of pathogenic microorganisms, resulted in a change in polysaccharide structure. Results obtained after 6-months incubation revealed that the degree of crystallinity of BNC is little changed, and it thermal stability is reduced. Microscopic observations showed loosening the fiber network structure of samples incubated in the sterile buffers and in the presence of microorganisms.

Conclusions

The action of the mold *Aspergillus fumigatus* brings about the strongest changes in the BNC structure.

Acknowledgments

This study was supported by the National Centre for Research and Development under Grant PBS II PBS2/A7/16/2013 entitled “Pre-clinical tests of possible applications of the original Polish bionanocellulose (BNC) in regenerative medicine in the aspect of bioimplants in cardiac and vascular surgeries”.

References

[1] R. Chandra, R. Rustigi. Prog. Mater. Sci. 23 (1998), 1273 - 1335.
[2] S. Bielecki, H. Kalinowska. Post. Mikro. 47(2008), 163-196.
[3] E. Galwas, A. Krystynowicz. PL 171952 B1(1993)
[4] A. Krystynowicz, W. Czaja, S. Bielecki. PL 212003 B1 (2003)