INTRODUCTION

The purpose of the study was to evaluate the biocompatibility of the selected biomaterials, as a potential source for artificial tissue scaffolds that may act as an extracellular matrix in regenerative medicine.

Biocompatibility of the biomaterials was assessed by:
- 1) liquid extracts test
- 2) direct contact test
- 3) cell ability to growth and proliferation on the biomaterials

Cell lines in the assays:
- human dermal skin fibroblasts,
- B16F10 (mouse melanoma cells),
- HS/MEC (Human Skin Microvascular Endothelial Cells)
- HEPC-CB1 (Human Endothelial Progenitor Cells – Cond Blood Cells), impact of the biomaterials on cells were assessed: 1) by measuring cytotoxic effect of the biomaterials liquid extract and 2) by direct contact test. The ability of cells to attach to the biomaterials was tested as well as cells' potential to growth and proliferate on the surface of the biomaterials. None of the tested biomaterials show cytotoxicity towards the tested cells, making them a potential valuable raw material for 3D scaffold development that would find its applications in tissue engineering. The efficiency of cells attachment and proliferation between tested biomaterials and cells lines were observed. In addition, a stimulating effect of the biomaterials on cells growth was also detected.

Production of biomaterials by electrospinning

Electrospinning is the most common method for the preparation of nanofibers from the solution. The coaxial electrospinning, a variation of the electrospinning, was employed to produce the biomaterials. The shaping (morphology) of nanofibers of the core solution and shell solution. Nanofibers are produced in this process. The shell solution is stretched by electrostatic field within the zone of straight-forward flow. The flow of the core-forming solution is stretched due to the interactions and friction imposed on it by the coating solution. The shaping (morphology) of nanofibers of the core-shell polymer-type is also strongly influenced by the evaporation rate of solvents used in the process. [1]

RESULTS OF THE BIOCOMPATIBILITY ASSESSMENT

1) Determination of the biomaterials’ liquid extract impact on cells viability

Method: MTT assay

Conclusions: The mean viability of the cells didn’t decrease below 70%, what means that none of the extracts of the tested biomaterials shown toxic effect to the tested human skin fibroblasts, B16F10, HS/MEC and HEPC-CB1 cells.

2) Determination of the biomaterials’ direct contact impact on cells viability and attachment

Method: FDA staining

Conclusions: Cells attached to all of the biomaterials but with different efficiency. Efficiency of the cells attachment may depend on the kind of the biomaterials and cells type. Representative pictures are shown.

3) Determination of cells ability to growth and proliferation on the biomaterials

Methods: alamarBlue assay & DIO staining

Conclusions: Total fluorescence of the alamarBlue was higher, even twice, in wells with biomaterials when compared to the well with cells without any biomaterial. That indicated, that the presence of the biomaterial triggered cell proliferation and growth. The same trend was observed for HEPC – CB1 cells (data not shown). Moreover, cells stained with DiD were incubated for 96h and pictures were taken every 4h. Results indicated cells ability to growth and proliferate on the biomaterials with efficiency that vary between cells type and biomaterial type (data not presented).

Fig. 1A: Electrospinning device; Fig. 1B Interior of the electrospinning device; Fig. 1C Taylor’s cone

Fig. 2: pictures of the biomaterials structure, JdK magnification

A. PCL
B. PCL+SHAP
C. PCL+NHAP
D. PCL+PLGA
E. PCL+CaCO3
F. PCL+SHAP+NHAP+CaCO3
G. PAN

Fig. 3A: Drop of water on a surface of a biomaterial. Hydrophobic property of the biomaterials makes them quite a big challenge in regenerative medicine and has to be overcome e.g. by cold plasma treatment. [2]

Fig. 3B: Drop of water on a surface of a biomaterial after plasma treatment. The drop changed its shape, flatness is clearly visible.

Cold plasma treatment performed and pictures taken by dr G. Busko

Fig. 3C: pictures of the biomaterials structure and properties of slow dissolving nanofibers obtained by (co-)electrospinning, a variation of the electrospinning, was employed to produce the biomaterials by co-electrospinning, a variation of the electrospinning, was employed to produce the biomaterials. The shaping (morphology) of nanofibers of the core solution and shell solution.

REFERENCES


