DESCRIPTION FOR GENERAL PUBLIC (IN ENGLISH)

Tissue engineering, the perspective branch of regenerative medicine is intended to obtain a functional substitutes for the treatment of damaged tissues and organs. Cell cultures performed *in vitro* allow to obtain the biological material that can replace damaged tissue. For culture of adherent cells, the use of so called scaffolds is necessary, as they provide support for growing cells. Until now a variety of scaffolds of different size and shape, mainly based on synthetic and natural degradable polymers are developed. Scaffolds with proliferated cells are implanted in the place of the damaged tissue or organ. Cells fill the space of the tissue defect accelerating tissue regeneration while the scaffold degrades after a certain period of time. It was proved that the products of polymer degradation were not completely neutral to the human body. The oligomeric compounds derived from degrading polymer can accumulate in tissue, leading to local acidification within the tissue and thereby causing inflammation. The challenge is to obtain scaffold that would enable the efficient cell proliferation and formation of tissue prototype, but on the other hand, that would not to introduce polymer derivatives into the human body.

The main objective of the project is to obtain new polymeric scaffolds with temperature dependent solubility (TDS-scaffold) for potential application in tissue engineering. The resulting two- and three-dimensional scaffold will provide a support for cell growth and formation of tissue prototype at the culture conditions. When cell culture is completed it will be possible to separate the tissue prototype from the scaffold by dissolution caused merely by lowering the temperature.

To prepare the TDS-scaffold, thermoresponsive polymers based on 2-alkyl-2-oxazolines (POx), their copolymers and blends will be used. Polymers for scaffold preparation will be obtained via cationic ring opening polymerization. Their physicochemical properties, such as melting temperature, glass transition temperature and crystallinity will be adjusted to the processing requirements and to the possibility of 2D or 3D scaffold formation. Other polymer properties, such as solubility, phase transition in water and culture medium and hysteresis of phase transition will be optimized for the final, desired properties of the scaffold. Scaffolds will be fabricated from chosen polymers by electrospinning and 3D printing. These techniques have not been previously used for fabrication of biomaterials derived from poly(2-alkyl-2-oxazoline)s. Thus, obtained results will extend the present state of knowledge on POx processing. The properties of scaffolds important in terms of cell culture, such as the mechanical strength under simulated culture and the dissolution rate by lowering the temperature will be investigated by modern techniques. The final task of the project will include the adhesion and proliferation of model cell lines and the possibility of formation a tissue prototype on scaffolds. The possibility of separation of the cultured cells from the scaffold by its dissolution will be studied.

Two innovative aspects are formed in the project:

- poly(2-alkyl-2-oxazoline)s will be used for the preparation of scaffolds by electrospinning and 3D printing. By an appropriate design of polymers composition and control of their properties it will be possible to adapt them to the processing method and to the final biomaterials.
- the separation of cultured tissue prototype from the scaffold will be carried out by simply dissolution of the scaffold at the laboratory conditions, not by conventional degradation of the polymer in the human body. Thus, there is no oligomeric products of polymer degradation that are formed in the human body and the tissue prototype can be quickly separate from the scaffold without affecting of its integrity.

Research planned in the project are part of the latest trend of world research in the field of modeling, design and control the properties of polymeric materials that are applied as biomaterials in regenerative medicine.