The process parameters impact on the surface pores size of the small diameter cylindrical polyurethane structures – description for the general public

Cardiovascular diseases are the major cause of death worldwide. Every year demand or artificial blood vessel is increasing. For this reason there is constant search for the new solution, especially for small diameter vascular grafts (diameter below 6mm).

The basis of the artificial blood vessel is cylindrical scaffold, which must fulfill certain characteristics - appropriate bio- and hemocompatibility (not causing an immune response or blood clotting). Additionally, the structure must have pores with appropriate size primarily at the surface. The diameter of the surface pore adjusted to the size of the cell, will help in faster integration with the surrounding tissue during the healing. Furthermore, a proper porosity ensures the exchange of gaseous substances and nutrients by the cell.

Aim of the presented research is obtaining small diameter cylindrical polyurethane structure with surface pores within the range of 8μm to 10μm. These structures will be prepared using the phase inversion method. It is planned to select the most favorable polyurethane concentrations, type of the non-solvent and process parameters for obtaining the desired structure. The materials biocompatibility as well as interaction with blood will be investigated.

The main objective of the present research is to complement the current state of knowledge on the manufacturing cylindrical polyurethane porous structures using the phase inversion method. This studies will allow to investigate the effect of the individual process parameters on the surface pores size and distribution. In addition, an important aspect of the proposed project is the material toxicity and hemocompatibility evaluation. The applied method and the selection of the most favorable parameters will allow for more precise control of the surface pores amount and size in the obtained material. Properly designed cylindrical structure could be the scaffold for further work on the development of the small diameter vascular graft, which would expedite the breakthroughs in biomaterials engineering and cardiology.