Załącznik nr 3

mgr inż. Iwona Łopianiak
(professional title, name)

Faculty of Chemical and Process Engineering/
Department of Biotechnology and Bioprocess Engineering
(Faculty/Unit)

Warsaw University of Technology
(University)

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ABSTRACT OF THE DISSERTATION

„ Fabrication and characterization of multilayered fibrous vascular grafts produced using solution blow spinning process"

dissertation supervisors: prof. dr hab. inż. Tomasz Ciach
dr hab. Beata Butruk-Raszeja

Surgical treatment of small-diameter blood vessel (<6 mm) occlusions using vascular prostheses remains a significant challenge in clinical practice. Existing solutions rarely ensure long-term patency in vessels with small lumen diameters. A modern approach combining tools from chemical engineering, product engineering, and tissue engineering offers an alternative to conventional synthetic grafts by enabling the development of biofunctional implants that support vascular regeneration.

The aim of the present research was to develop a layered, fibrous vascular graft with mechanical properties similar to those of native blood vessels. The structure of the graft was designed to promote the adhesion and proliferation of vascular wall cells while minimizing platelet adhesion. The materials were fabricated from medical-grade polyurethanes using the solution blow spinning (SBS) technique. A detailed analysis of the influence of SBS process parameters, polymer properties, and solution characteristics on the morphology and mechanical properties of the fibrous materials was conducted, allowing for the controlled production of scaffolds with targeted properties. The effect of scaffold structure on the behavior of selected vascular cell types was also assessed. Blood-contact studies were carried out to evaluate platelet adhesion and the hemolytic potential of the surfaces.

Based on the obtained results, a multilayered vascular graft was designed and fabricated, exhibiting structural and functional properties favorable for the restoration of vascular tissue. The layered grafts developed in this study meet key structural and mechanical criteria required for scaffolds used in vascular tissue engineering. Furthermore, they provide a suitable environment for the growth of specific vascular cell types and demonstrate an acceptable level of platelet adhesion upon blood contact. The results indicate high application potential of the proposed implants.

Iwona Łopianiak