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Immobilization of proteolytic enzymes onto silica nanofibers

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Even in modern medicine, it is still necessary to remove necrotic tissue from burns in a very painful method – by using surgical instruments. It is possible to replace the surgical method with application of proteolytic enzymes directly to the wound, which removes the necrotic tissue completely painlessly. However, most enzymes are active only for a short time and under the specific conditions. The catalytic activity of enzymes can be increased e.g. by immobilization of enzymes onto the biocompatible silica nanofibers. The nanofibers must be functionalized by suitable reagents to form a ligand between silica nanofibers and amino groups of proteolytic enzymes. There are many ligands, but most are inappropriate for use in health care, e.g. glutaraldehyde. In our research, the nanofibers surface was modified by 3-Aminopropyl triethoxysilane firstly, then functionalization by succinic anhydride and N-Hydroxysuccinimide ester was done. As the next step, 7 different proteolytic enzymes were immobilized to the silica nanofibers surface. Proteolytic activity of enzymes was tested under conditions simulated skin burns environment (temperature of 37°C and pH 4.6). Higher temperature influence on the proteolytic activity was demonstrated on nanofibers with the protease from *Aspergillus oryzae*, where the difference between the activity at 4°C and 37°C was more than doubled. Conversely, bromelain seemed to be temperature independent in this temperature range. Bromelain from pineapple stem, α-chymotrypsin from bovine pancreas, protease from *Aspergillus oryzae* and trypsin from bovine pancreas were selected for further testing – the long-term stability of silica nanofibers with immobilized enzymes and cytotoxicity tests.

Biography

Danilová Iveta is a PhD student in the field of Materials Engineering and Textile Technology, Technical University of Liberec. The topic of dissertation thesis is Development of Nanofibrous Materials for Biomedical Applications and her supervisor is Associate Professor Irena Lovětinská-Šlamborová.

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