

Progress of science and the methods of characterization of the surrounding world, not only on the macro-, but also on atomic level, enables better development of new materials and the knowledge about natural materials around us, including human tissues. These actions resulted in appearing in the recent past of new, very fast growing field of science - tissue engineering, which combines knowledge of materials, biology and medicine to develop materials necessary for the treatment of humans.

On one hand, new materials for tissue regeneration or even whole organs, are developed, while on the other, the mechanisms of tissues regeneration in a living body, and their construction are investigated. The research on the issues mentioned above have shown that mammalian cells to be able to grow, apart from the suitable nutrients, also need structures which they can naturally stick to and climb over like on a scaffold. Such three-dimensional environments in mammalian tissues are called the extracellular matrix (ECM). The matrix consists of, among others, of very thin fibres, protein (collagen) to which the cells attach and which provide tissue flexibility.

The observation of this phenomenon encouraged people to start working on materials similar to collagen structures, both in terms of morphology, as well as the chemical composition. There are many studies concerning collagen or collagen-like materials in tissue regeneration, treatment of burns, dental implants, cosmetics, etc. Another large branch of science is related to the investigations of materials that mimic thin collagen fibres found in our tissues. Such fibres may be formed by electrospinning. Very thin fibres (diameter of the nanoscale) through an analogy to the extra cellular matrix and the perspective of applications in industry gained in importance and work on them is dynamically developing.

In the proposed research, we try to combine the advantages of the electrospinning method and the native structure of collagen. In the classic process of electrospinning, highly toxic chemicals destroy the native structure of the collagen, which is crucial for the regeneration of tissues. Our goal is the formation of ultra-thin fibres without using of toxic chemicals, followed by attachment of collagen using the chemical processes of hydrolysis and aminolysis. Consequently, the process of electrospinning becomes cheaper and much more environmentally friendly.

The outcome of the proposed research project will be systematization and broadening of the knowledge concerning optimal conditions of following processes:

- aminolysis and hydrolysis of electrospun nanofibrous materials
- attachment of collagen on previously functionalized ultrathin fibres in order to obtain materials of high regenerative potential.

These objectives will be achieved with the additional benefits of:

- reducing the cost of production of aforementioned materials,
- elimination of the use of highly toxic and denaturing solvents (ecological value),
- the prospect of developing of materials with potential use in regenerative medicine (social value).