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Development, investigation and application of composite chitosan-based matrices for tissue engineering

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Chitosan is well known as the most promising polymer for medical application because it combines bioresorption, absence of cytotoxicity and low environmental impact during processing. The aim of our work was development of the resorbable (biodegradable) 1D-, 2D- and 3D-matrices for proliferation and differentiation of stem cells that is claimed in medicine, biology, pharmacology, bioengineering and tissue engineering. Due to highly hydrophilic nature of chitosan, its properties are unstable and, as result, their strength and rigidity are reduced in the wet state. Therefore, in our laboratory we try to develop and investigate composite materials based on chitosan in order to optimize mechanical properties of final matrices. As 1D-matrices we can produce fibers, which can be used as prototype of muscular tissue and ligaments as well as suture threads. For this purpose we introduce chitin nanofibrils in chitosan-based fibers, aiming at an increase of their stability in wet conditions and variation of resorption time. Composite chitosan-based 2D-matrices – films and fibers felt as prototype of dermal tissue can be produced directly from chitosan solution or by electrospinning method. Such matrices consisting of electrospun chitosan nanofibers shows very good results as wound dressing in combustiology. Chitosan 3D-matrices – sponges as prototype of bones, cartilaginous tissues and tissues of parenchymal organs (liver, spleen, lungs, kidney, pancreas, etc.) – can be modified by incorporation of different nanofillers and then implanted in various parts of living organism.

Biography

Elena M Ivankova has completed her PhD from Peter the Great St. Petersburg Polytechnic University (St. Petersburg, Russia) and then worked as Scientific Collaborator at Institute of Material Science, Martin Luther University Halle-Wittenberg (Halle/Saale, Germany) and at Fracture Physics Department of Ioffe Physical-Technical Institute RAS (St. Petersburg, Russia). Now she is the Senior Scientist in Institute of Macromolecular Compounds RAS (St. Petersburg, Russia). She has published more than 45 papers in reputed journals and has been serving as a Reviewer.

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