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Ag-doped PCL nanofibers for tissue engineering

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Poly-ε-caprolactone (PCL) is a biocompatible and biodegradable polymer that is attracting great interest as the promising materials for various applications is in medicine and, in particular, in tissue engineering. Here, we produced PCL nanofibers by electrospinning technique that allows one to obtain the nanofiber structure similar to that of extracellular matrix. The PCL scaffolds can be used as bone fillers and skin bandages. To improve bioactivity and to endow the PCL nanofibers with antibacterial properties, the material was first coated with multifunctional bioactive nanostructured films and then implanted with Ag ions. To select Ag ion energy, SRIM (The Stopping and Range of Ions in Matter) calculations were carried out. Microstructure and phase composition of modified fibers were studied by means of scanning electron microscopy and X-ray photoelectron spectroscopy. The adhesion and proliferation of the MC3T3-E1 cells cultivated on the surface of TiCaPCON-coated PCL nanofibers were significantly improved in comparison with the uncoated nanofibers. The antimicrobial effect of the Ag-doped samples was evaluated against clinically isolated Escherichia coli U20 (E. coli), Staphylococcus aureus 839 (S. aureus) bacteria and different strains of Neurospora crassa (N. crassa) Wt987, Nit-6 and Nit 20. In all cases surface Ag-doped nanofibers had strong antibacterial effect, however Ag ions didn't release from the scaffold that means they don't be accumulated in the liver. Inductively coupled plasma mass spectrometry (ICP-MS) which was utilized to determine the amount of Ag ions leached from the scaffolds indicated less than 5 ppb/cm^2 released Ag ions for 7 days.

Biography

Permyakova Elizaveta is a PhD student of Material Technology in National University of Science and Technolgy "MISiS". The main topic of her research is related to the deposition of bioactive multicomponent thin films, immobilization of biomolecules and surface analysis. Her work is absolutely essential for the development of novel bioactive materials used in regenerative medicine. Permyakova has already published eleven articles indexed in Scopus and she is first author of four articles. Permyakova has demonstrated very good expertise in biochemistry, cell biology and material characterization.

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