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Tissue Science 2019: Ag-doped PCL nano fibers for tissue engineering - Permyakova Elizaveta - National University of Science and Technology "MISiS", Russia

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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 fiberswere 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 coliU20(E. coli), Staphylococcus aureus839(S. aureus) bacteria and different strains of Neurosporacrassa (N. crassa) Wt987, Nit-6 and Nit 20. In all casessurface 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/cm2 released Ag ions for 7 days.

Embedded gadgets are inclined to bacterial contaminations, which can bring about embed slackening and gadget disappointment. Relieving these contaminations is imperative to both embed security and patient wellbeing. The advancement of antibacterial embed coatings can diminish the nearness of bacterial provinces, decreasing the hazard for bacterial-subordinate embed disappointment. Here, we show that electrospun polycaprolactone (PCL) filaments doped with silver nanoparticles (NPs) from a silver nitrate antecedent can possibly diminish the pervasiveness of Streptococcus pneumoniae while supporting osteoblast connection and expansion. An air plasma decrease strategy for PCL electrospun filaments was utilized to get ready strands doped with silver NPs. Filaments were portrayed utilizing examining electron microscopy and transmission electron microscopy for subjective assessment of NP appropriation and quantitative investigation of fiber breadths. Antibacterial testing against S. pneumoniae was performed with effective hindrance saw after 24 h of presentation. In vitro testing was finished utilizing Saos-2 cells and proposes that the negative surface charge can possibly build mammalian cell practicality even within the sight of strands containing NPs. Taking everything into account, this examination depicts a novel technique to deliver bioresorbable embed coatings with the capacity to diminish bacterial diseases encompassing the embed surface while staying biocompatible to the host.

Tissue engineering uses a combination of cell biology, chemistry, and biomaterials to fabricate three dimensional (3D) tissues that mimic the architecture of extracellular matrix (ECM) comprising diverse interwoven nanofibrous structure. Among several methods for producing nanofibrous scaffolds, electrospinning has gained intense interest because it can make nanofibers with a porous structure and high specific surface area. The processing and solution parameters of electrospinning can considerably affect the assembly and structural morphology of the fabricated nanofibers. Electrospun nanofibers can be made from natural or synthetic polymers and blending them is a straightforward way to tune the functionality of the nanofibers. Furthermore, the electrospun nanofibers can be functionalized with various surface modification strategies. In this review, we highlight the latest achievements in fabricating electrospun nanofibers and describe various ways to modify the

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surface and structure of scaffolds to promote their functionality. We also summarize the application of advanced polymeric nanofibrous scaffolds in the regeneration of human bone, cartilage, vascular tissues, and tendons/ligaments.