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Cyto-compatibility of poly-L-lactic acid doped with graphene nanoplatelets and activated with plasma

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Polylactic-L-Lactic Acid (PLLA) is a biodegradable polymer that is increasingly popular with properties that enable its use in healthcare. The most common is the use of copolymers, or the formation of composites with different nanoparticles and fibers. Modern is the creation of so-called conductive polymeric nanocomposites that combine a nonconductive polymeric matrix with conductive nanoparticles. These composites can react to chemical, thermal or mechanical stimuli by changing electrical properties, making them of interest in the manufacture of sensors. Composites of PLLA and multi-wall Carbon Nanotubes (CNT), which served as a sensor for the detection of volatile organic solvents was already prepared. The low humidity sensor was developed with PLLA and gold nanoparticles. We have focused on preparation of bulk doped PLLA layers with Graphene Nanoplatelets (GNP) and the surface activation. Homogeneously doped PLLA with graphene nano-platelets was consequently activated both with plasma and heat treatment. Subsequently both the pristine doped and the plasma treated samples were chosen for experiments on cyto-compatibility of prepared samples, therefore may have several applications in tissue engineering. GNPs-doped specimens were thoroughly characterized and their physicochemical properties were evaluated. The optimization of the preparation of volume-doped PLLA layers with GNPs was performed for different amount of GNPs. Plasma treatment induced GNPs to be revealed which subsequently affected the surface roughness. The modification of PLLA/GNP by plasma had a significant influence both on wettability and surface roughness. As stabilized PLLA doped layers can be safely labeled after 70 hours of aging. The most important is that we proved, that PLLA with GNPs may have a positive influence on cell adhesion and proliferation, the positive cell response to GNPs may be further enhanced with plasma treatment. The most important is that we proved, that PLLA with GNPs may have a positive influence on cell adhesion and proliferation (Fig.1), the positive cell response to GNPs may be further enhanced with plasma treatment. This work was supported by the Ministry of Health of CR under the project 15-32497A

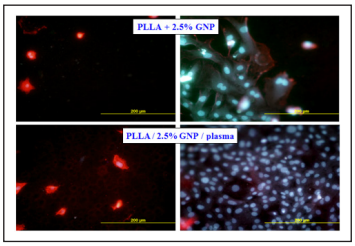

Figure-1: Photographs of adhered and proliferated VSMC cells on the 1st (left column) and 6th (right column) day from seeding on PLLA with 2.5 wt. % of GNPs and PLLA with 2.5 wt. % of GNPs consequently treated with plasma (3 W and 240 s).

Recent Publications

1. P Slepicka, N Slepickova Kasalkova, J Siegel, Z Kolska, L Bacakova, V Svorcik (2015) Nano-structured and functionalized surfaces for cyto-compatibility improvement and bactericidal action. *Biotechnology Advances;* 33: 1120-1129.

References

1. E Castro-Aguirre, F Iniguez-Franco, H Samsudin, X Fang, R Auras (2016) Poly(lactic acid)- Mass production, processing, industrial applications and end of life. *Adv. Drug Delivery Rev*; 107: 333-366.

Biography

Petr Slepicka is an Associate Professor of Materials Engineering at University of Chemistry and Technology, Prague, Czech Republic. He has received his PhD from University of Chemistry and Technology Prague in 2007. His current main research activities include plasma and laser beam modification of polymers; modification of structure of solid state materials; study of surface physicochemical properties of materials and biocompatibility of polymers; metal nanostructures, preparation and characterization; atomic force microscopy and other surface analytical methods, interaction of metal with polymer and preparation of nanoparticles by deposition into liquids and interactions of graphene with polymer.

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