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Silica Nanofibres – Promising Material for Regenerative Medicine

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Abstract : Currently, attention of tissue engineers has been attracted to novel nanofibrous materials having advanced properties and ability to mimic extracellular matrix (ECM) by structure which makes them interesting candidates for application in regenerative medicine as scaffolding and/or drug delivering material. Throughout the last decade, more than 200 synthetic and natural polymers have been successfully electrospun leading to the formation of nanofibres with a wide range of chemical, mechanical and degradation properties. In this family, inorganic nanofibres represent very specific group offering an opportunity to manufacture inert to body, well degradable and in properties tunable material. Aim of this work, was to reveal unique properties of silica (SiO2, CAS 7631-86-9) nanofibres and their potential in field of regenerative medicine. Silica nanofibres were prepared by sol-gel method from tetraethyl orthosilicate (TEOS, CAS 78-10-4) as a precursor and subsequently manufactured by needleless electrospinning on NanospiderTM device. Silica nanofibres thermally stabilized under 200°C were confirmed to be fully biodegradable and soluble in several simulated body fluids. In vitro cytotoxicity tests of eluate (ES ISO 10993-5:1999) and in direct contact (ES ISO 10993-5:2009) showed no toxicity - e.g. cell viabilities reached values exceeding 80%. Those results were obtained equally from two different cell lines (Vero, 3T3). Non-toxicity of silaca nanofibres´ eluate was additionally confirmed in real time by testing on xCelligence (ACEA Biosciences, Inc.) device. Both cell types also showed good adhesion to material. To conclude, all mentioned results lead to resumption that silica nanofibres have a potential as material for regenerative medicine which opens door to further research.

Keywords : cytotoxicity, electrospinning, nanofibres, silica, tissue engineering
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