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A novel design of PVA electrospun nanofibrous scaffold embedded with liposomes as drug delivery carriers for tissue engineering applications

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Aim of this work is to develop a novel scaffold for tissue engineering (TE) applications incorporating a drug delivery system. Electrospinning is an emerging technology for the production of fibrous biodegradable polymeric scaffolds. Polyvinyl alcohol (PVA) is a biodegradable, biocompatible polymer, demonstrating a fast hydrolytic degradation rate, suitable for cell viability and function. Liposomes have received widespread attention as carriers of therapeutically active compounds due to their unique characteristics, e.g. incorporation of hydrophilic and hydrophobic drugs, good biocompatibility and targeted delivery of bioactive compounds to the action site. Combination of liposomes with PVA nanofibers may result in a scaffold with high efficiency in tissue regeneration as the controlled degradation and high surface-to-volume ratio of nanofibers, make them excellent carriers for therapeutic or tissue regeneration agents. In the present work we produced PVA membranous scaffolds enriched with calcein-loaded liposomes, where calcein was used as the fluorescent marker (at 100 mM where its fluorescence is quenched). The liposomal composition that we used was 1,2-distearoyl-sn-glycero-3-phosphocholine: cholesterol- [DSPC/Chol] in ratio 1:1 mol/mol. We showed that blend electrospinning of PVA leads to successful incorporation of liposomes into the fibers with highly retained encapsulation efficiency. Morphology of the fibers was examined by SEM. The fiber diameters ranged from 200 to 300 nm, presenting a good morphology. To confirm the successful incorporation of liposomes, we visualized the fibers using confocal laser scanning microscopy. The stability of the liposomes embedded on the electrospun fibers, was determined fluorometrically by measuring the calcein retention in liposomes (latency). It was proven that the embedded liposomes exhibited a high and constant retention rate of the calcein from the nanofibers. Given the combined properties of liposomes and nanofibers, the above system could serve as a convenient delivery vehicle for a number of biologically active compounds in tissue engineering and regenerative medicine.

Biography

Dimosthenis Mavrilas is an Associate Professor of Biomedical Engineering in the University of Patras, Greece. He has completed his PhD in Biomechanics from the University of Patras. He has published more than 30 papers in the fields of Biomechanics and Biomaterials, as well in Scaffolds for Tissue Engineering.

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