TS019
Designing silk fibroin-based matrices with ionic liquids for tissue engineering strategies using human adipose stem cells

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Silk (SF) is an attractive biomaterial to be used in tissue engineering applications because of its excellent mechanical properties and biocompatibility [1, 2]. In this work, the cellular response of silk hydrogels produced through dissolution of this protein in ionic liquids (ILs) was investigated. For that, degummed fibers obtained from the cocoons of mulberry silkworm (Bombyx mori) were dissolved in an IL and the solution was gelified in ethanol, followed by IL removal from gels using soxhlet extraction. The fabricated hydrogels were characterized biochemically and biophysically by detecting amino acid composition, FTIR, SEM and mechanical testing (DMA). For *in vitro* assessment, human adipose stem cells (hASCs) were seeded in the hydrogels and cultured for different time periods. The resulting hydrogels have a rubbery consistency, homogeneous surface and viscoelastic behavior. Additionally, no differences on amino acid composition were found, indicating that the silk composition was kept. Confocal images confirmed cell attachment and alignment of actin filaments within the hydrogel matrix with well-develop nuclei. The MTS assay demonstrated the metabolic activity of hASCs in contact with hydrogels up to 28 days. Furthermore, the results of DNA quantification showed that hASCs are able to proliferate during studied period. These results indicated that (i) the efficiency of IL removal resulted in hydrogels with minimal cytotoxicity; and (ii) positive cellular response of the materials surface for the adhesion and proliferation of hASCs. SEM observations corroborated with the results obtained from MTS and DNA suggested that cells are able to migrate at different levels within the structure. These findings indicated that silk hydrogels produced using ILs may be potential candidates for tissue engineering strategies, namely cartilage regeneration.

Acknowledgments: The authors acknowledge financial support from Portuguese Foundation for Science and Technology -FCT (Grant SFRH/BPD/45307/2008; SFRH/BD/64601/2009), "Fundo Social Europeu"-FSE, and "Programa Diferencial de Potencial Humano-POPH". This work was partially supported by the FEDER through POCTEP 0330_IBEROMARE_1_P

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TS020
Multilayered polymeric particle production using superhydrophobic surfaces methodology for drug delivery and tissue engineering applications

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Encapsulating technologies that render spherical particles containing cells or relevant moleculeshave been developed to be used in fields such as tissue engineering, pharmaceutics, cosmetics, agriculture, as also in other bio-related applications, namely biosensors and bioreactors. The multiple bioactive agents release, with an important role in tissue regeneration, constitutes an important strategy in tissue engineering. The control of bioactive agents release may be achieved increasing the complexity of the encapsulating particles by adjusting the chemistry and the architecture. In this context, multi-compartmentalized systems able to simultaneously deliver various bioactive agents at different kinetics have emerged and are envisioned to be the next area of development. Multilayered particles exhibiting predefined diameters and layers thickness may offer additional advantages including higher bioactive agents loads, improved molecules stability, and tailored release schedules such as delayed or pulsatile avoiding initial bursts. The most external layers could even act as rate-limiting barriers to further reduce burst release. Since multilayered particles are compartmented, each particle can load multiple bioactive agents isolated from each other. Similarly, more than one type of cells may be immobilized into different compartments. The layers thickness and composition determine the performance of the system. Compared to monocompartment delivery systems, the development of multi-compartmented structures is still immature and intensive efforts are being done to efficiently produce this type of systems. The production of multi-compartmented particles is quite challenging and the existing methodologies involve wet and aggressive conditions that compromise the encapsulation efficiency of bioactive agents and the viability of cells. Herein we report a simple bottom-up approach suitable for preparing multilayered polymeric particles in a very fast way, which involves the use of biomimetic superhydrophobic surfaces. In the present work, concentric multilayered polymeric particles were prepared by adding layers one-by-one, and then their applications as carriers for sequential multiple drug release and as scaffolds for cells immobilization intended in cell therapies or tissue engineering were explored. The results showed that the engineered particles can be loaded with different molecules confined in different compartments for later sequential and time-programmed release. They can also immobilize cells maintaining them viable for long time, being potentially useful for cell-based therapies.