WBC2020 - Virtual Submission

Surface modifications

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Impact of surface modification on polyester nanofibers properties and scaffold-cells interaction

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Introduction: Surface modification is one of the methods used to improve cell-scaffold interaction. As cell adhesion is determined by material surface properties, such as wettability, surface energy, stiffness, and presence of charged groups or bioactive sequences, surface modification of scaffold provides an opportunity to improve cell-material interaction without changing its bulk properties [1,2,3]. In this study, we modified the surface of three types of electrospun nano- and microfibers using aminolysis treatment and gelatin immobilization.

Experimental methods: Poly(caprolactone), poly(L-lactide-co-caprolactone) and poly(L-lactide) fibers were obtained by electrospinning technique. The aminolysis reaction was carried out by immersing materials in ethylenediamine solution in isopropanol. Various treatment conditions were applied to test the susceptibility of fibers to the reaction. Then, gelatin was chemically immobilized on the surface using glutaraldehyde as a cross-linking agent. For comparison, samples with physisorbed gelatin were prepared. The density of amine groups and gelatin on the surface was evaluated by the ninhydrin test and BCA test, respectively. Change of morphology, average molecular weight and crystallinity were determined using scanning electron microscopy, gel permeation chromatography and wide angle X-ray scattering technique, respectively. The wettability of modified samples was measured by a goniometer. Fibers with chemically and physically attached gelatin were incubated in phosphate-buffered saline (PBS) to test the stability of the coating. L929 cells were cultured on modified samples to investigate the biological response to modified samples.

Results and discussions: A significant difference in aminolysis efficiency depending on the type of polyester fibers was observed. Poly(L-lactide) fibers were the most susceptible to reaction, while poly(caprolactone) fibers were the least reactive. Average molecular weight measurements provided information that aminolysis is not only a surface-oriented reaction, however it is possible to modify fibers without significant change of polymer chains length. Gelatin immobilization completely changes the wettability of samples from hydrophobicity to superhydrophilicity regardless of the attaching method. The incubation of samples in PBS showed that chemically bind coatings are more stable than those that were physisorbed. For all gelatin-coated fibers, improvement of cells morphology and their metabolic activity were observed in comparison to unmodified samples, however change was most visible in the case of poly(caprolactone) scaffolds.

Conclusions: Study shows that aminolysis reaction enables chemical binding of gelatin on various types of polyesters. However, it is important to optimize reaction conditions depending on the scaffold application because aminolysis can significantly influence the average molecular weight of the polymer and mechanical properties of the scaffold. Chemically attached gelatin was more stable than physisorbed gelatin, and more siginificantly changed L929 cells response.

References/Acknowledgements: 1. Amani, Hamed, et al. "Controlling cell behavior through the design of biomaterial surfaces: a focus on surface modification techniques." *Advanced Materials Interfaces* 6.13 (2019): 1900572.

2. Rahmati, Maryam, et al. "Biological responses to physicochemical properties of biomaterial surface." *Chemical Society Reviews* 49.15 (2020): 5178-5224.

3. Jeznach, Oliwia, et al. "Aminolysis of various aliphatic polyesters in a form of nanofibers and films." *Polymers* 11.10 (2019): 1669.

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