Development of stratified porous scaffolds based on polyesters as supports for indirect cell co-culture

M. Herrero-Herrero[1], A. Vallés-Lluch[1,2], J.C. Rodríguez-Hernández[1], J.A. Gómez-Tejedor[1,2]

[1]Centro de Biomateriales e Ingeniería Tisular (CBIT), Universitat Politècnica de València, Camino de Vera, s/n, Valencia, Spain
[2]Centro de Investigaciones Biomédicas en Red en Bioingeniería, Biomateriales y Nanomedicina (CIBER-bbn), Spain

maherhe7@upv.es

One of the main problems in the field of biomaterials and drug development is the use of animals in experimentation, which is an ethical issue that concerns all the society.[1] In this sense, tissue engineering is working to find alternatives. One of these alternatives is the development of *in vitro* models based on polymer supports for *in vitro* cell growth. These structures, moreover, could be used not only in drug testing or *in vitro* research to reduce the use of animals in experimentations, but also for tissue regeneration, simulating from simple tissues in which there is a single cell type, to more complex tissues from cell co-culture.[2]

Thus, a three-dimensional system with a stratified porous structure have been developed to allow both indirect cell co-culture and drug release assays (**Figure 1**). For this purpose, porous supports (scaffolds) have been obtained by means of the solvent-casting particle-leaching technique using salt as porogen, whose pore size allows cells to be housed in its interior, on which electrospun membranes have been arranged, forming a sandwich structure. These membranes form a structure of cross-linked fibers, leaving spaces between them that are much smaller than the cell size, so that they allow the passage of nutrients and molecules through them, but act as a barrier to the cells, preventing their migration to other areas of the three-dimensional system.[3]

Different polyesters were used to adjust the hydrophilicity, biodegradability, drug release kinetics and biological behavior, as desired. Moreover, fiber diameter was stablished at 1.8 µm and membranes with and without curcumin as model drug were obtained by modifying the electrospinning parameters.[4] Curcumin was introduced by two methods: blend and coaxial electrospinning, so different delivery profiles were observed due to in blend electrospinning curcumin is placed in the whole fiber, while in coaxial electrospinning forms the core.[5] For that reason, in coaxial electrospinning the release depends strongly on the degradation, that is higher for polylactic acid and poly(lactic-co-glycolic) than poly(ε-caprolactone).

Because of the thickness limit of electrospinning, the 3D structure was obtained by using a sacrifice membrane. [6]

Finally, its use in indirect cell co-culture was tested by seeding fibroblast L929 in the scaffold, showing that scaffold allow cells to proliferate inside them, preventing an outside migration, so that indirect cell co-culture can be achieved by means of these structures.

References

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Figures

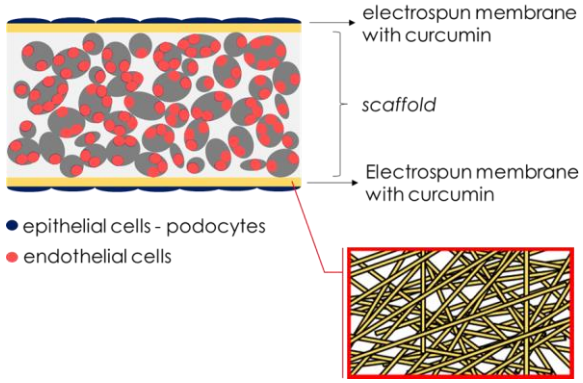

Figure 1. Scheme of the three-dimensional structure