Ultraporous interweaving nanofibers for tissue engineering

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ABSTRACT

In the field of tissue engineering, integration of micro-porosity, nano-topogaphical features and weattability into one three-dimensional (3D) scaffold remains a challenge. Here we report that a nanoscale immiscible polymer blend solution electrojet can assemble into ultraporous interweaving microfibers. The hierarchical porosity influenced cell infiltration, proliferation and differentiation significantly.

Multi-lamellar cylindrical structure was originated from a blend of PCL and PEO in DCM/DMF mixed solution when the ratio between each component reached a threshold and where the electrospinning parameters were delicate controlled. The morphology, crystallinity, surface chemistry and wettabilities were characterized to understand the mechanism of formation. The interplay of the two semi-crystalline polymers and the pair of solvents/non-solvents with the electrospinning processing parameters was found to be critical for the formation of the unique structure.[1]

The hydrophilic, hierarchically porous fibers were appilied in culturing fibroblasts and studied the cell infiltration and colonization. Compared to the tight-packed, hydrophobic PCL scaffold, the hydrophilic, micro-porous fibers enhanced the cell infiltration and colonziation significantly. Moreover, the unique nano-topographical environment that may stimulate cells in a drastically different manner from that of traditional solid, smooth electrospun fibers, which holds great potential in reconstructing tissues that require strong contractile forces.(Fig) [2]

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References

[1] Li Y; Rubert, M; Yu Y; Dong, M; Besenbacher, F; Chen, M*. Nanoscale, **2014**, 6, 3392-402, highlighted in Global Medical Discovery June 23, 2014, https://globalmedicaldiscovery.com/key-nanotechnology-articles/ultraporous-interweaving-electrospun-microfibers-from-pcl-peo-binary-blends-and-their-inflammatory-responses/

[2] Li, Y; Gregersen, H; Nygaard, J; Cheng, W; Huang, Y; Dong, M; Besenbacher, F; Chen, M*. Nanoscale, **2015**, 7, 14989 – 14995

Figures