ELECTROSPUN POLY(ESTER-ETHER)/POLYSACCHARIDE BLEND FIBERS FOR BONE TISSUE ENGINEERING

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ABSTRACT

Bone tissue engineering (TE) scaffolds should closely mimic the natural bone extracellular matrix (ECM) niche and should satisfy the following criteria: excellent biocompatibility, adequate surface properties and mechanical performance, as well as controlled bioresorbability, osteoconductivity and vascularization. In this context, blending of polymers is a widely used approach, which leads to enhanced cellular response. Compared to synthetic or natural polymers, blends of synthetic and natural polymers have been found to be more promising. Amongst naturally-derived polymers, polysaccharides are interesting materials since their carbohydrate moieties interact with or are integral components of many cell adhesion molecules and matrix glycoproteins. In particular, anionic sulphate groups present in polysaccharides have been shown to modulate the activity of vascular endothelial growth factor (VEGF), thereby improving angiogenesis.

Novel electrospun scaffolds consisting of blends of κ- carrageenan (κ–CG) or fucoidan (FUC) with the synthetic poly(ester-ether), polydioxanone (PDX) resulted in improved biocompatibility, biomineralization potential and human osteosarcoma (SaOS-2) cell differentiation ability. The two polymers in both blend systems phase separated as shown by differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). Miscibility and intermolecular interactions between the polymers directed the distribution of the natural polymers within the electrospun blend fibers which in turn influenced surface hydrophilicity, degradation behaviors and cellular response. Indeed, cell viability was significantly improved in PDX/FUC scaffolds (96 %) in contrast to PDX/κ–CG (80 %) or pure PDX (70 %). Furthermore, both PDX/FUC scaffolds and PDX/κ–CG resulted in improved bioactive and osteogenic properties, including fast apatite-forming ability and the deposition of nano-sized apatite crystals similar to native bone. This observation was correlated to cell morphology in particular, cell shape, aspect ratio and nucleus area.

Reference:

[1] Goonoo, N.; Khanbabaee, B.; Bhaw-Luximon, A.; Jonas, U.; Pietsch, U.; Jhurry, D.; Schönherr, H, *Biomacromolecules*, **2016**, submitted.