(P 112) Degradable Particulate Composite Reinforced with Nanofibre Meshes for Biomedical Applications

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In the biomaterials field, nanofibre based structures and its composites are promising materials to produce scaffolds mimicking the architecture of the extracellular matrix (ECM). The main purpose of this work was to develop a novel composite structure which combines polymeric microfibres reinforced by nanofibres. This combination was obtained by melting extrusion of a composite with a natural polymer, Chitosan particles, and a biodegradable polymer, poly(butylene succinate) (50:50 wt), reinforced with chitosan nanofibre meshes (0.05% wt). The chitosan meshes were produced by electrospinning. The nanofibre reinforced microfibres were analysed by SEM demonstrated a considerable alignment of the nanofibres along the longitudinal axis of the microfibres.

Tensile mechanical properties revealed that the introduction of the reinforcement in the microfibres composite increased the tensile modulus until 295.7 ± 16.2 MPa. This improvement is around 70% since the tensile modulus of microfibres without the nanofibre reinforcement was 175.6 ± 32.7 MPa. Various structures were subjected to swelling and degradation tests, in an isotonic saline solution at 37°C. The presence of chitosan nanofibres in the microfibres enhanced the water uptake in up to 24%. The weight loss was also increased, reaching a maximum of 7.4% at the third day of the degradation tests.

The combination of good mechanical properties and enhanced degradability of the developed fibres may have a great potential to produce 3D fiber meshes scaffolds.

Human bone marrow-derived stromal cells (hBMSCs) were seeded on those 3D fiber meshes scaffolds reinforced by nanofibers and sustain osteogenic differentiation, are adequate for bone tissue engineering.