Polycaprolactone / bioactive glass hybrid scaffolds with doping agents

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ABSTRACT

Introduction. Bioactive glasses (BG) bond to bone and stimulate bone regeneration [1], but their brittleness limits their use to low load-bearing applications. The toughness of the material can be greatly enhanced by combining BG with a polymer to produce composites or sol-gel hybrids [2]. Unlike conventional composites, BG-polymer hybrids behave as a single phase thanks to the interpenetration of the organic and inorganic networks at a molecular level [3]. In the present work, 3-dimensional polycaprolactone (PCL) / BG hybrid scaffolds with well-controlled porosity were synthesised through a sol-gel process that allowed the incorporation of organic and inorganic doping agents.

Experimental. Homogeneous hybrids containing 70 wt.% PCL and 30 wt.% BG were obtained and scaffolds were prepared by a microsphere leaching technique. The BG was a binary system of 75 wt.% SiO_2 and 25 wt.% CaO. Hybrids were also doped with Sr^{2+} ions or fisetin. The macroporous structure, the *in vitro* apatite-forming ability and the *in vivo* performance of PCL-BG hybrid scaffolds were evaluated.

Results and discussion. The macroporous structure could be finely tuned thanks to the fabrication process. The selected scaffolds had pores of 300 to 500 μm and interconnections of 100 to 200 μm, resulting in a porosity of 68 % ± 1 %. PCL-BG hybrid scaffolds rapidly formed biomimetic apatite when soaked in SBF at 37°C. After 3 months of implantation in a mouse critical-size calvarial defect, hybrid scaffolds allowed faster bone regeneration (32 % ± 3 %) compared to commercialised bovine bone (16 % ± 5 %). Bone reconstruction was twice as fast when hybrid scaffolds were doped with Sr^{2+} ions (58 % ± 7 %) or fisetin (55 % ± 7 %).

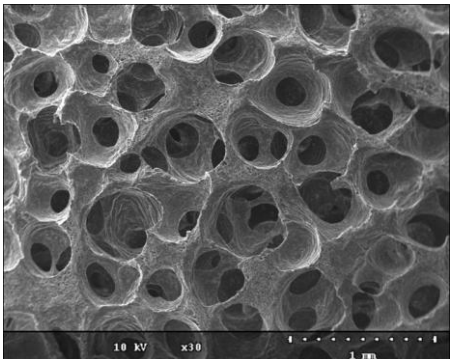

Figure 1: PCL-BG hybrid scaffold.

References.

[1] Xynos ID, Edgar AJ, Buttery LD, Hench LL, Polak JM, *J Biomed Mater Res* 2001; 2: 151-157.
[2] Jones JR, *Acta Biomater.* 2013; 9: 4457-4486.
[3] Lao J, Dieudonné, Fayon F, Montouillout V, Jallot E, *J Mater Chem B* 2016; 4: 2486-2497.