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Effect of synthesis process variables on morphological and mechanical properties of vitreous carbon scaffolds for tissue engineering applications

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Vitreous carbon foams have been shown to promote bone cell adhesion, mineralization and proliferation. However, their low mechanical resistance as well as their high manufacturing cost restricts their utilization in the biomedical area. The purpose of this study was to develop bone tissue engineering scaffolds from vitreous carbon foams, which were fabricated through the template route using an economical and renewable precursor. Towards this, cellulose sponges were impregnated with a sucrose-based resin and then carbonized under inert atmosphere. The effect of the concentration of the components of the resin (HNO_3 and sucrose) on the mechanical and morphological properties of the resulting foams was determined. Moreover, the ability of the synthesized foams to promote cell adhesion was evaluated *in vitro* using human osteoblasts. Our results show that it was possible to produce vitreous carbon foams with highly interconnected polyhedral cells (cell size~1000 µm). Scaffold morphology was strongly affected by the concentration of the catalyst in the resin (HNO_3) due to its foaming effect, which lead to porous and irregular surfaces on the carbonaceous materials. Also, increasing the concentration of sucrose in the precursor resin favored the mechanical resistance of the resulting foams, reaching values close to the commercial foams. In conclusion, vitreous carbon foams with trabecular bone-like morphology were obtained from a non-toxic and renewable precursor. The fabricated foams were shown to be highly cytocompatible and to promote human osteoblast adhesion. Although the compressive strength of the foams is much lower than that of native bone, their high porosity will allow their reinforcement using an additional biocompatible phase (coating/filler). Therefore, the vitreous foams synthesized here could be used as the porous component of a composite biomaterial system for the treatment of bone defects

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