Bioactive Glass/Polycaprolactone Composite for Tissue Repair

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The great challenge of regenerative medicine is the development of new materials for repair or replacement of tissue or organs. Scaffolds are 3D structures used as support for cellular growth and proliferation. For bone applications, an ideal scaffold needs to be biocompatible with human tissues and mechanically compatible with native bone. Polycaprolactone (PCL) is used in tissue engineering, because of good mechanical properties and easy processing. Several polymers that are used for bone repair have adequate mechanical properties nevertheless, these polymers have low biological properties[1]. Improving biological properties, inorganic phases have been added to polymers in order to increase the mechanical strength and biological properties of materials. Bioactive glasses (BG) are promising for application in bone repair due to have excellent bioactive property, which ensure a good response in bone tissue formation. Lanthanum-containing apatite is an inorganic compound which ensures promising materials with adequate mechanical and biological properties and radiopacity. Thus, the aim of this study is to develop a composite based on PCL and BG for 3D printing and tissue engineering. BG was synthesized according to previous methodology[2]. Composite was made by extrusion process. First, BG and PCL were mixed and the mixture was extruded for obtaining homogenous composite in filament shape, which were utilized for producing 3D scaffolds (Figure 1). At Figure 2 PCL scaffold showed an increase of mechanical resistance with addition of BG and La-containing apatite. Moreover, material didn´t present toxicity (Figure 3).

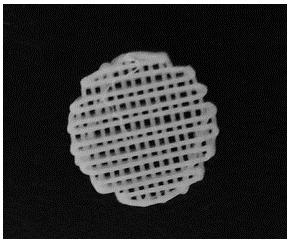

Figure 1. Printed 3D scaffold.

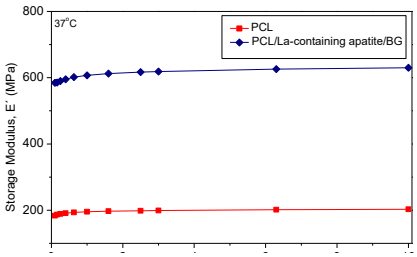

Figure 2. Storage modulus curve versus frequency samples by bending.

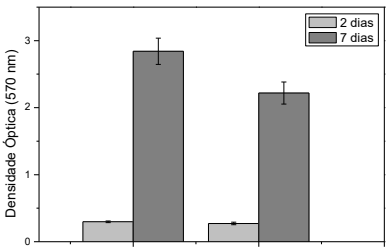

Figure 3. Optical density at 570 nm within 2 and 7 days of cell proliferation by MTT.

Then, BG/La-containing apatite/ PCL is an interesting material for application in scaffolds construction. Results show it can be applied for tissue regeneration.

[1] MANO, J. F. et al. Journal of the Royal Society, 4, 17, 999–1030, 2007.
[2] LEI, B. et al. Materials Science & Engineering C, 33, 3, 1102–1108, 2013.

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