Biological properties of a new Si-Ca-P porous scaffold for tissue engineering.

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Abstract

In the last few decades, life expectancy of the population has increased as a consequence of health improvements, increasing the incidence of bone problems, like fractures, osteoporosis and bone metastasis. Traditionally, these bone lesions are treated by reconstructive surgery, using autologous, allogeneic or xenogeneic implants, having the problems of lack of donated organs and tissues as well as the immune rejection. For this reason, the emergence of tissue engineering was necessary. This science studies how to achieve the regeneration of diseased tissues using scaffolds with appropriate physical and biological properties. Silicon (Si) is a trace element that enhances bone formation and maturation in the body. Therefore, in this work, an 85wt% C_2S-15wt% TCP porous scaffold has been studied for future medical uses.

The porous scaffolds were produced by the polymer replication method using polyurethane sponges with open cells as a template. They were impregnated with an appropriated ceramic slurry and sintered. After obtaining the porous scaffold, ions release was performed to know their behavior in DMEM, cytotoxicity and metabolic activity assays were carried out to know their biocompatibility with ahMSC and, finally, FESEM images were obtained to observe the morphology of the ahMSC over the surface of the material.

The exchange of ions between the media and the material was good and the rest of experiments showed a low cytotoxicity and a good metabolic activity of the ahMSC, as well as a good morphology of the cells over the surface of the material at different times.

We can conclude that these scaffolds could be a good option for future uses in regenerative medicine, although more in vitro and in vivo experiments will be necessary to complete this study.

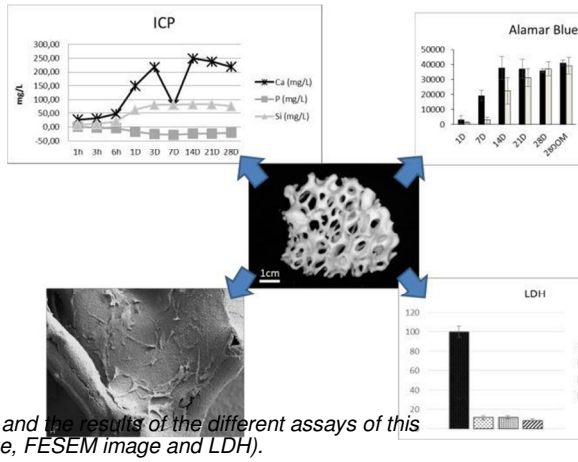

Fig.1. Porous scaffold and the results of the different assays of this work (ICP, Alamar Blue, FESEM image and LDH).

Recent Publications

1. P. Ros-Tárraga, Á. Murciano, P. Mazón, S. A. Gehrke, P. De Aza, New 3D stratified Si-Ca-P porous scaffolds obtained by sol-gel and polymer replica method: Microstructural, mineralogical and chemical characterization, Ceramics International, 10.1016/j.ceramint.2017.02.081, 2017.
2. P. Ros-Tárraga, P. Mazón, M.A. Rodríguez, L. Meseguer-Olmo, P. De Aza, Novel Resorbable and Osteoconductive Calcium Silicophosphate Scaffold Induced Bone Formation, Materials, 9 (2016) 785.
3. R. Rabadan-Ros, P. Velásquez, L. Meseguer-Olmo, P. De Aza, Morphological and Structural Study of a Novel Porous Nurse's A Ceramic with Osteoconductive Properties for Tissue Engineering, Materials, 9 (2016) 474.
4. Lugo, G.J.; Mazón, P.; de Aza, P.N. Phase transitions in single phase Si-Ca-P-based ceramic under termal treatment. J. Eur. Ceram. Soc. 2015, 35, 3693–3700.
5. Lugo, G.J.; Mazón, P.; de Aza, P.N. Material processing of a new calcium silicophosphate ceramic. Ceram. Int.2016, 42, 673–680.

I am Patricia Ros Tárraga, and I am a Biotechnology graduated at Universidad Miguel Hernández of Elche (UMH). Nowadays, I am a pre-doctoral student at Universidad Católica San Antonio de Murcia (UCAM), and I am working in the design and development of new bioactive materials and their use in the field of bone tissue regeneration. I am studying the physical properties of Si-Ca-P-based scaffolds and their effect on the adult human Mesenchymal Stem Cells (ahMSC) behavior.

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