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Silicocarnotite-Tricalcium phosphate: A new bioactive ceramic which transforms insitu into porous hydroxyapatite

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Abstract

This work examines the in vitro bioactivity and biocompatibility of new biphasic scaffolds from eutectoid ceramic composition corresponding to the sub-system Silicocarnotite - Tricalcium phosphate, in order to evaluate their potential application in bone tissue engineering. Polyurethane sponges with desired pore size and geometry were used as templates, which were impregnated in barbotine and sintered by heat treatment. In vitro bioactivity was assessed by different soaking times in simulated body fluid (SBF), according to ISO/FDIS 23317.Biocompatibility of adult human mesenchymal stem cells (ah-MSCs), in terms of adhesion and proliferation, were studied in vitro on the scaffolds' surface. Samples were characterized by X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) coupled with Energy Dispersive Spectroscopy (EDS), Attenuated Total Reflectance by Fourier-Transform Infrared Spectroscopy (ATR-FTIR), Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) and Transmission Electron Microscopy (TEM-HRTEM).The results showed biphasic porous scaffolds with high porosity and interconnected structure of macro and micropores. The morphology presents a eutectoid microstructure of lamellae type, composed of alternating layers of silicocarnotite and α-tricalcium phosphate.The eutectoid scaffold material, when soaked in SBF, reacts first by dissolving the silicocarnotite phase and immediately forming a microporous structure of hydroxycarbonate apatite (HCA) by a pseudomorphic transformation of the α- tricalcium phosphate lamellae. After 21 days, a precipitation of hydroxyapatite formed a layer on the surface of the scaffold plugging the microporous structure keeping the 3D structure of the scaffold intact. The ah-MSCs adhered and proliferated on the scaffolds' surface, establishing a close contact between them and forming an extensive monolayer to 21 days. Scaffolds presented a good in vitro bioactivity and biocompatibility then; they might be useful for future applications in bone tissue engineering.

Biography:

Piedad N de Aza received her doctoral degree in Chemistry-Ceramic 1995. She did a postdoctoral stage at the IRC in Biomaterials at the Queen Mary College, University of London (U.K.) working on in vitro and in vivo behavior of bioceramics. She is Professor of Materials Science and Metallurgical Engineering and Researcher at the Bioengineering Institute at the Miguel Hernandez de Elche University.

Speaker Publications:

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