

BIOMATERIALS

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Design of a composite bioink for bioprinting applications

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3D bioprinting is an expanding field that allows the fabrication of customized tissue engineered scaffolds with encapsulated cells. Designing a biomaterial fit for 3D printing and cell encapsulation (bioink) is a complex task due to the high number of requirements that need to be accomplished. Bioinks are usually based on combinations of different hydrogels due to their encapsulation capacities, but other kinds of materials can be added in order to improve certain characteristics of the final scaffold. A novel composite bioink that includes alginate as a printable hydrogel and calcium-releasing particles as a vascularization promoter is optimized and studied. Rheometry studies show that the addition of calcium-releasing particles to alginate increases its viscosity, but does not alter its shear thinning properties; therefore maintaining the printability of the material. Solid scaffolds with theoretically high nutrient diffusion rates (filament diameter $\approx 200 \mu\text{m}$) are printed using this novel bioink and a novel cross-linking method. A bioprinting procedure that includes encapsulation of cells is optimized and tried out successfully with different bioinks, obtaining good survival rates. The addition of calcium releasing-particles improves cell survival after the bioprinting process as well as during the first culture days. Moreover, the interaction between calcium-releasing particles and alginate is proven to be adequate for bioprinting and could be an interesting line of research for bone regeneration and tissue vascularization applications.

Biography

M A Mateos-Timoneda is an expert in the field of Biomaterials and Scaffolds for Tissue Engineering. He holds a PhD in Supramolecular Chemistry from the University of Twente (Enschede, The Netherlands). Since 2007, he is a Senior Researcher at CIBER en Bioingeniería, Biomateriales y Nanomedicina (CIBER-BBN) and in the Biomaterials for Regenerative Therapies Group at the Institute for Bioengineering of Catalonia (IBEC) in Barcelona (Spain). His main interests are the study of cell delivery using biodegradable microcarriers and 3D printing and bioprinting.

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