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BIOACTIVE GLASSES, BIOACTIVE GLASS SCAFFOLDS, AND CELL-SEEDED BIOACTIVE GLASS SCAFFOLDS

ABSTRACT

This invention relates to bioactive glasses and bioactive glass scaffolds, particularly to porous bioactive glass scaffolds, more particularly to 3D porous bioactive glass scaffolds, as biomedical technologies for tissue regeneration and engineering. The invention also relates to preparation methods and uses thereof.

Additionally, this invention relates to cell-seeded bioactive glass scaffolds and their cell-seeded variants referred in previous paragraph. Furthermore, this invention relates to cell-seeding methods of these bioactive glass scaffolds.

Finally, this invention relates to uses in tissue regeneration and/or engineering, particularly in osteoinduction, of products referred in previous paragraphs (bioactive glass, bioactive glass scaffolds, cell-seeded bioactive glass scaffolds, and their variants).

It was developed by researchers belonging to the Spanish National Research Council (CSIC), the University of Malaga, and the Biomedical Research Networking Centre in Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN).

DESCRIPTION

An increasing clinical demand on bone tissue engineering push research effort to enhance the bioactivity of the bone substitute materials.

A reliable process to produce derived bioactive glass porous scaffolds with a suitable pore network for bone in-growth have been developed.

A primary objective of this invention was designing and processing new functional intelligent bio-glasses able to provide new biologically active signals to favor cell adhesion, migration, proliferation and differentiation creating a better cellular stimulus and a better ability to sense biological demand or changes in their environment.

These new biologically active signals were produced by functionalizing the surface of bioactive glass porous scaffolds.

In vitro cellular response to porous bioactive glass scaffolds was evaluated by monitoring the response to murine osteoblastic cells cultures and the progression of adhesion, migration, cell growth and osseous differentiation.

Biocompatibility and osteoconductivity of the bio-glasses was assessed.

Assessment of cell growth on cell-seeded scaffolds was carried out at different time points after seeding.

Osseous differentiation on the bio-glasses was assessed by osteoinduction of cells seeded on the scaffolds, followed by alkaline phosphatase detection.

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APPLICATIONS

- Tissue regeneration and engineering.
- Osteoinduction

DEVELOPMENT STATUS

Developed

Laboratory tested

IP STATUS

Patent pending

AVAILABLE FOR

- Exclusive license agreement
- Non-exclusive license agreement
- Further research or development

INDUSTRIAL PROPERTY

Spanish Patent Application **P201400570,** filed on July 10, 2014

International Patent Application **PCT/ES2015/070535**, filed on July 9, 2015

INNOVATIVE ASPECTS AND ADVANTAGES

- Biocompatibility and osteoconductivity.
- Different functional groups (signalling) introduced into bio-glass scaffold surface, modifying binding and cell response.
- New biologically active signals to favor cell adhesion, migration, proliferation and differentiation.
- Better cellular stimulus and osteoblastic cells adhesion to bio-glasses.
- Cell growth significantly higher, and earlier osseous differentiation of osteoblastic cells.
- Cells distribute uniformly over the bio-glass surface.
- Cell density increased along time, covering the entire bio-glasses surface.
- Micro-pores (< 10 µm) favor delivery of nutrients and oxygen to cells.
- Micro-pores increase the scaffold surface, intensifying adsorption of factors, ion exchange, organization of adsorbed protein layers. Therefore, specific cellular response.
- Trabecular hierarchically porous structure well connected.
- Interconnected pores allow cell migration, proliferation and vascularization.

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