Fibrin hydrogel with plasmonic nanoparticles for biomedical applications

Plasmonic fibrin hydrogel matrix for biomedical applications, able to generate externally controllable hyperthermia with considerable reliability and spatiotemporal precision in deep body tissues.

Description and essential characteristics

A fibrin hydrogel matrix that is easy to synthesise, implantable, biocompatible, biodegradable and non-immunogenic, embedded with specific plasmonic nanoparticles and thermosensitive effectors, which contain therapeutic agents that are released after applying electromagnetic radiation at a specific intensity and wavelength. The physical-chemical properties of this matrix can be modulated by varying its formulation.

The fibrin/plasmonic nanomaterial combination results in a compound capable of creating robust and sustainable temperature increases over time after being activated by electromagnetic radiation. These temperature increases are localised and their intensity can be modulated. The compound can be used as a source of hyperthermia with a therapeutic effect in biological tissues. The matrix also includes thermosensitive effectors in its structure, such as liposomal vesicles or genetically engineered cells, which respond to local temperature increases of specific intensity. Thus, the establishment of measured hyperthermia within the matrix results in the active release of therapeutic agents that are stored or are produced by the thermosensitive effectors depending on the temperature increase achieved.

This matrix is useful for biomedical applications that require the generation of optical hyperthermia and/or the provision of therapeutic agents in a biological tissue (cells, organs, injuries, etc.), for example, for the destruction of tumours, the treatment of infections and tissue regeneration, as well as for the controlled delivery of therapeutic agents.

Competitive advantages

The main advantage of this technology is based on the use of a protein material to form hydrogels that adopt plasmonic characteristics that enable them to absorb electromagnetic radiation and generate robust and sustainable temperature increases over time. This material can have an autologous origin (e.g., fibrinogen obtained from the patient's blood plasma), thus minimising the immunogenic risk and avoiding the use of xenogeneic products (e.g., silk fibroid).

Another significant advantage is due to the plasmonic nanomaterial itself. The form in which this nanomaterial is presented has high efficiency for absorbing light energy; its conversion of electromagnetic radiation to heat energy per unit of mass is much higher than that of other nanomaterials.

Due to the protein structure of the fibrin hydrogel, cell adhesion and proliferation is boosted in this type of material, which has provided excellent results in regenerative medicine applications whose objective is to obtain equivalents for skin, cartilage, cornea, and heart replacements.

Type of collaboration sought

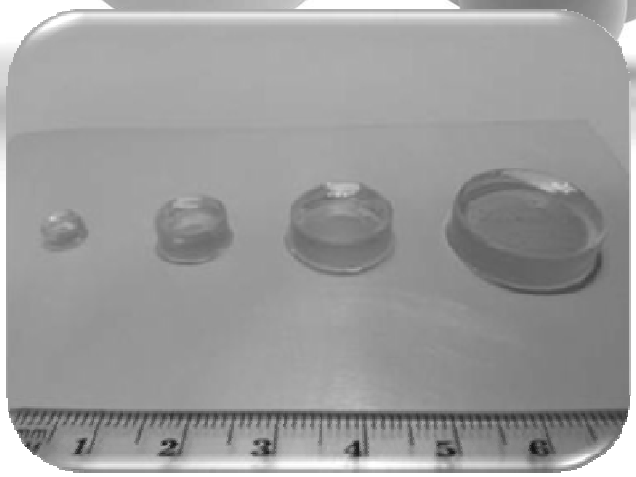
Cooperation is sought with any Party interested in partnering, licensing or investing in the technology, whether it be an investor to fund the project, a partner interested in getting involved in any of the various phases until its placement on the market, a patent licensee, etc. The organisations potentially interested in this technology are those devoted to the manufacture, commercialisation and/or distribution of biomedical implants and devices; as well as universities, hospitals, research centres and all types of institutions engaged in biomedical experimental research (biomaterials, implants, biomedical devices, etc.).

Current stage of development

R&D Phase

Current state of intellectual property

Spanish patent P201330894, granted in November 2015.
International patent application PCT/ES2014/070484.



Plasmonic fibrin constructs obtained in cylindrical moulds of various sizes.

For further information, please contact

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