New fluorescent/magnetic systems for the treatment of inflammation

Brief description

In the UCM research group on TECHNOLOGIES BASED ON INORGANIC-ORGANIC HYBRID MATERIALS, work is being done on the preparation of fluorescent and/or magnetic nanoparticles that have a wide potential for application in biomedicine.

The research carried out pursues the preparation and study of new systems based on fluorescent and/or magnetic nanoparticles that are stable, biocompatible and non-toxic and that allow obtaining good and better images of diseased cells and tissues that open the possibility of providing much faster, more effective and quite selective diagnoses.

How does it work?

Their use in in vitro studies will allow us to determine whether the samples obtained are suitable for acting against inflammation, detecting diseased cells or as contrast agents. If this is the case, subsequent in vivo studies will confirm this. Furthermore, due to their bifunctional nature, the subsequent application of an external magnetic field to these systems will allow their removal from the interior of a living organism.

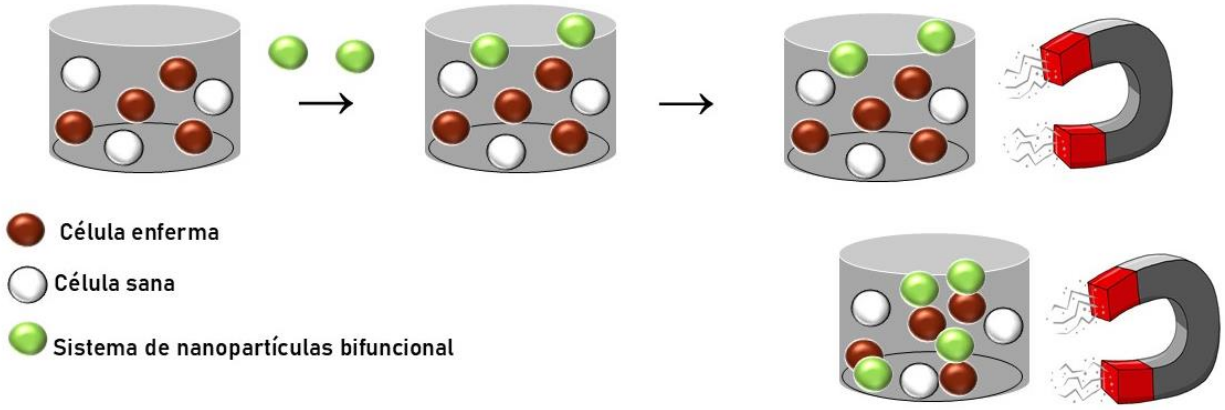

Figure 1. *Performance of new bifunctional systems based on fluorescent-magnetic nanoparticles.*

What problem does it solve?

The need to take fluorescence imaging (with its unique advantages at the cellular level) into account will help to obtain better spatial resolution diagrams that can also function as contrast agents, opening the possibility of penetrating deeper into the tissues. This is relevant if we consider that the skin or muscles are more transparent, while tissues such as the liver or spleen are less so. In addition, these systems can be removed from the body once they have performed their action.

What future products will it develop?

As a result of the research carried out, new systems based on fluorescent and/or magnetic nanoparticles will be obtained that are stable, biocompatible and non-toxic, allowing the obtaining of images of diseased cells or tissues, opening the possibility of providing much faster, more effective and highly selective diagnoses.

Competitive advantages compared to another research

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Most of the systems investigated to date, including organic dyes, conducting polymer nanoparticles, so-called quantum dots (QDs) - semiconductors: CdSe, CdTe, HgTe, PbS, PbSe, PbTe, InAs, InP and GaAs - or a large majority of up-conversion nanoparticles, do not meet the requirements mentioned above. For this reason, we continue to investigate to obtain new visualization systems that allow us to improve diagnoses and act against inflammation before the disease manifests itself. Current imaging techniques such as X-rays, mammography, ultrasound, computed axial tomography (CAT, CT), positron emission tomography (PET), magnetic resonance imaging (MRI) or endoscopy compete with those that address the morphological analysis of cells or tissues (cytology, histopathology - biopsy to probe for malignancy). However, in many cases this set of techniques is not effective for detection, especially in those early stages in which the disease has already become apparent.

The need to jointly take into consideration CAT images, MRI images (sensitive to soft tissues) and fluorescence images (with unique advantages at the cellular level) can allow something unprecedented, which consists of obtaining diagrams with better spatial resolution, opening the possibility of being able to penetrate even further into the tissues. Something relevant if we consider that the skin or muscles are more transparent, while tissues such as the liver or spleen are less so.

Where has it been developed?

The UCM research group on TECHNOLOGIES BASED ON INORGANIC-ORGANIC HYBRID MATERIALS led by J. Isasi Marín, full Professor in the Department of Inorganic Chemistry, and M. Alcolea Palafox, full Professor in the Department of Physical Chemistry of the Faculty of Chemical Sciences of the UCM https://www.ucm.es/materialesaplicados/. María del Carmen Martínez Rincón, María Lourdes de Pedraza Velasco, María Paloma Posada Moreno, María Rapp Diez de la Cortina, Esther Hernán García and Luis Espada Morán are also members of the group. The first three are full Professors in the Department of Nursing of the Faculty of Nursing, Physiotherapy and Podiatry. The PhD students María Rapp Diez de la Cortina and Esther Hernán García are carrying out their doctoral thesis under the supervision of J. Isasi. Finally, Luis Espada Morán is a Computer Services Technician. Atos-CAU Department of Sciences.

And moreover…

The UCM research group on TECHNOLOGIES BASED ON INORGANIC-ORGANIC HYBRID MATERIALS maintains a direct relationship with the UAM since they have shared and continue to share research projects with D. Jaque Daniel Jaque García, University Professor in the area of Applied Physics at the Autonomous University of Madrid in the Department of Materials Physics, Director of the NanoBIG Research Group (Nanomaterials for Bioimaging Group).

Researcher in charge

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