Nanoparticles as contrast agents for high field magnetic resonance imaging

CSIC, in collaboration with the Andalusian Health System, has developed nanoparticles that, comprising a core consisting of $DyPO_4$ or $NaDy(MoO_4)_2$, and a coating of polyacrylic acid, exhibit characteristics that make them suitable as contrast agents for magnetic resonance imaging (MRI) in scanners working at ultra-high fields.

Industrial partners are being sought to collaborate through a patent licence agreement.

An offer for Patent Licensing

Description of the technology

Magnetic resonance imaging (MRI) is a non-invasive technology that produces detailed anatomical images in three dimensions thanks to the effect of an external magnetic field (B0). The use of high B0 fields increases the signal-to-noise ratio and images can be obtained with higher resolution than with low fields or with the same resolution in less time.

Although the so-called high-field (1 T<B0<3 T) scanners are the most popular MRI instruments used in clinics nowadays, the very high-field (3 T<B0<7 T) and ultra-high-field (UHF) (B0>7 T) segments are expected to experience the highest growth rate during the next years.

Contrast agents currently in clinical use (gadolinium complexes and, to a lesser extent, iron-based nanoparticles) show good contrast at low magnetic fields, but their efficacy decreases dramatically at high fields. There is a need to find new contrast agents effective at high magnetic fields.

The developed nanoparticles present characteristics, such as high transverse relaxivity in ultrahigh field, chemical and colloidal stability in phosphate buffered saline (PBS) and negligible toxicity for cells, which make them suitable for its use as contrast agents for MRI in scanners operating at fields ≥ 7 T.

The use of the nanoparticles developed as contrast agents represents an enormous advance in obtaining MR images in ultra-high-field scanners, scanners that enables the patient's exposure time to be reduced or the resolution of the image to be increased

Main innovations and advantages

- The developed synthesis procedure yields $DyPO_4$ or $NaDy(MoO_4)_2$ nanoparticles with both uniform size and shape and with tunable size within the nanometer range.
- The developed functionalization strategy with polyacrylic acid is successful to confer colloidal stability to the nanoparticles in PBS buffer.
- The developed nanoparticles, in contrast with MRI contrast agents used in clinics, show a high transversal relativity at ultrahigh magnetic fields. It makes them suitable for obtaining MR images in this type of scanners.
- In contrast with other Dy-containing nanoparticles, which are also known to have high transversal relaxivity at ultrahigh magnetic fields, the $DyPO_4$ and $NaDy(MoO_4)_2$ nanoparticles are not soluble in aqueous media, requisite for in vivo MRI imaging application.

Patent Status

European priority patent application suitable for international extension

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