Ref: OT-59

Nanoparticles doped with copper for MRI

Summary:

CNIC has developed a new family of nanoparticles with interesting properties for MRI. They can be used as positive contrast agents and they can be obtained in a simple, fast and reproducible manufacturing procedure.

Innovative aspects:

In magnetic resonance imaging (MRI), the majority of nanoparticles (NP) based on iron oxide provide a negative (T2) signal which results in the area where these NPs accumulate to appear in a black colour. For several reasons, such colour complicates the diagnosis and thus limits its clinical use. Therefore, research is searching for NPs generating contrast based in the longitudinal relaxation time (T1), which renders a brightening of the image where the probe has accumulated.

The search for new iron oxide nanoparticle-based probes for MRI has moved to the development of iron oxide nanoparticles (IONP) as “positive” contrast agents, showing large values of their longitudinal relaxivity (r1), a value that measures the capacity of a contrast agent to provide a bright signal.

CNIC has developed copper-doped iron oxide nanoparticles (CuIONP) capable of providing good contrast in T1. When iron oxide nanoparticles are doped with Cu (copper), a significant increase in the value of r1 is achieved. "Normal" values of contrast agents for clinical use have values in the 4-6 range. In contrast, Cu-doped iron oxide nanoparticles (CuIONP), provide values of 16 $mM^{-1}s^{-1}$. In addition, the synthesis of these nanoparticles can be achieves in a simple, reproducible and controlled manner, which facilitates Good Manufacturing Practice (GMP), required for clinical use.

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Competitive advantages:

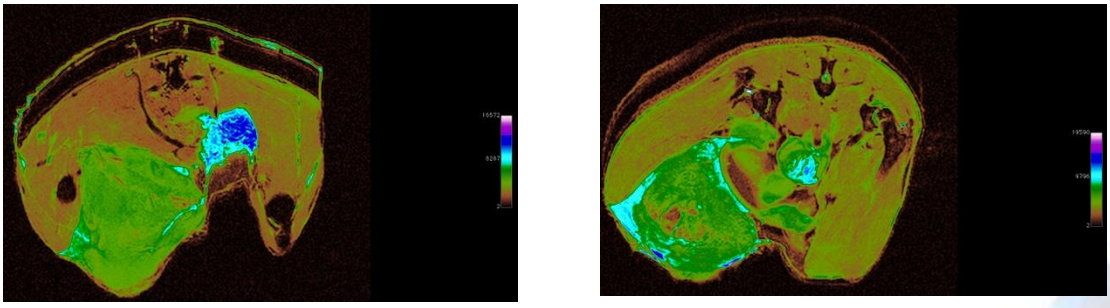
• A small amount of Cu has a significant increase of r1, achieving values of 16 $mM^{-1}s^{-1}$.

• The final particles are obtained using microwave-driven synthesis (MWS) in a 10 minutes one-pot synthesis. This methodology can produce, in extremely short times, homogeneous nanoparticles with excellent properties for molecular imaging.

• Nanometric size iron oxides have already been approved by the FDA and other regulatory agencies.

• The nanoparticle components, both iron oxide and copper are non-toxic.

• The new nanomaterial has been fully characterized and demonstrated its in vivo use for the enhanced diagnosis of tumors in animal models.



Mice MRI, before (left) and after (right) inyecting the nanoparticles.

Key words: medical diagnosis, nanoparticles, MRI, MWS

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