OPTIMIZATION OF THE CELL UPTAKE OF GADOLINIUM OXIDE NANOPARTICLES BY CAPPING WITH SORBITOL FOR CELL TRACKING IN MRI

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Design of novel nanoparticles with antioxidant capabilities for MRI contrast enhancement is an active field of research [1]. In the optimization of the cell uptake of contrast agent for cell tracking in MRI, it is important to make compromises between the optimal contrast in MRI and metabolic cell activity. In this work, we investigated if the Sorbitol aids the uptake of Gd2O3 nanoparticles (GdNP) by the cells. In order to test this hypothesis, GdNP were both capped to and immersed in Sorbitol. Micro Magnetic Resonance Imaging was used to investigate the contrast enhancement and the uptake of the MRI contrast agents by mouse alveolar macrophages. The samples were scanned with a 9.4 Tesla (400 MHz) micro MRI scanner, with a vertical bore high-resolution superconducting magnet (Japan Superconductor Technology, Inc., Kobe, Japan). The immortalized mouse alveolar cell line MH-S (1x106 cells/ml) were incubated with a GdNP and GdNP were both capped to and immersed in Sorbitol.

Longitudinal relaxation rates and the corresponding calculated regression slopes for filtered DEG-Gd2O3 nanoparticle samples (GdNP) and GdNP, both capped to and immersed in Sorbitol were measured experimentally. Chemiluminescence recordings of the reactive oxygen species (ROS) production from neutrophil granulocytes (2x106 cells/ml) after an exposure the NP was carried out. Effect of addition of capping or immersion of Sorbitol to GdNPs to change of the T1-contrast in MRI has been investigated.

The cell optimization strategies presented in this work may be of importance to several fields aiming at imaging inflammatory diseases, based on the utilization of contrast agent-loaded macrophages.

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1. P. Eriksson, A. A. Tal, A. Skallberg, C. Brommesson, Z. Hu, R. D. Boyd, W. Olovsson, N. Fairley, I. A. Abrikosov, X. Zhang and K. Uvdal, Cerium oxide nanoparticles with antioxidant capabilities and gadolinium integration for MRI contrast enhancement, Sci. Rep. 8, 6999 (2018).