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Water transverse relaxation rates in aqueous dispersions of superparamagnetic iron oxide nanoclusters with diverse hydrophilic coating

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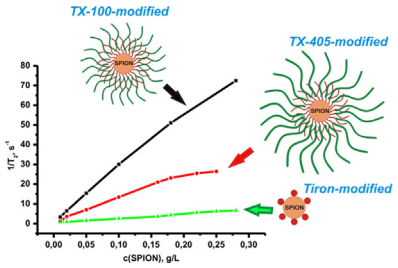
HIGHLIGHTS

- Hydrophilic coating of oleate-coated SPIONs by surfactants and triblock copolymers.
- Self-assembly of surfactants onto oleate layer is more predominant than ligand exchange.
- Structure of amphiphilic molecules affects clustering of SPIONs within hydrophilic coating.
- Particular effect of outer zone versus nearest one on relaxivity of hydrophilic SPIONs.
- Counter-ion interactions with ATP induce changes in relaxivity of surfactant-coated SPIONs.

GRAPHICAL ABSTRACT

The effect of the hydrophilic external layer on the relaxation rate of iron oxide hydrophilic nanoclusters.



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ABSTRACT

The article introduces transverse relaxation rates of water protons in the aqueous hydrophilic colloids synthesized on the basis of the oleate-coated iron oxide nanoparticles (17 nm) with non-ionic and cationic surfactants, triblock copolymers, polyethyleneimine (PEI) and 4,5-dihydroxybenzene-1,3-disulfoacid disodium salt (Tiron) as hydrophilic components. The IR spectroscopy, atomic force and transmission electron microscopy, along with dynamic light scattering data were obtained to evaluate the content of the hydrophilic coating, the clustering of iron oxide nanoparticles within the hydrophilic covering and the aggregation of hydrophilic nanoclusters. The analysis of the obtained results together with transverse relaxation rates under various concentration, counter-ion and temperature conditions reveals the particular importance of the water molecules diffusion in the outer hydrophilic layer versus the nearest to the iron oxide core layer. The obtained results reveal the counter ion binding with the charged hydrophilic iron oxide colloids as a route to affect the water transverse relaxation rates by biorelevant anionic substrates such as adenosine triphosphates.

1. Introduction

Superparamagnetic iron oxide nanoparticles (SPIONs) are a top of current interest today due to their applicability in medicine [1–6]

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