122

Multicore Iron Oxide Nanoflowers: Effect of Poly-L-lysine Functionalization on Magnetic and Physicochemical Properties for Biomedical Applications

Author: Iryna Khmara[1]

Co-authors: Katarina Dibdiakova [2]; Jana Vojtova [2]; Martina Kubovcikova [1]; Monika Liskova [2]; Oliver Strbak [2]; Vlasta Zavisova [1]; Martina Koneracka [1]

[1] *Institute of Experimental Physics SAS*

[2] *Biomedical Centre Martin, Jessenius Faculty of Medicine in Martin,Comenius University in Bratislava*

Multicore iron oxide nanoflowers (IONFs) are magnetic nanostructures with strong inter-core interactions, resulting in enhanced collective magnetic behavior relevant for magnetic fluids. In this work, magnetite IONFs were synthesized via a polyol method and functionalized with poly-L-lysine (PLL) to improve colloidal stability.

Transmission electron microscopy confirmed well-defined multicore nanoflowers with preserved morphology after PLL coating. X-ray diffraction verified the magnetite crystal structure, with crystallite sizes of ~15 nm (IONFs) and ~17 nm (PLL-IONFs).

Both systems exhibited superparamagnetic behavior at room temperature with high saturation magnetization (~74 emu/g for IONFs and ~73 emu/g for PLL-IONFs), indicating minimal impact of PLL coating. Magnetic core sizes were estimated at 10.8 nm (IONFs) and 18.8 nm (PLL-IONFs), consistent with structural data.

Relaxometric measurements at 7 T showed dominant transverse relaxation with high relaxivity. Bare IONFs had r_1 = 3.23 ± 0.93 $mM^{-1}s^{-1}$, r_2 = 513.05 ± 29.53 $mM^{-1}s^{-1}$, r_2= *626.52 ± 193.58 $mM^{-1}s^{-1}$, while PLL-IONFs showed increased r_2 (651.81 ± 37.71 $mM^{-1}s^{-1}$) and r_2* (742.63 ± 120.23 $mM^{-1}s^{-1}$). The high $r_2(*)/r_1$ ratios (>150) reflect strong local magnetic field inhomogeneities typical for multicore systems (Figure 1).

Cytotoxicity assays showed acceptable cell viability (6.25 –100 µg/mL), with only mild, non-significant effects at lower concentrations. Toxicity depended on cell density and possible aggregation at higher concentrations; further studies are needed.

These results demonstrate that PLL functionalization preserves magnetic properties while improving surface characteristics, supporting the use of IONFs as stable magnetic fluid systems for advanced applications.

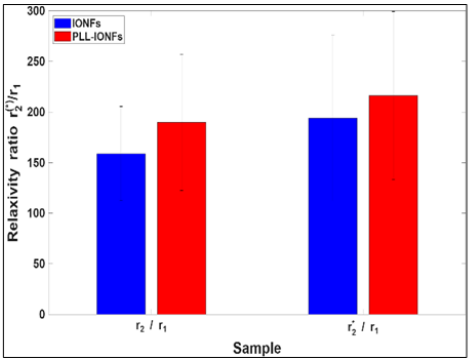

Figure 1. Relaxivity ratios for IONFs and PLL-IONFs.

This work was funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under Grant 09I03-03-V04-00296.

Type:

Poster