101

BSA-Coated Magnetic Nanoparticles for Betulinic Acid Delivery and MRI Contrast Enhancement

Author: Valentin Jedinak[1]

Co-authors: Alena Jurikova[1]; Iryna Antal[1]; Iryna Khmara[1]; Katarina Dibdiakova[2]; Martina Koneracka[1]; Martina Kubovcikova[1]; Monika Liskova[2]; Oliver Strbak[2]; Paula Pillarova[1]; Vlasta Zavisova[1]

[1] *Institute of Experimental Physics SAS*

[2] *Biomedical Center Martin*

Magnetic resonance imaging (MRI) is a non-invasive diagnostic technique that provides high-resolution images of internal tissues based on nuclear magnetic resonance. It relies on the interaction between hydrogen nuclei and an external magnetic field to generate contrast between different biological structures. Contrast agents are often used in MRI to enhance image quality and improve diagnostic accuracy. Among these agents, iron oxide nanoparticles, specifically magnetite (Fe_3O_4) and maghemite (γ-Fe_2O_3), are used primarily to shorten the transverse relaxation time (T_2), thereby significantly enhancing image contrast.

BSA-coated magnetite nanoparticles were synthesized and stabilized with $HClO_4$; subsequently, betulinic acid (BA) was conjugated to the resulting carrier. Physicochemical characterization revealed that the hydrodynamic diameter increased from 34.0 nm for the magnetic fluid (MF) to 52.1 nm after BSA coating (MFBSA), and further increased to 89.9 nm following BA binding (MFBSA-BA). Additionally, the observed decrease in zeta potential from +31.0 mV (MF) to +19.8 mV (MFBSA) confirms the successful coating of the positively charged maghemite core with amphiphilic BSA molecules. The MF sample exhibited the highest longitudinal relaxivity ($r_1 = 6.49$ mM^{-1}s^{-1}) together with high transverse relaxivity ($r_2 = 389$ mM^{-1}s^{-1}). Conjugation with BSA resulted in a substantial decrease in r_1 (1.72 mM^{-1}s^{-1}), while r_2 remained relatively high (370 mM^{-1}s^{-1}). Further functionalization with betulinic acid (BA) led to a slight additional decrease in both r_1 (1.51 mM^{-1}s^{-1}) and r_2 (273 mM^{-1}s^{-1}). Overall, surface modification reduced both the longitudinal and transverse relaxivities while significantly increasing the r_2/r_1 ratio (60 $\rightarrow$ 215 $\rightarrow$ 181), indicating predominantly T_2-type contrast behavior.

Type:
Poster