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$CoFe_2O_4$ Nanoassemblies as Dual agents: Carriers of Anti-inflammatory Drug and Imaging Probes

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Abstract:

The emerging need for multimodal clinical nanoagents for theranostics points out the demand for magnetic nanoparticles (MNPs) with optimum size, shape, magnetization, surface chemistry and stability. The targeted synthesis of MNPs permits new inventive surface modification ways with a view to ensure their *in vivo* fate and clinical performance. In addition, these drug carriers undergo certain limitations concerning the drug release mechanism and kinetics, while easy post-release removal is a prerequisite for the avoidance of *in vivo* side effects (1). Herein, we present the development of a stable dual system: anti-inflammatory **drug delivery** and **T2** imaging **system** (DD/T2S) for the first time (Fig. 1). $CoFe_2O_4$ magnetic nanoparticles <10 nm, with moderate magnetic properties (~60 emu g^{-1}), coated with octadecylamine, were synthesized solvothermally. The DD/T2S was formed by an inverse micelles method with sodium dodecyl sulfate (SDS) chains that also allowed the introduction of the anti-inflammatory drug Naproxen. The resulted DD/T2S is stable and has a small hydrodynamic size (d_H = 320 nm), which is also confirmed by Transmission Electron Microscopy (TEM) imaging. The enhancement of proton transverse relaxivity was evaluated by MRI (r_2 = 24 mM^{-1} s^{-1}, r_1 =2.8 mM^{-1} s^{-1}, measured at 3 T) and by NMR measurements (r_2 = 50 mM^{-1} s^{-1}, 11.7 T). The relaxivity values of DD/T2S are compared with their non Naproxen carrying analogue system (r_2 = 30 mM^{-1} s^{-1}, r_1 =1.1 mM^{-1} s^{-1}, measured at 3 T). The Naproxen release by the DD/T2S was also studied and compared with other functionalization routes presented before by us (1).

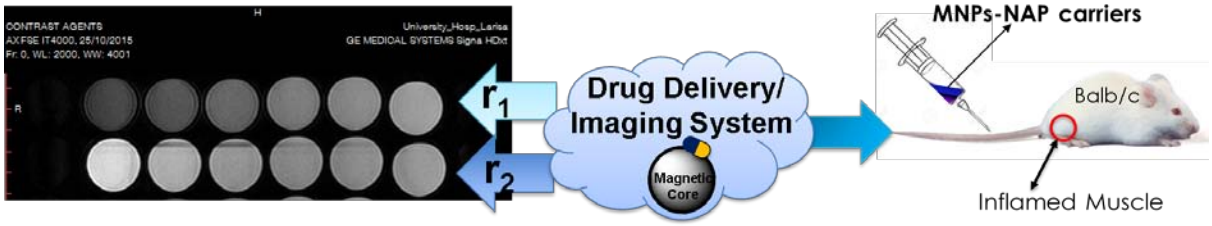

Figure 1. $CoFe_2O_4$ Nanoassemblies as Dual agents (DD/T2S).

(1) *ACS Appl. Mater. Interfaces*, 2016, *8*, 9345-9360