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PLoS One. 2019 Jun 6;14(6):e0217072. doi: 10.1371/journal.pone.0217072. eCollection 2019.

Multifunctional graphene oxide/iron oxide nanoparticles for magnetic targeted drug delivery dual magnetic resonance/fluorescence imaging and cancer sensing

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PMID: 31170197 PMCID: PMC6553710 DOI: 10.1371/journal.pone.0217072

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Abstract

Graphene Oxide (GO) has recently attracted substantial attention in biomedical field as an effective platform for biological sensing, tissue scaffolds and in vitro fluorescence imaging. However, the targeting modality and the capability of its in vivo detection have not been explored. To enhance the functionality of GO, we combine it with superparamagnetic iron oxide nanoparticles (Fe₃O₄ NPs) serving as a biocompatible magnetic drug delivery addends and magnetic resonance contrast agent for MRI. Synthesized GO-Fe₃O₄ conjugates have an average size of 260 nm and show low cytotoxicity comparable to that of GO. Fe₃O₄ nanoparticles provide superparamagnetic properties for magnetic targeted drug delivery allowing simple manipulation by the magnetic field and magnetic resonance imaging with high r₂/r₁ relaxivity ratios of ~10.7. GO-Fe₃O₄ retains pH-sensing capabilities of GO used in this work to detect cancer versus healthy environments in vitro and exhibits fluorescence in the visible for bioimaging. As a drug delivery platform GO-Fe₃O₄ shows successful fluorescence-tracked transport of hydrophobic doxorubicin non-covalently conjugated to GO with substantial loading and 2.5-fold improved efficacy. As a result, we propose GO-Fe₃O₄ nanoparticles as a novel multifunctional magnetic targeted platform for high efficacy drug delivery traced in vitro by GO fluorescence and in vivo via MRI capable of optical cancer detection.

Figures

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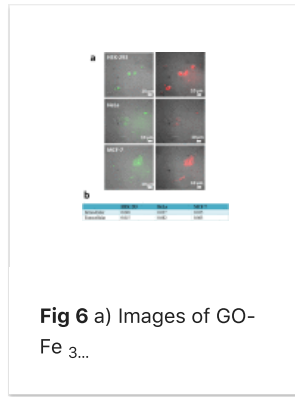
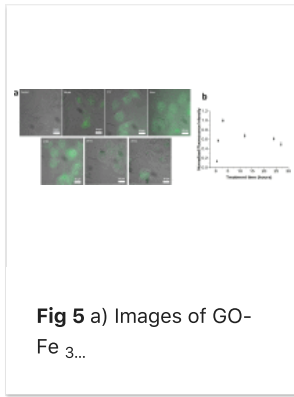
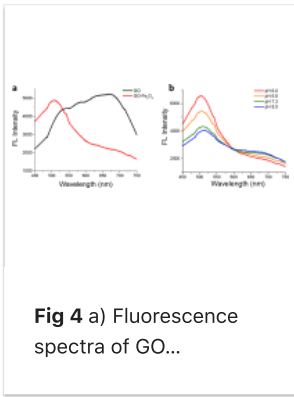
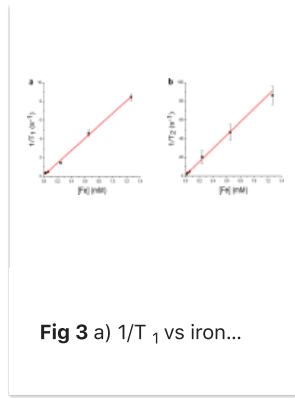
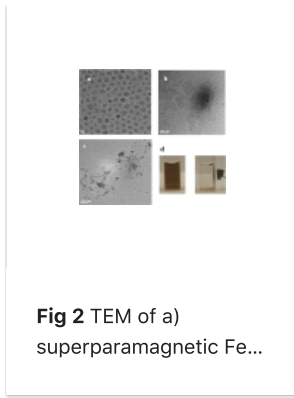
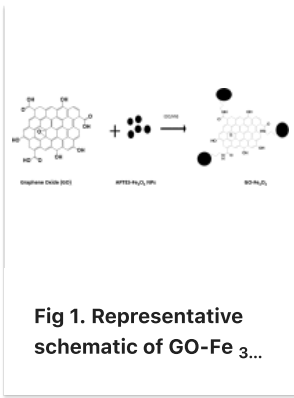
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