Iron-Reduced Graphene Oxide Core-Shell Micromotors for Photothermal Therapy under Second Near-Infrared Light

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Core-shell nano-micromotors have garnered significant interest in biomedicine owing to their versatile task-performing capabilities [1,2].

We present a novel core-shell micromotor that combines magnetic and photothermal properties. It is synthesized via the template-assisted electrodeposition of iron (Fe) and reduced graphene oxide (rGO) on a microtubular pore-shaped membrane. The resulting Fe-rGO micromotor consists of a core of oval-shaped zerovalent iron nanoparticles with large magnetization. At the same time, the outer layer has a uniform reduced graphene oxide (rGO) topography. Combined, these Fe-rGO core-shell micromotors respond to magnetic forces and near-infrared (NIR) light (1064 nm), achieving a remarkable photothermal conversion efficiency of 78% at a concentration of 434 μg mL^{-1}. They can also carry doxorubicin (DOX) and rapidly release it upon NIR irradiation. Additionally, preliminary results regarding the biocompatibility of these micromotors through *in vitro* tests on a 3D breast cancer model demonstrate low cytotoxicity and strong accumulation. These results suggest that such Fe-rGO core-shell micromotors could hold great potential for combined photothermal therapy.

References

[1] M. Yan, K. Liang, D. Zhao, B. Kong. Small 18 (2022) 2102887.

[2] D.F. Báez, Pharmaceutics 15 (2023) 2286.

Figures

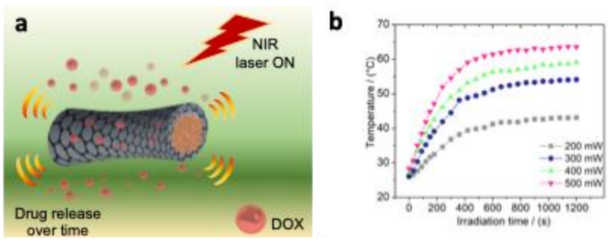

Figure 1. a) Scheme of the core-shell iron graphene oxide micromotors under NIR irradiation. b) Temperature change vs. irradiation time at various power intensities.