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Silica Nanoplatforms as Bimodal Contrast Agents for ^{1}H MRI and Optical Imaging

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Among the numerous imaging techniques, magnetic resonance imaging (MRI) has become the most powerful tool for diagnosis owing to its high spatial resolution, unlimited tissue penetration, and nonionizing nature. Nevertheless, one can mention its lack of sensitivity, which constitutes a major drawback especially in the field of molecular imaging. The combination of MRI and optical imaging (OI), detecting the luminescence emitted by a tracer, offers the high spatial resolution of the former and the high sensitivity of the latter. In this context, this study focused on the improvement of the relaxation properties of a commercial gadolinium chelate, Gd-HP-DO3A, by a non-covalent confinement of the complex in a semi-permeable nanosystem. To induce the bimodality, a fluorescent compound, i.e. ZW800-1, has been co-encapsulated inside the nanoparticle in a one-pot process. Thanks to their exceptional properties (i.e. biocompatibility, chemical stability, low toxicity) silica nanoparticles (SiO_2 NPs) have been chosen as a matrix. Narrow size distribution SiO_2 NPs were obtained by a reverse microemulsion process (D_H: 80 nm). Relaxometric measurements of the synthesized nanoplatforms have proven its efficiency to decrease $T_{1,2}$ of water proton molecules. The fluorescent properties were kept after the encapsulation of the fluorophore. The final system was characterized by Dynamic Light Scattering (DLS), Nuclear Magnetic Resonance (NMR) spectroscopy, relaxometry measurements, UV-Vis and IR spectroscopies and Transmission electron microscopy (TEM).