

Preparation of Functionalized Silica Nanoparticles for Multimodal Imaging

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Introduction

The association of magnetic resonance imaging (MRI) with optical imaging (OI) presents several advantages in the preclinical imaging field owing to the high spatial resolution of the former and the high sensitivity of the latter. The main objective of this project was to develop an efficient single MRI/OI probe by associating a gadolinium complex with a NIR-emitting compound within a nanoparticulate matrix.

Methods

The encapsulation of a conventional Gd-complex (*i.e.* Gd-HP-DO3A) within silica nanoparticles (SiO₂-NPs) has been performed by a reverse micro-emulsion process. To ensure the colloidal stability, the particle surface has been modified by the introduction of PEG chains. Carboxylic functions were introduced by means of photochemical treatment in the presence of a carboxylated diazirine system. Afterwards, ZW800-2 dyes were grafted onto the particles surface using a classical EDC approach in order to obtain the desired fluorescent properties.

Results/Discussion

Stable paramagnetic/fluorescent nanoparticles were successfully prepared and characterized. PEG-coating procedure has allowed a long-term stability in physiological conditions. Besides, the presence of carboxylic groups onto fully PEG-coated SiO₂-NPs has allowed the introduction of a fluorescent NIR-luminescent probe (ZW800-2 dye) to combine MRI to the benefits of OI within the *in vivo* optical window. In addition to the advantage of dye coupling, such modification allowed to design a prototype for multimodal imaging as a proof of concept for functionalization procedure.

Conclusions

The preparation of NPs was particularly effective for the entrapment of Gd-HP-DO3A which improved efficiently the relaxometric properties in comparison with the free complex. Modifications using a carboxylated diazirine linker allowed the easy post-derivatization of the nanoplateform without affecting its colloidal stability. In future development, the as-proposed system will be modified with biological vectors for molecular imaging applications.

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Disclosure

I or one of my co-authors have no financial interest or relationship to disclose regarding the subject matter

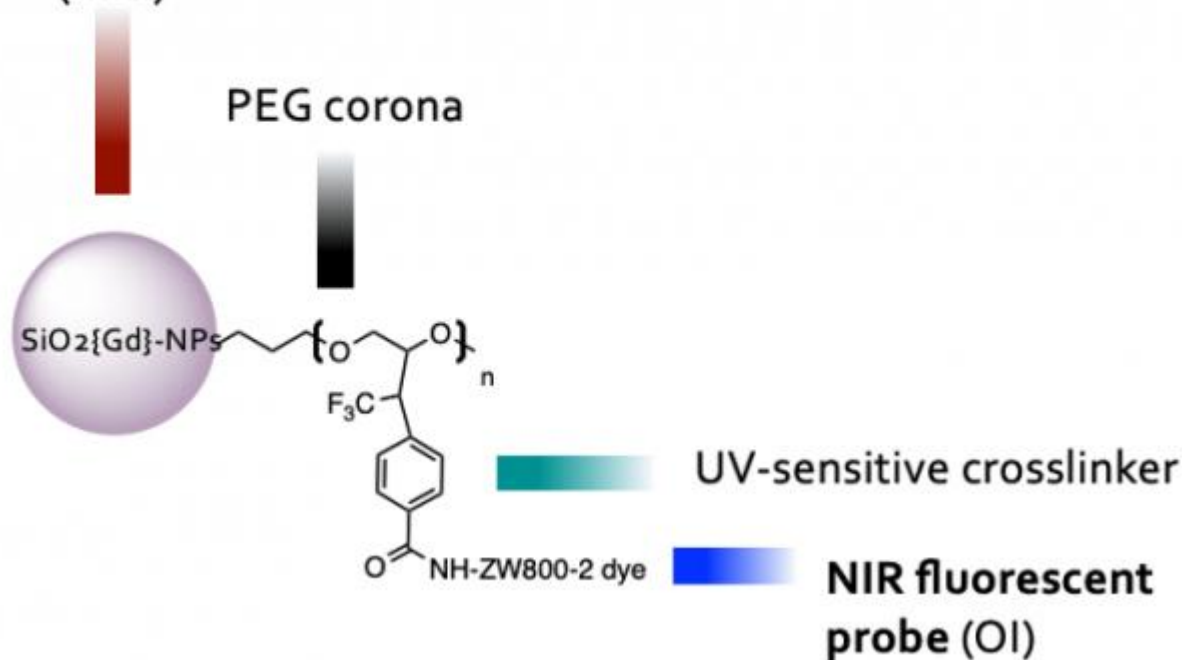
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Gd³⁺ chelates
inside SiO₂ matrix
(MRI)



Functionalized silica nanoplateform