Functionalization of inorganic nanoparticles for specific applications

E. Lopez-Cabarcos*, P. Alonso-Cristobal, D. Mendez-Gonzalez, M. Laurenti, J. Rubio-Retama

Department of Physical-Chemistry II, Faculty of Pharmacy, Complutense University of Madrid, 28040 Madrid, Spain

**cabarcos@ucm.es*

By combining the properties of inorganic nanoparticles and the possibilities that offers the silica coating, it is possible to make nanoengineering. The silica coating method permits to obtain inorganic nanoparticles covered with a silica shell that can be controlled with nanometric precision. Thus, the production of structured nanoparticles with a remarkable homogeneity enables their use in different applications that will be defined by the functionalization done on its surface [1,2]. In this work, the surface of silica coated inorganic nanoparticles has been functionalized with DNA, a doxorubicin-photoactive molecule, and poly(ethylene glycol). The resulting hybrid nanomaterials demonstrate that the combination of the properties of the inorganic nanoparticles with specific molecules is a potential tool for the creation of advanced functional nanomaterials. What makes this strategy interesting is that is an open-source-like method that offers a high versatility making possible to combine almost any nanoparticle in the core with a wide variety of surface functionalization. For example, we have developed a photoresponsive material [3] based on NaYF4:Yb,Tm@SiO2 nanoparticles and its surface was functionalized with PEG and a derivative of the photoresponsive molecule ortho-nitrobencylalcohol (o-NBA) that was conveniently modified so that, when the system was exposed to a light stimulus the drug Doxorubicin was released (see Figure 1).

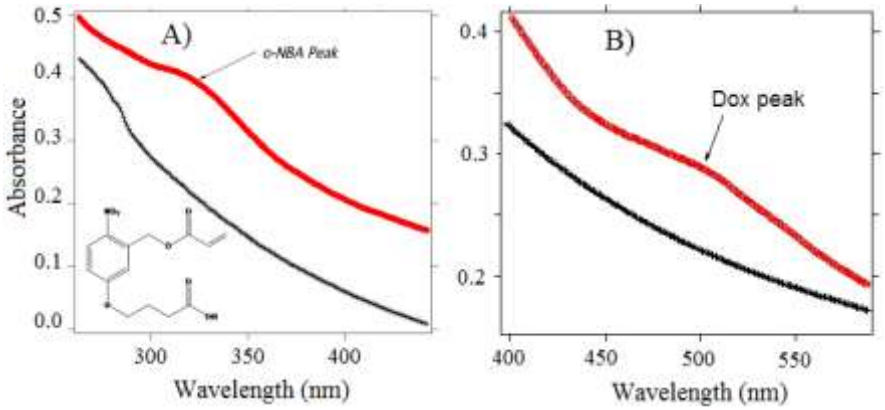

Figure 1. A) UV-Vis spectra of bare $NaYF_4$:Yb,Tm@SiO_2 nanoparticles (black) and the photoresponsive *o*-NBA-functionalized $NaYF_4$:Yb,Tm@SiO_2 nanoparticles (red). Inset: structure of the modified *ortho*-nitrobencylalcohol photoresponsive molecule. B) UV-Vis spectra of the $NaYF_4$:Yb,Tm@SiO_2 nanoparticles (black) and Dox-loaded $NaYF_4$:Yb,Tm@SiO_2 nanoparticles (red).

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