Photosensitizer-Silica Nanoparticle as Platform for Photodynamic Therapy

Nerea Epelde-Elezcano[1,2], Virginia Martinez-Martinez[1], Iñigo Lopez-Arbeloa[1], Sylvie Lacombe[2],

[1] University of the Basque country UPV-EHU, Aptd 644 48080, Bilbao, Spain
[2] IPREM, UMR CNRS 5254, Université de Pau et des Pays de l'Adour, Hélioparc 64039, Pau, France
nerea.epelde@ehu.eus

The photodynamic therapy (PDT) is a non-invasive treatment of cancers based on photodynamic reactions involving Reactive Oxygen Species (ROS).

Appropriate dye molecules denoted photosensitizers are able to generate singlet oxygen (cytotoxic species) for PDT applications, should present several properties to kill tumour cells; low toxicity, selective accumulation on cancer cells, high absorption in the Visible/near-IR region to have the maximum light absorbed in the skin, and efficient intersystem crossing (ISC) to obtain high singlet oxygen quantum yield.

In order to perform this photomedical technique, it would be suitable to use a mesoporous silica core-shell of several nanometers size as drug carrier of photosensitizer. Mesoporous silica core-shell nanoparticles are selected due to their low-toxicity, tuneable size and a surface which is easily functionalized. In this sense different photosensitizers are grafted on the external surface of the nanoparticle. The silica nanoparticles were synthesized by so-gel process in order to control the particles size (around 30 nm), shape (spherical) and porosity.

Different photosensitizers are selected to be grafted at the external surface of the shell of silica NP: commercial Rose Bengal and new halogenated Boron DiPyrromethene (BODIPY) because of their strong VIS/NIR absorption bands and the high intersystem crossing (ISC) efficiency which shows high singlet oxygen production.

References

[1] Indrajit Roy, Tymish Y. Ohulchanskyy, Haridas E. Pudavar, Earl J. Bergey, Allan R. Oseroff, Janet Morgan, Thomas J. Dougherty, Paras N. Prasad, J. Am. Chem. Soc. **125** (2013) 7860.
[2] Ronzani, F; Blanc, Sylvie; Bordat, P; Pigot, T; Cugnet, C; Arzoumanian, E; Oliveros, E; Sarakha, M; Richard, C; Lacombe, S. Phys. Chem. Chem. Phys, **15** (2013) 17219.
[3] Ortiz, M.J; Agarrabeitia, A.R; Dueran-Sampedro, G; Bañuelos Prieto, J; Arbeloa Lopez, T; Massad, W.A; Montejano, H.A; Garcia, N.A, Lopez Arbeloa, I. Tetrahedron, **68** (2012) 1153.

Figures. (left) Silica Nanoparticle Core-Shell TEM image and (right) the schematic representation of BODIPY grafted on nanoparticle shell.