Novel systems for Photodynamic Therapy based on Photosensitizer-Silica nanoparticles

Ruth Prieto-Montero[1]*, A. Prieto-Castañeda[2], A. Katsumiti[3,4], M.P. Cajaraville[4], A. R. Agarrabeitia[2], M. J. Ortiz[2], and V. Martinez-Martinez[1]

[1]Departamento de Química Física, UPV/EHU, Apartado 644, 48080, Bilbao, Spain
[2]Departamento de Química Orgánica I, UCM, Ciudad Universitaria, 28040, Madrid, Spain
[3]GAIKER Technology Centre, BRTA, 48170, Zamudio, Spain
[4]CBET group, Department Zoology and animal cell biology, UPV/EHU, 48620, Leioa, Spain
* *ruth.prieto@ehu.eus*

Cancer is the second cause of human death worldwide and currently, the most common procedures against it are radiotherapy and chemotherapy. Nevertheless, both treatments damage healthy cells, and consequently, patients suffer important side effects. In this work, photodynamic therapy (PDT) is proposed as a complementary cancer treatment. PDT is a minimally invasive procedure in which under suitable light irradiation a sensitive drug (photosensitizer, PS) is activated and generates Reactive Oxygen Species, mainly singlet oxygen, a cytotoxic species able to damage nearby cells. Nowadays, there are many different photosensitizers but most of them are not adequate for their use against tumors because of their poor aqueous solubility and their lack of selectivity for cancer tissues.[1] Therefore, mesoporous silica nanoparticles (MSN) are proposed as a carrier for these PSs due to their biocompatibility, tunable size, easy functionalization and high chemical stability.[2]

In this research, MSN of monodisperse distribution around 50 nm were synthesized by modified Stöber method, Figure 1, and decorated with different PS (commercial and custom-made based on BODIPY structure) together with polyethylene glycol (PEG) and folic acid (FA) to improve the stability of nanosystems and the selectivity to cancer cells, respectively. MSNs with high singlet oxygen production and well stability and selectivity were obtained, and *in vitro* studies were carried out to test their photoactivity in HeLa cells, Figure 1.[3]

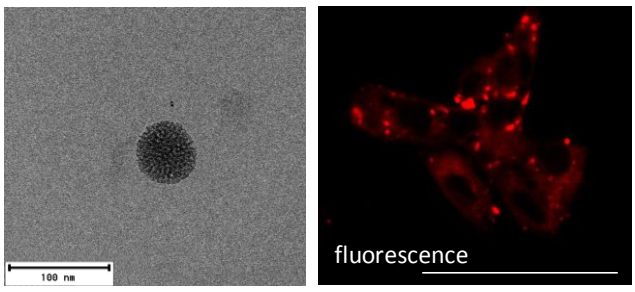

Figure 1. *(left) TEM images of mesoporous silica nanoparticles. (right) Fluorescence microscopy image of Rose Bengal-MSN in HeLa cells, at 1 μM concentration of Rose Bengal. Scale bars 100 μm*

References

[1] S.S. Lucky *et al. Chemical Reviews*, **2015**, 115, 1990-2042
[2] M. Manzano *et al*. *Advanced Functional Materials*, **2020**, 30, 1902634-1902647.
[3] R. Prieto-Montero, *et al. International Journal of Molecular Sciences,* **2021**, 22, 6618-6641