Magnetic/plasmonic liposomes as nanocarriers for novel antitumor tricyclic lactones against non-small cell lung cancer

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Multifunctional nanosystems are one of the most promising therapeutic approaches in cancer treatment. The combination of the plasmonic effect with a superparamagnetic behavior results in materials with magnetic guidance, hyperthermia and controlled drug delivery capabilities in a single nanosystem [1]. Therefore, magnetic/plasmonic nanomaterials are promising in cancer therapy for simultaneous chemotherapy and phototherapy, as they can act both as magnetic and photothermal agents, allowing magnetic guidance, local temperature increase and triggered drug release.

In this work, $MnFe_2O_4$/Au core/shell nanoparticles (NPs) and $MnFe_2O_4$ NPs decorated with Au NPs were synthesized and the structural, spectroscopic and magnetic properties evaluated. The prepared NPs were covered with a lipid bilayer, forming solid magnetoliposomes (SMLs) [2,3]. The heating capabilities of the nanosystems were assessed through the fluorescence quenching of Nile Red (incorporated in the lipid bilayer of the SMLs) under irradiation [4]. Two novel antitumor thienopyridine derivatives (tricyclic lactones **1** and **2**, figure 1) were encapsulated in the lipid bilayer of the SMLs and the growth inhibitory activity in human tumour cell line NCI-H460 (non-small cell lung cancer), was evaluated in the presence and absence of a light source. SMLs were also tested in non-tumor cells, under irradiation, for comparison. Low inhibitory concentrations of 0.11 µM and 0.12 µM were observed for SMLs based on $MnFe_2O_4$/Au core/shell NPs loaded with compound **1** and **2**, respectively, pointing these nanosystems as promising therapeutic agents in future applications of combined lung cancer therapy.

REFERENCES

[1] Espinosa, A., Di Corato, R., K.-Tabi, J., Flaud, P., Pellegrino, T., Wilhelm, C., ACS Nano 10 (2016) 2436-2446
[2] Rodrigues, A.R.O., Ramos, J.M.F., Gomes, I.T., Almeida, B.G.; Araújo, J.P., Queiroz, M.-J.R.P., Coutinho, P.J.G., Castanheira, E.M.S., RSC Advances 6 (2016) 17302–17313.
[3] Rodrigues, A.R.O., Almeida, B.G., Rodrigues, J.M., Queiroz, M.J.R.P., Calhelha, R.C., Ferreira, I.C.F.R., Pires, A., Pereira, A.M., Araújo, J.P., Coutinho, P.J.G., Castanheira, E.M.S. RSC Advances 7 (2017) 15352-15361.
[4] Rodrigues, A.R.O., Matos, J.O.G., Nova Dias, A.M., Almeida, B.G., Pires, A., Pereira, A.M., Araújo, J.P., Queiroz, M.-J.R.P., Castanheira, E.M.S., Coutinho, P.J.G., Pharmaceutics 11 (2019) 10.

FIGURES

Compound **1** Compound **2**

Figure 1: Structure of the tricyclic lactones derivatives of thienopyridine.