Magneto-sensitive liposomes containing manganese ferrite nanoparticles as nanocarriers for new promising antitumor thienopyridin-amine derivatives

Ana Rita O. Rodrigues,[1] Ricardo C. Calhelha,[2] Juliana M. Rodrigues,[3] Isabel C.F.R. Ferreira,[2] Maria João R. P. Queiroz,[3] Paulo J. G. Coutinho,[1] Elisabete M. S. Castanheira[1]

[1] Centre of Physics (CFUM), University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal
[2] Mountain Research Centre (CIMO), Polytechnic Institute of Bragança, 5301-855 Bragança, Portugal
[3] Centre of Chemistry (CQ-UM), University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal
ritarodrigues@fisica.uminho.pt

Magneto-sensitive liposomes, resulting from the encapsulation of magnetic nanoparticles into liposomes, combine the remarkable physical properties of these two types of systems, while preserving the magnetic properties of the nanoparticles. These nanosystems can overcome pharmacokinetics problems of the encapsulated drugs and can be guided and localized to the therapeutic sites of interest by external magnetic field gradients. The use of magneto-sensitive liposomes as nanocarriers allows a safer use of powerful anticancer drugs in therapy with lower drug dosage and a more efficient treatment. In this work, manganese ferrite ($MnFe_2O_4$) nanoparticles, with superparamagnetic behaviour at room temperature, were obtained by coprecipitation method and their structural and magnetic properties were evaluated [1]. The synthesized nanoparticles were either entrapped in liposomes, originating aqueous magnetoliposomes (AMLs), or covered with a lipid bilayer (solid magnetoliposomes, SMLs), with sizes below 150 nm (Figure 1), suitable for biomedical applications [1,2]. Membrane fusion between both types of magnetoliposomes and giant unilamellar vesicles, used as models of cell membranes, was confirmed by FRET (Förster Resonance Energy Transfer) assays [1,2].
New promising antitumor drugs, thienopyridine derivatives containing an amine moiety (compounds **1** and **2,** Figure 2) [3], were successfully incorporated in aqueous and solid magnetoliposomes, with encapsulation efficiencies between 75% and 89% for both antitumor compounds. Drug-loaded magnetoliposomes, containing compounds **1** or **2**, presented very low growth inhibitory concentrations (GI_{50}), between 0.09 and 5.67 µM, when tested *in vitro* against several human tumor cell lines; MCF-7 (breast adenocarcinoma), NCI-H460 (non-small cell lung cancer), HeLa (cervical carcinoma) and T3M4 (pancreatic cancer cells) [4]. These results are promising for future drug delivery applications using magnetoliposomes in oncology, allowing a dual therapeutic approach (simultaneous chemotherapy and magnetic hyperthermia).

References

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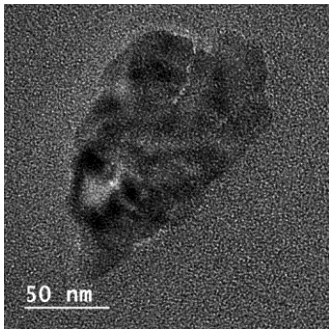
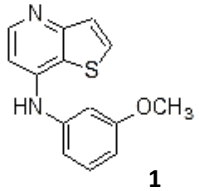


Figure 1. TEM image of solid magnetoliposomes.



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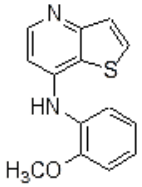

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Figure 2. Structure of compounds **1** and **2**.