Assessment of lipid formulations to develop multi-stimuli-responsive solid magnetoliposomes using fluorescence-based methodologies

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Abstract. The clinical success of liposomes in pharmaceutical sciences has driven the development of new multifunctional approaches for controlled drug delivery. Magnetoliposomes are hybrid lipid-nanoparticle complexes whose interest is based on the ability for magnetic targeting, controlled cargo release induction, thermal therapy potentiation, and theranostics capability. This work is focused on the assessment of lipid formulations to design solid magnetoliposomes (SMLs) as multi-stimuli-responsive vesicles for controlled release of doxorubicin (DOX) in pathological areas under the influence of thermal, magnetic, and pH stimuli [1]. The intrinsic fluorescence of DOX can be used as a facilitating tool for DOX-loaded SMLs characterization. Thus, the fluorescence spectroscopy technique was fundamental to evaluating the effect of lipid formulations on SMLs' properties, such as its encapsulation efficiency. The DOX localization in the lipid bilayer with pH variation was assessed by the simultaneous analysis of its fluorescence intensity variation with the steady-state fluorescence anisotropy (r). The interaction degree between the lipid vesicles and human serum albumin (HSA) allowed to conclude about the stability of formulations under physiological conditions. For that, the fluorescence quenching effect of HSA Trp214 residue, resulting from changes in the conformation of the HSA after interaction with vesicles, was monitored. The results confirm the fundamental role of PEG in enhancing the stealth properties of SMLs. Finally, DOX release kinetics assays were performed in mimetic environments of physiological conditions (37 °C, pH = 7.4) and therapeutic conditions (42 °C, pH = 5.5). The results reinforce the potential of SMLs as stimuli-responsive nanosystems for cancer targeting and therapy.

References: [1] Cardoso, B. D., Cardoso, V. F., Lanceros-Méndez, S., and Castanheira, E. (2022). Solid magnetoliposomes as multi-stimuli-responsive systems for controlled release of doxorubicin: assessment of lipid formulations. Biomedicines, 10(5), 1207.