Magnetic liposomes containing calcium ferrite nanoparticles for breast cancer therapy

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Liposomes can overcome many of the problems associated with other systems used in therapy, such as those involving solubility, pharmacokinetics, *in vivo* stability and toxicity. However, this system still presents some issues for *in vivo* application, namely its recognition and capture by the immune system and also the location in therapeutic sites for drug release. In order to overcome these problems, magneto-sensitive liposomes (magnetoliposomes) have been proposed. The magnetic components allow concentration of the liposomes in the desired area of the patient's organs by magnetic forces, often augmented by magnetic agglomeration. This way, a new therapy emerges, involving the guided transport of biologically active substances, most of them toxic and with systemic side effects [1,2]. In therapy, the most promising applications of magnetoliposomes are magnetic guided drug delivery and hyperthermia [1,2].

Considering their biocompatibility, calcium ferrite nanoparticles were prepared and characterized. The structural and magnetic properties of the nanoparticles were evaluated by XRD, TEM and SQUID. The synthesized nanoparticles were either entrapped in liposomes, originating aqueous magnetoliposomes (AMLs), or covered with a lipid bilayer, forming solid magnetoliposomes (SMLs) [3-5]. Magnetoliposomes present average diameters around 150 nm, suitable for biomedical applications (Fig. 1). Membrane fusion between magnetoliposomes and GUVs (giant unilamellar vesicles), used as models of cell membranes, was confirmed by FRET (Förster Resonance Energy Transfer) assays.

The magnetoliposomes were loaded with new potential anticancer drugs, thienopyridine derivatives (Fig. 2), with a strong antitumor activity against breast cancer cells [6]. Fluorescence anisotropy measurements indicate that the new antitumor drugs are mainly located in the lipid membrane of the magnetic liposomes. These results point to a promising application of magnetoliposomes in oncological therapy, simultaneously as hyperthermia agents and as nanocarriers for antitumor drugs.

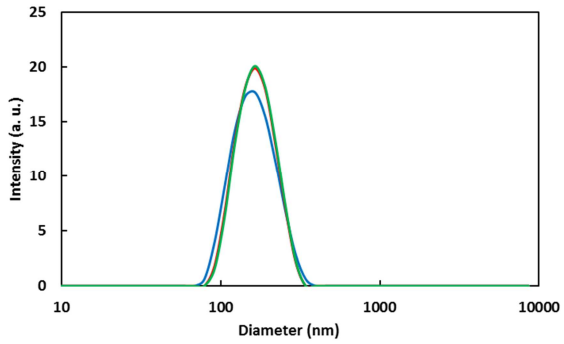

Fig. 1: Average diameter of AMLs containing calcium ferrite nanoparticles obtained by DLS (three independent measurements).

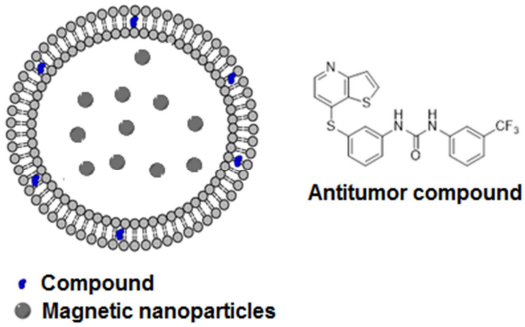

Fig. 2: Schematic representation of an aqueous magnetoliposome loaded with an antitumor thienopyridine derivative.

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6) V. A. Machado *et al.*, *J. Cell. Biochem.,* **2016**, *117*, 2791.

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