Magnetic liposomes based on nickel ferrite nanoparticles as nanocarriers for new potential antitumor compounds

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Guided transport of biologically active molecules (most of them toxic and with systemic side effects) to target specific sites in human body has been a focus of research in therapeutics in the past years. Magnetoliposomes (liposomes entrapping magnetic nanoparticles) are of large importance, as they can overcome many pharmacokinetics problems and can be guided and localized to the therapeutic site of interest by external magnetic field gradients [1,2]. In this work, nickel ferrite nanoparticles (NPs) with size distribution of 11±5 nm were obtained. Synthesized NPs show superparamagnetic behaviour at room temperature (magnetic squareness of 7.2×10^{-5} and coercivity field of 12 Oe), being suitable for biological applications. These NPs were either entrapped in liposomes, originating aqueous magnetoliposomes (AMLs), or covered with a lipid bilayer, forming dry magnetoliposomes (DMLs), the last ones prepared by a new promising route. Recently, AMLs and DMLs containing nickel-based nanoparticles were successfully prepared and characterized [3]. A potential antitumor compound [4] was successfully incorporated into the lipid bilayer of magnetoliposomes. DMLs structure was evaluated by FRET (Förster Resonance Energy Transfer) measurements between the fluorescent-labeled lipids NBD-C_{12}-HPC (donor) included in the second lipid layer and rhodamine B DOPE (acceptor) in the first lipid layer. A FRET efficiency of 23% was calculated, with a corresponding donor-acceptor distance (r) of 3.11 nm, confirming DMLs structure. Preliminary assays of the non-specific interactions of both types of magnetoliposomes with biological membranes (modeled by giant unilamellar vesicles, GUVs) were performed, keeping in mind future applications of drug delivery using this type of magnetic systems. Membrane fusion between magnetoliposomes and GUVs was confirmed by FRET.

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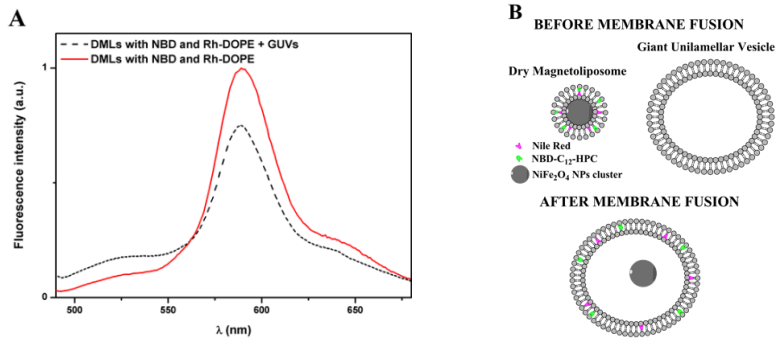

Figure 1 - A. Fluorescence spectra (λ_{exc}=470 nm) of DMLs labeled with NBD-C_{12}-HPC and Rhodamine B-DOPE, before and after interaction with GUVs. **B:** Illustration of the fusion between the GUVs and DMLs labeled with both NBD-C_{12}-HPC and Rhodamine B-DOPE.