Solid magnetoliposomes containing $Ca_xMg_{1-x}Fe_2O_4$ mixed ferrite nanoparticles

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Magnetoliposomes based on superparamagnetic nanoparticles are highly promising therapeutic nanosystems for cancer therapy. The entrapment of magnetic nanoparticles provides guidance using an externally applied magnetic field gradient (which is translated in a higher accumulation at the target site), while an alternating magnetic field can modulate the release of chemotherapeutic drug molecules and, synergistically, induce magnetic hyperthermia on cancer microenvironments. This behaviour arises as a result of the nanoparticles strong magnetization in the presence of an external magnetic field (disappearing once the external magnetic field is removed) and to their remarkable magnetic heating properties [1,2]. The lipid bilayer not only provides the ability to transport drugs with pharmacokinetic and pharmacodynamic problems, but also improves biocompatibility and stability of the nanoparticles. Hereby, its potentially has been of uttermost interest on the entrapment of ferrite nanoparticles to finely introduce its promising physicochemical properties in biomedical applications [3,4]. In this work, three different mixed magnesium/calcium ferrite nanoparticles ($Mg_xCa_{1-x}Fe_2O_4$, x=0.75, 0.5 and 0.25) were prepared and characterized on their colloidal stability, magnetic and structural properties (figure 1.a). The nanoparticles were further covered with a lipid bilayer of dipalmitoylphosphatidylcholine (DPPC) forming solid magnetoliposomes (SMLs). The formation of the lipid bilayer was proved through fluorescence-based techniques (figure 1.b). The potential as drug delivery systems was assessed by evaluating their fusion with giant unilamellar vesicles (GUVs) and interaction with bovine serum albumin (BSA). The polyphenolic antitumor compound curcumin was incorporated into the lipid bilayer of the developed magnetoliposomes, considering its strong hydrophobic character, which has been a barrier to its applicability in therapeutic applications. Therefore, the magnetoliposomes were evaluated as successful nanocarriers for curcumin to enhance its therapeutic potential in oncological therapy approaches.

a)

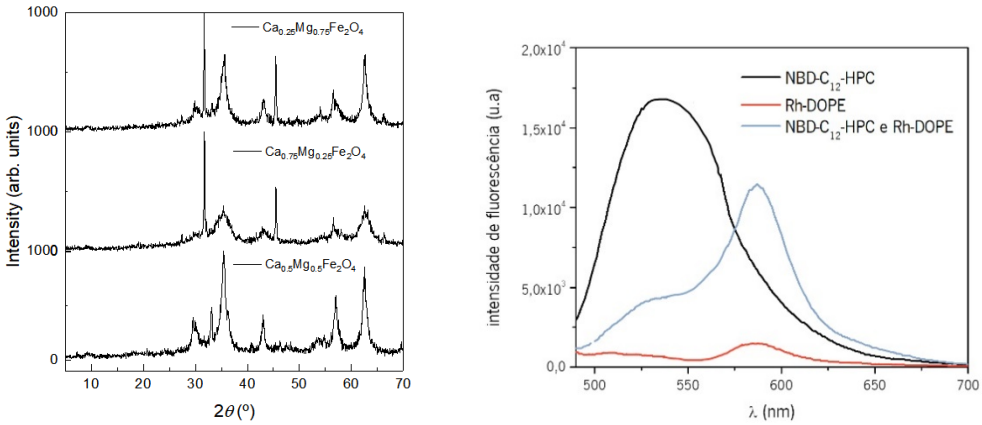

Figure 1: a) XRD spectra of $Ca_{0.25}Mg_{0.75}Fe_2O_4$, $Ca_{0.75}Mg_{0.25}Fe_2O_4$ and $Ca_{0.5}Mg_{0.5}Fe_2O_4$. b) Fluorescence spectra ($\lambda_{exc.}$ = 470 nm) of SMLs with DPPC bilayer labeled with NBD-C_{12}-HPC and/or Rh-DOPE.

Acknowledgements: FCT, FEDER, PORTUGAL2020 and COMPETE2020 for funding under Project PTDC/QUI-QFI/28020/2017 (POCI-01-0145-FEDER-028020) and Strategic funding UID/FIS/04650/2013 and UID/FIS/04650/2019. B. D. C. acknowledges FCT for a PhD grant (SFRH/BD/141936/2018).

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