Stealth magnetoliposomes based on calcium-substituted magnesium ferrite nanoparticles for curcumin transport and release

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The phytochemical curcumin has been showing a wide range of promising pharmacological properties, including anticancer action [1]. However, it is characterized by a low water solubility, rapid metabolism and elimination, limiting its biomedical use and therapeutic effect. The development and optimization of functionalized nanocarriers for curcumin aim to improve curcumin ADMET (absorption, distribution, metabolism, excretion and toxicology) and specificity for targeted therapies. In this work [2], stealth (aqueous and solid) magnetoliposomes containing calcium-substituted magnesium ferrite nanoparticles, $Ca_xMg_{1-x}Fe_2O_4$ (with x = 0.25, 0.50, 0.75) were developed as nanocarriers for curcumin, following previously developed work [3]. Magnetic nanoparticles were synthesized by coprecipitation method and characterized on their colloidal stability and optical, magnetic and structural properties. Their superparamagnetic properties and crystalline structure, with sizes below 10 nm, make them suitable to act as magnetic mediators for magnetoliposomes guidance and hyperthermia action. The magnetoliposomes based on these nanoparticles have hydrodynamic diameters around or below 150 nm, a low polydispersity and the ability to encapsulate hydrophobic drugs, as the potential antitumor drug curcumin. Considering the leaky nature of tumor blood vessels, as a result of the presence of gaps within the range of 100 to 780 nm between the endothelial cells of tumor capillaries and the lack of lymphatic drainage, the synthesized magnetoliposomes are an effective strategy for curcumin passive targeting. Magnetoliposomes were sterically stabilized with polyethylene glycol (PEG) to reduce in vivo opsonisation. The influence of an alternating magnetic field (AMF) on drug release over time (in PEGylated and non-PEGylated solid magnetoliposomes) was evaluated and compared with curcumin release by diffusion (Figure 1). The results suggest the potential of drug-loaded magnetoliposomes as nanocarriers that can be magnetically-guided to the tumor sites and act as agents for a synergistic effect combining magnetic hyperthermia and controlled drug release.

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