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Nanosystems for magnetic hyperthermia and local drug administration

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In this work, drug-delivery nanosystems with a combination of chemotherapy and magnetic hyperthermia using doxorubicin-loaded magnetic lipid carriers were investigated. The superparamagnetic iron oxide nanoparticles (SPIONs) and doxorubicin (DOX) were encapsulated in two types of nanostructured lipid carriers (NLC): gelucire-based NLCs (NLC(GEL-DOX-SPIONs)) and palmitate-based NLCs (NLC(PAL-DOX-SPIONs)) by a hot ultrasonication method [1]. The SPIONs and DOX alone were synthesized and encapsulated in NLCs for comparison. The resultant magnetic NLCs with DOX-loaded present a hydrodynamic diameter around 200 nm determined by dynamic light scattering (DLS). The structural, magnetic and morphological properties of the nanocarriers were studied by X-ray diffraction (XRD), transmission electron microscopy (TEM), superconducting quantum interference device (SQUID) and optical microscopy. The hyperthermia behavior of free SPIONs and nano-formulations were studied. Drug release tests were carried out in both physiological (pH 7) and tumor medium (pH 5) with a water bath from 35ºC to 50ºC, and also under an alternating magnetic field (10 mT, 556k Hz). The in vitro cytotoxicity assays in breast tumor cells (MCF-7) indicated that both lipid-based formulations were thermal and pH- sensitive, which allowed a passive drug release under different environments. The DOX-loaded NLCs demonstrated a greater cytotoxic capacity in tumor cells than the free DOX molecule. This therapeutic effect was even amplified in the presence of SPIONs upon an external alternating magnetic field (magnetic hyperthermia). This nanoplatform has been proved to be a promising system in multifunctional cancer therapies combining heat release and local chemotherapy.

Scientific Area

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