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Multi-functional magneto-liposomes for photo-thermally triggered drug release and MRI imaging

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Magnetic nanoparticles exhibit extraordinary properties, which make an excellent candidate for biomedical applications. Iron oxide nanoparticles have been used in MRI imaging, drug delivery and cancer hyperthermia. In the present work we report the engineering of hybrid vesicular systems between temperature-sensitive liposomes (TSL) and magnetic nanoparticles, as promising smart nanocontainers for photo-thermally triggered drug release and magnetic resonance imaging. Superparamagnetic iron oxide nanoparticles with different compositions, core sizes, and surface coating were successfully incorporated into TSL. Liposome-iron oxide hybrids (magneto-liposomes) were prepared using lipid film hydration and extrusion, and doxorubicin (Dox) was encapsulated in the liposome aqueous core using a remote loading method. The developed magneto-liposomes were characterized using dynamic light scattering (DLS), transmission electron microscopy (TEM), inductively coupled plasma mass spectrometry (ICP-MS). Dox release from our novel hybrids was assessed in response to near infrared radiation (NIR) laser. Magneto-liposomes were also studied to evaluate their capabilities as magnetic resonance imaging (MRI) contrast agent. Our results revealed that the incorporation of small hydrophobic SPIO in the TSL lipid bilayer did not affect liposome size, stability and Dox loading. Moreover, our magneto-liposomes showed fast drug release in response to laser, and superior MRI imaging capabilities compared to free SPIO nanoparticles. In conclusion, we report, for the first time, novel magneto-liposomes that could be used as a laser-responsive system, and can be combined with MRI for image-guided drug delivery.

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