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Solid and Aqueous Magnetic Liposomes as Nanocarriers for a New Potential Drug Active Against Breast Cancer

The potential of magnetic nanoparticles for biomedical applications has been recognized, due to their unique size and physicochemical properties. Nanoparticles with superparamagnetic behavior are preferred for these purposes, as they exhibit a strong magnetization only when an external magnetic field is applied [1]. Liposomes entrapping magnetic nanoparticles (magnetic liposomes) can be guided and localized in the therapeutic site by external magnetic field gradients and used in cancer therapy by hyperthermia, while acting as carriers for chemotherapy agents [2].

In this work, iron oxide nanoparticles (NPs), with diameters around 12 nm, were synthesized by coprecipitation method (Figure 1). The magnetic properties indicate a superparamagnetic behavior with a coercive field of 9.7 Oe and a blocking temperature of 118 K. Both aqueous and solid magnetic liposomes containing magnetite NPs were obtained, with sizes below 140 nm (Figure 2). Interaction between both types of magnetic liposomes and models of biological membranes was proven. A new antitumor compound, a diarylurea derivative of thienopyridine (Figure 3), active against breast cancer, was incorporated in both aqueous and solid magnetoliposomes, being located mainly in the lipid membrane. A promising application of these magnetic liposomes in oncology is anticipated, allowing a combined therapeutic approach, using both chemotherapy and magnetic hyperthermia.

References

[1] A. Hervault, N. T. K. Thanh, Nanoscale, 6 (2014) 11553-11573

[2] A. R. O. Rodrigues *et al.*, Phys. Chem. Chem. Phys., 17 (2015) 18011-18021; RSC Advances, 6 (2016) 17302-17313

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Figures

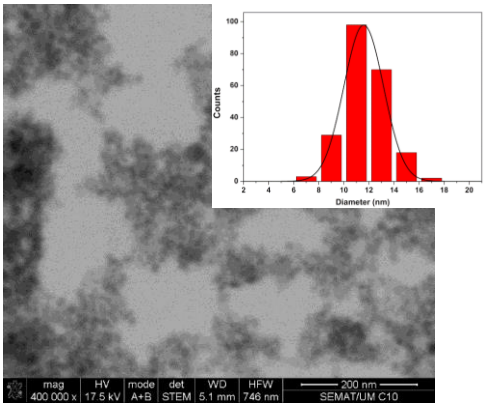

Figure 1: SEM image of magnetite nanoparticles. Inset: Particles size histogram and fitting to a Gaussian distribution.

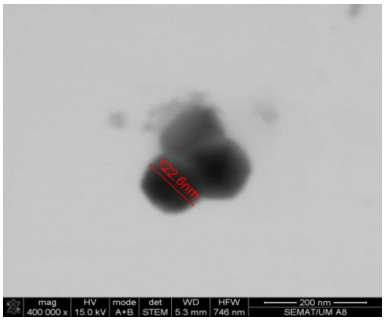

Figure 2: SEM image of solid magnetic liposomes.

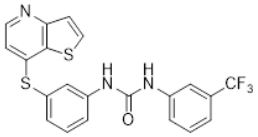

Figure 3: Structure of the antitumor diarylurea derivative of thienopyridine.