Magnetoliposomes based on magnetic/plasmonic nanoparticles loaded with tricyclic lactones for combined cancer therapy

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Supplementary Material

Modeling of Nile Red absorption spectra

A set of absorption spectra of the dye Nile Red, at several temperatures, were globally fitted to a sum of eight Gaussian functions and a dispersive background, as follows:

$$g_j(\lambda) = \frac{1}{\sigma_j\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\lambda-\lambda_{max,i}}{\sigma_j}\right)^2}$$

$$Abs(\lambda, T_i) = A_{disp}(\lambda, T_i) + A(T_i)\sum_{j=1}^{8} f_j g_j(\lambda)$$

$$A_{disp}(\lambda, T_i) = A_{offset}(T_i) + \frac{A_d(T_i)}{(\lambda/100)^4}$$

$$f_1(T_i) = \sin^2\left(a_1 + b_1 \times \left(\frac{T_i - T_0}{T_0}\right) + c_1 \times \left(\frac{T_i - T_0}{T_0}\right)^2\right) \quad ; T_0 = 21\ ºC$$

$$f_j(T_i) = \left(1 - \sum_{k=1}^{j-1} f_k\right)\sin^2\left(a_j + b_j \times \left(\frac{T_i - T_0}{T_0}\right) + c_j \times \left(\frac{T_i - T_0}{T_0}\right)^2\right)$$

j = 2, 3,…, 7

$$f_8(T_i) = \left(1 - \sum_{k=1}^{j-1} f_k\right)$$

In order to control the fitting procedure, the parameters of the Gaussian functions were constrained as follows:

$$\lambda_{max,j} = \left(\lambda_{max,j}\right)_{min} + \left[\left(\lambda_{max,j}\right)_{max} - \left(\lambda_{max,j}\right)_{min}\right]\sin^2(m_j)$$

$$\sigma_j = (\sigma_j)_{min} + \left[(\sigma_j)_{max} - (\sigma_j)_{min}\right] \sin^2(s_j)$$

j	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
$(\lambda_{max,j})_{min}$	510	520	530	540	550	560	575	590
$(\lambda_{max,j})_{max}$	520	530	540	550	560	575	590	630
$(\sigma_j)_{min}$	5	5	5	5	5	5	5	5
$(\sigma_j)_{max}$	50	10	10	40	10	40	50	50

The global fitting procedure for each set of absorption spectra with varying temperature consists on minimizing the following quadratic error sum:

$$ErrorSum = \sum_{i=1}^{n_T} \sum_{l=1}^{n_\lambda} w_l \left(Abs(\lambda_l, T_i) - Abs_{experimental}(\lambda_l, T_i)\right)^2$$

where w_l is a weight at each wavelength of absorption. It was taken as 1, except in the region 520-570 nm, where a value of 50 was used. This procedure ensures a good fit where the spectrum has more features.

The parameters that are varied in order to reach a minimum in the *ErrorSum* are A_{offset} and A_d for each absorption spectrum; a_1 to a_7; b_1 to b_7; c_1 to c_7; m_1 to m_8 and s_1 to s_8.

We used six temperatures, so that each absorption spectrum is fitted with an average of $2 + (3\times7 + 2\times8)/6 = 8.17$ parameters. This is equivalent to two parameters for the dispersive background and between 2 and 3 Gaussian functions (5 to 8 parameters).

For the case of the fitting of spectra obtained as a function of irradiation time, the fitted parameters are A_{offset}, A_d and T_i for each irradiation time.

Photophysical stability of compound solutions

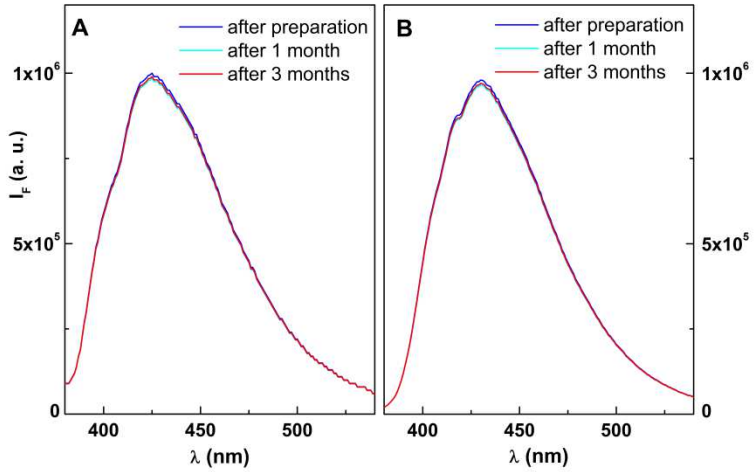

Figure S1. Fluorescence emission spectra of compound **1** in chloroform (**A**) and ethanol (**B**) (as examples), immediately after solution preparation and after 1 and 3 months of storage.

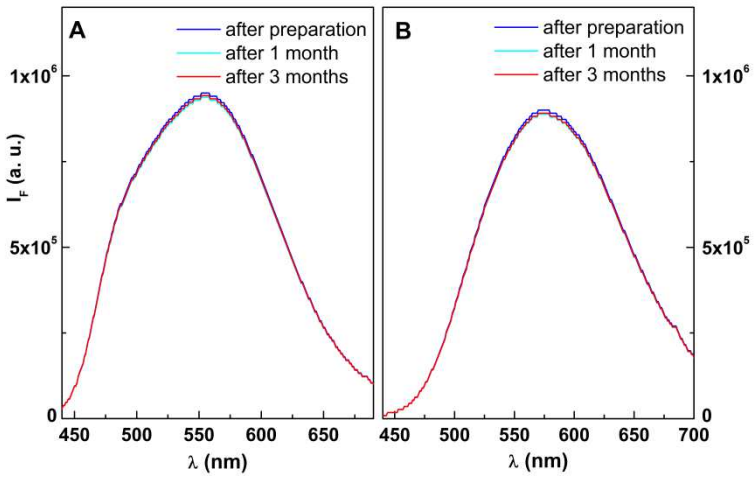

Figure S2. Fluorescence emission spectra of compound **2** in ethyl acetate (**A**) and acetonitrile (**B**) (as examples), immediately after solution preparation and after 1 and 3 months of storage.

TEM/STEM images and EDS analysis

Transmission electron microscopy (TEM)

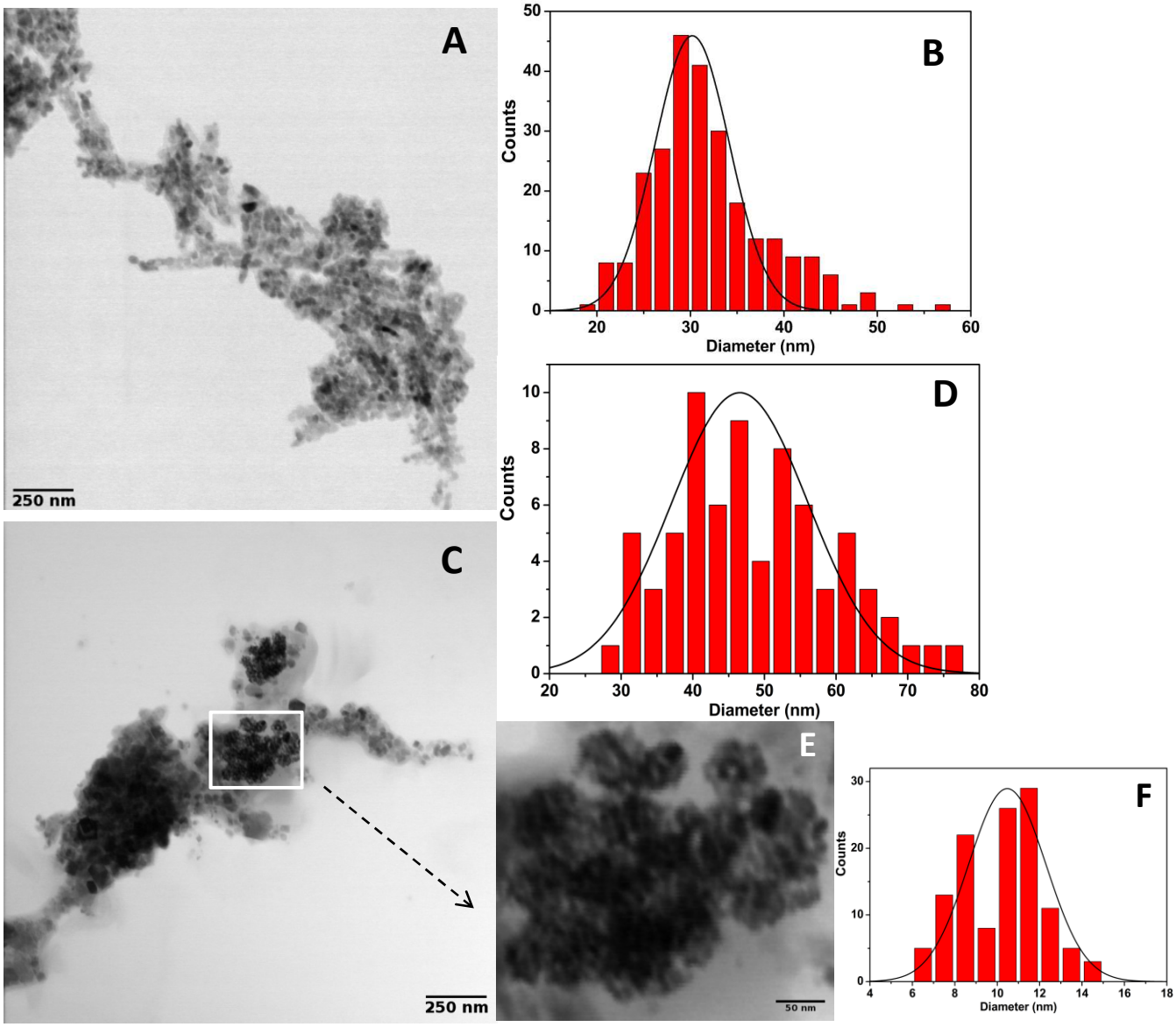

Figure S3. (**A**) Transmission Electron Microscopy image of core/shell nanoparticles and (**B**) corresponding histogram. (**C**) Transmission Electron Microscopy image of decorated nanoparticles and (**D**) corresponding histogram. (**E**) Expansion of image **C** (white square) and (**F**) corresponding histogram.

Scanning electron microscopy – transmission mode (STEM) and EDS analysis

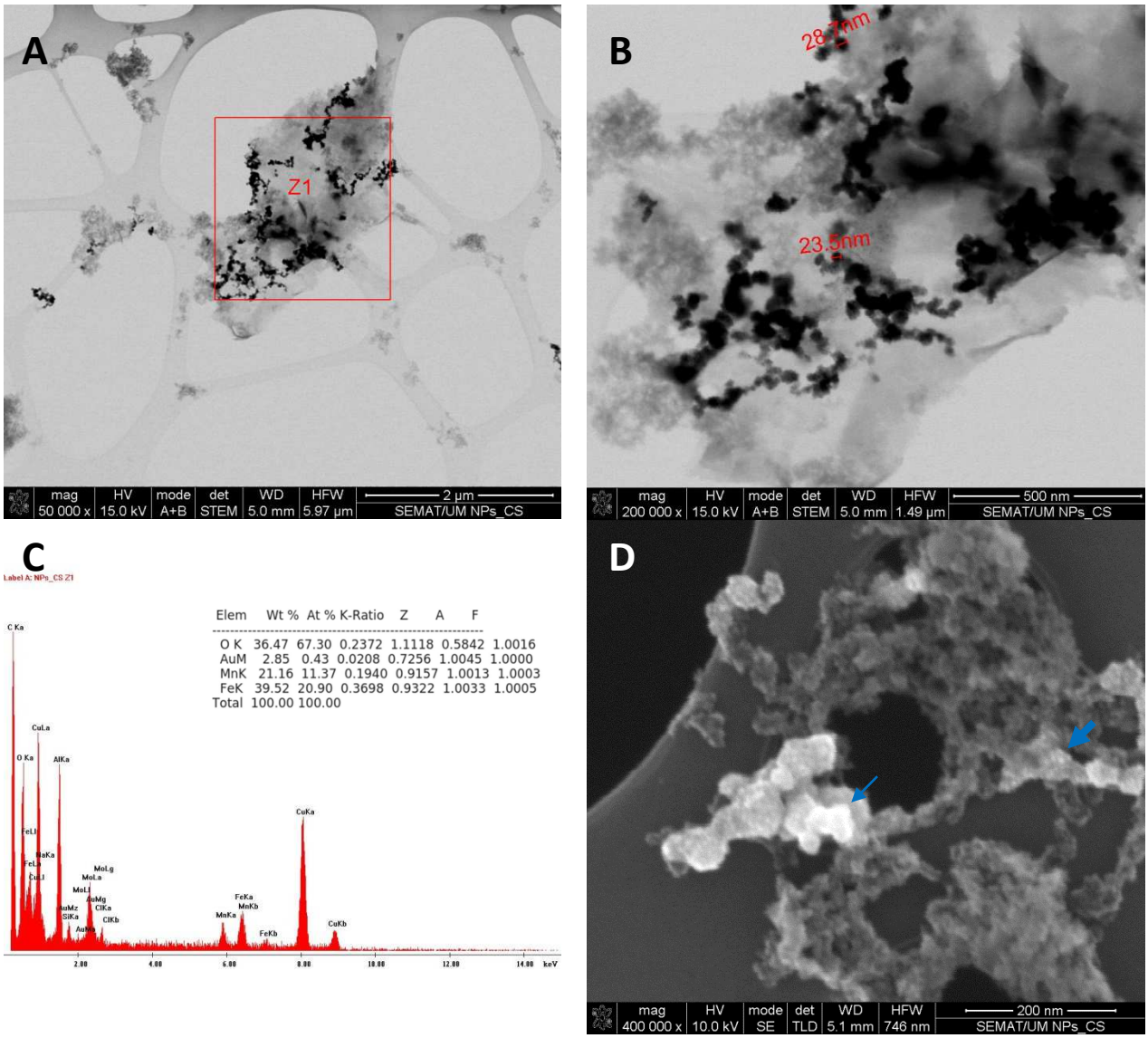

Figure S4. (**A**) and (**B**) Scanning electron microscopy images in transmission mode (STEM) of core/shell nanoparticles. (**C**) EDS spectrum of region Z1 from figure (**A**). (**D**) TLD image.