

Table S1. Amounts of reagents used in the preparation of the copolymers.

Figure. S1. Deconvolution of the main diffraction peak (311) of the A and B samples.

Figure. S2. Electron Diffraction Pattern from selected area of sample Fe₃O₄_A (left) and Fe₃O₄_B (right).

Figure. S3. Thermogravimetric analysis of the A and B nanoparticle samples.

Figure. S4- Fig. S8 Infrared spectra of the A and B samples functionalized with oleic acid and prepared PD, PD-PEG, PD-EM102 and PD-EM102-PEG ligands.

Figure. S9 Distribution of the hydrodynamic diameter obtained by DLS of the A and B samples, functionalized with PD, PD-PEG, PD-EM102 and PD-EM102-PEG ligands in water and saline medium.

Expression 1. Crystallite size of Fe₃O₄ nanoparticles (Scherrer Equation)

Expression 2. g_{eff} determination

Table S1. Amounts of reagents used in the preparation of the copolymers.

Sample	PMA (mmol)	DDA (mmol)	Triethylamine (mmol)	Drug (mmol)	PEG (mmol)	Solvent	Solvent (mL)
PD	6.4	4.8	7.17	-	-	THF	20
PD – EM102	0.676	0.507	0.676	0.03	-	DMF	20
PD – PEG 12.5%	0.064	0.048	-	-	0.0081	CHCl ₃	2
PD – PEG25%	0.064	0.048	-	-	0.0162	CHCl ₃	2
PD – EM102 – PEG12.5%	0.022	0.016	-	-	0.0028	CHCl ₃	2
PD – EM102 – PEG25%	0.025	0.018	-	-	0.0031	CHCl ₃	2

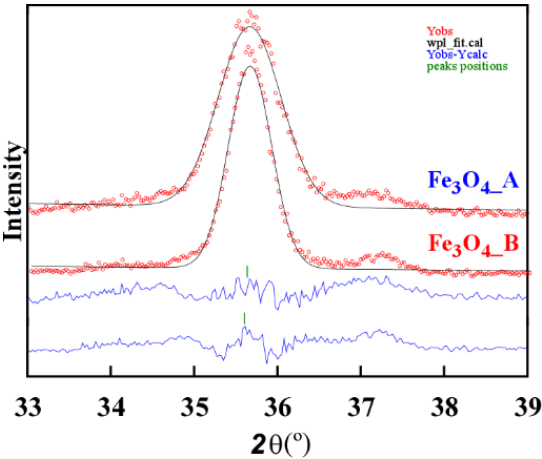


Figure. S1. Deconvolution of the main diffraction peak (311) of the Fe_3O_4_A and Fe_3O_4_B samples: experimental points (in red) = y_{obs} , peak position (turquoise mark) = peak pos, and difference between experimental data and fit (gray line) = $y_{\text{obs}} - y_{\text{calc}}$.

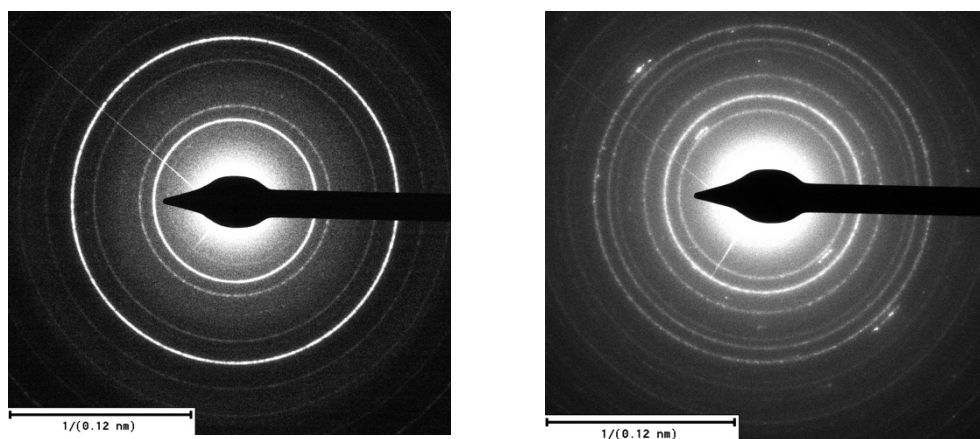


Figure. S2. Electron Diffraction Pattern from selected area of sample Fe_3O_4_A (left) and Fe_3O_4_B (right).

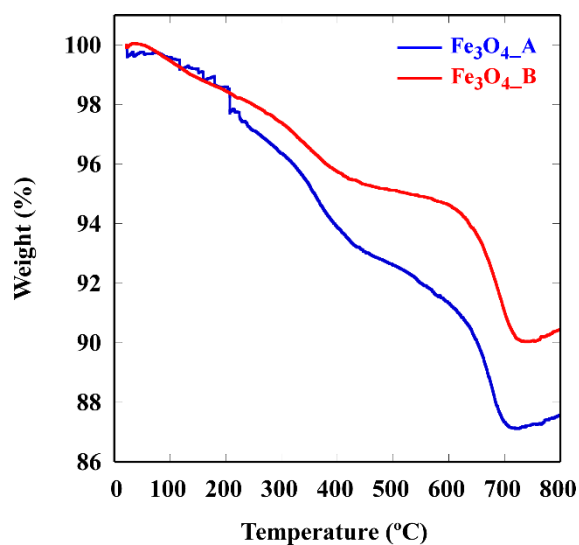
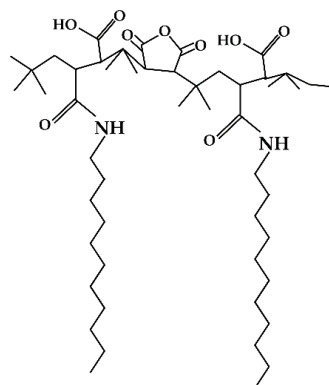
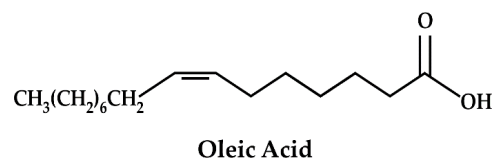


Figure. S3. Thermogravimetric analysis of the Fe_3O_4_A and Fe_3O_4_B nanoparticle samples.



The figure displays three stacked FTIR spectra from 3500 to 500 cm⁻¹. The top spectrum (black) is for PD-PEG12.5%, the middle (blue) for Fe₃O₄-A@PD-PEG12.5%, and the bottom (red) for Fe₃O₄-B@PD-PEG12.5%. Vertical colored bars indicate characteristic peaks: O-H st/N-H st (cyan, ~3300 cm⁻¹), C-H st (cyan, ~2900 cm⁻¹), C=O st/C-O-Hd st (yellow, ~1700 cm⁻¹), COO⁻ st (yellow, ~1600 cm⁻¹), O-Hb⁺ CH₃ dl (cyan, ~1500 cm⁻¹), C-O-C st / C-O st (cyan, ~1100 cm⁻¹), CH₃ st (cyan, ~1000 cm⁻¹), and Fe-O st (yellow, ~600 cm⁻¹).

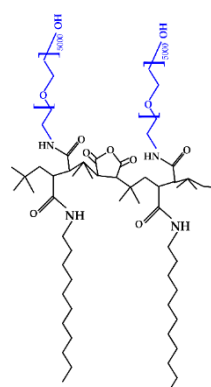


Figure. S6 Infrared spectra of PD-PEG12.5% copolymer and the Fe₃O₄_A-PD-12.5% and Fe₃O₄_B-PD-PEG25% samples in the left. The molecular structure of the PD-PEG% copolymer is provided on the right side.

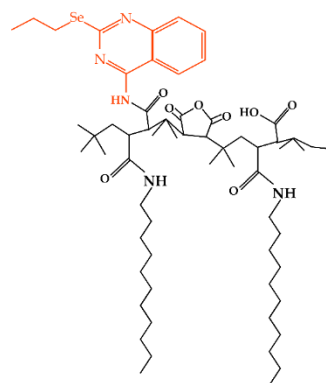


Figure. S7 Infrared spectra of drug EM102, PD-EM102 co-polymer, and the Fe₃O₄_A@PD-EM102 and Fe₃O₄_B@PD-EM102 samples on the left. The molecular structure of the PD-EM102 copolymer is shown on the right side.

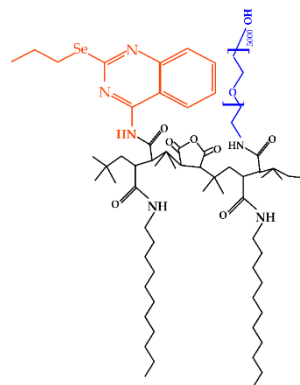


Figure. S8 Infrared spectra of PD-EM102-PEG12.5% copolymer, and the Fe₃O₄_A@PD-EM102-PEG12.5% and Fe₃O₄_B@PD-EM102-PEG25% samples on the left. The molecular structure of the PD-EM102-PEG co-polymer chain fraction is shown on the right side.

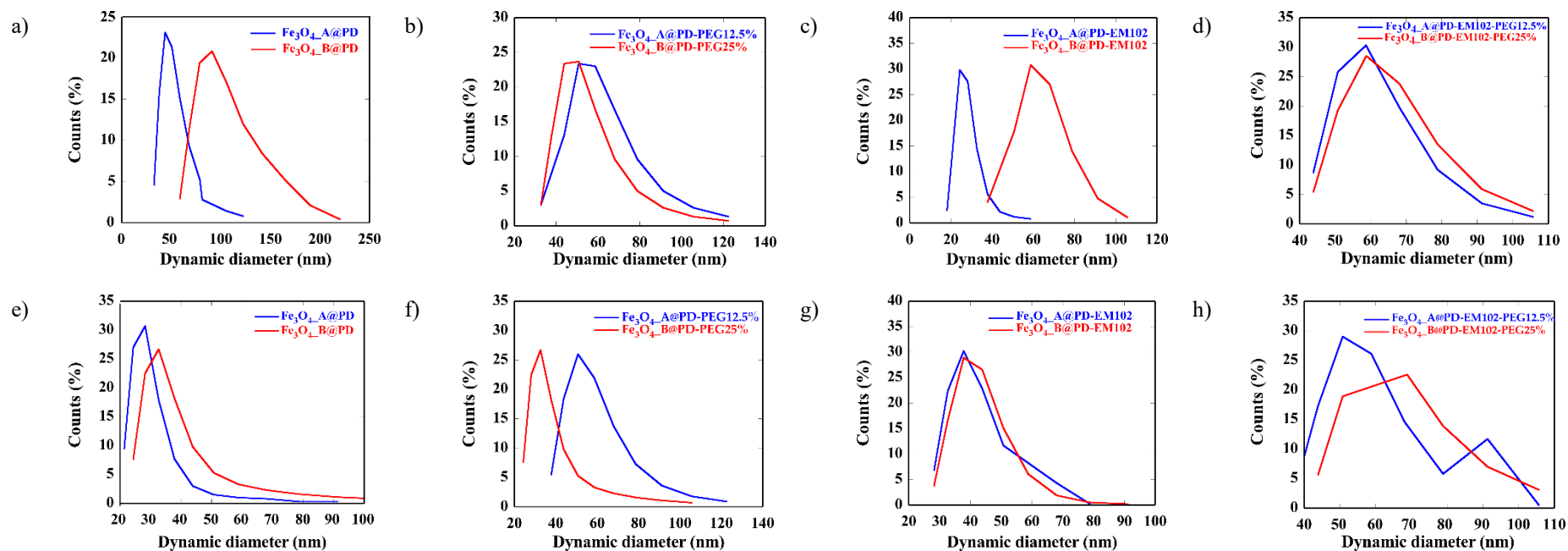


Figure. S9 Distribution of the hydrodynamic diameter obtained by DLS for the Fe_3O_4 _A and Fe_3O_4 _B nanoparticle samples functionalized with PD, PD-PEG, PD-EM102 and PD-EM102-PEG copolymers in water (a-d) and PBS (e-h) dispersion.

E1. Crystallite size of Fe₃O₄ nanoparticles

The crystallite sizes of samples A and B nanoparticles have been calculated by the deconvolution of the (311) diffraction peak of magnetite, using the Scherrer equation (S1):

$$D = \frac{K\lambda}{B_{structure} \cos\theta} \quad (S1)$$

Where K is the shape factor (0.85-0.95), $B_{structure} = B_{observed} - B_{instrumental}$ is the full width at half maximum, λ is the X-ray wavelength (in our case = $(K\alpha_1 + K\alpha_2)/2 = 1.5418 \text{ \AA}$), and θ is the angle of the peak position.

E2. g_{eff} determination

In order to compare the observed EMR signals, a value of g_{eff} has been determined (S2) for each sample assuming that the resonant field corresponds to the maximum of the microwave absorption curve.

$$\Delta E = h\nu = g\mu_B H_r \rightarrow g_{eff} = \frac{h\nu}{\mu_B H_r} \quad (S2)$$

where h is the Plank's constant, ν is the microwave frequency, μ_B is the Bohr magneton ($9.27 \cdot 10^{-21} \text{ erg G}^{-1}$) and H_r is the resonant field.