Supporting information

Ovalbumin coated Fe3O4 nanoparticles as a nanocarrier for chlorogenic acid to promote the anticancer efficacy on MDA-MB-231 cells

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Emission spectral studies of OVA with C-Fe_3O_4 NPs

The impact of the inner filter's effect (IFE) was regularized by the equation (Eqn. 1).

$$F_{corr} = F_{obs} \times e^{\frac{(A_{exc} + A_{emi})}{2}} \quad . \quad (1)$$

The Stern-Volmer equation (Eqn. 2) was then utilized to examine the quenching data.

$$\frac{F_0}{F} = 1 + K_{SV}[Q] \; (or) \; \frac{F_0}{F} = 1 + k_q \tau_0 [Q] \quad (2)$$

Where Stern-Volmer constant is denoted as K_{SV}, k_q is the bimolecular quenching constant, F_o and *F* reflects the corrected fluorescence intensities of OVA free and C-Fe_3O_4 NPs-bond forms, respectively. τ_0 is the average fluorescence lifetime of the Trp fluorophores of the native OVA and the quencher concentration is denoted by $[Q]$.

The emission spectra at different temperatures (298, 303, 308, and 313 K) were also used to estimate the binding constant (K_b), number of binding sites (*n*) and mode of binding involved in the interaction of C-Fe_3O_4 NPs with OVA using equation (Eqn. 3).

$$\log \left[\frac{F_0 - F}{F}\right] = \log K_b + n \; log \; [Q] \quad (3)$$

Where, $[Q]$, *F* and F_o represent the same parameters as that in equation 2.

$$\ln K_a = -\frac{\Delta H^\circ}{TR} + \frac{\Delta S^\circ}{R} \quad (4)$$

Where, K_a denotes the binding affinity constant, *R* represents gas constant and T(K) corresponds to absolute temperature.

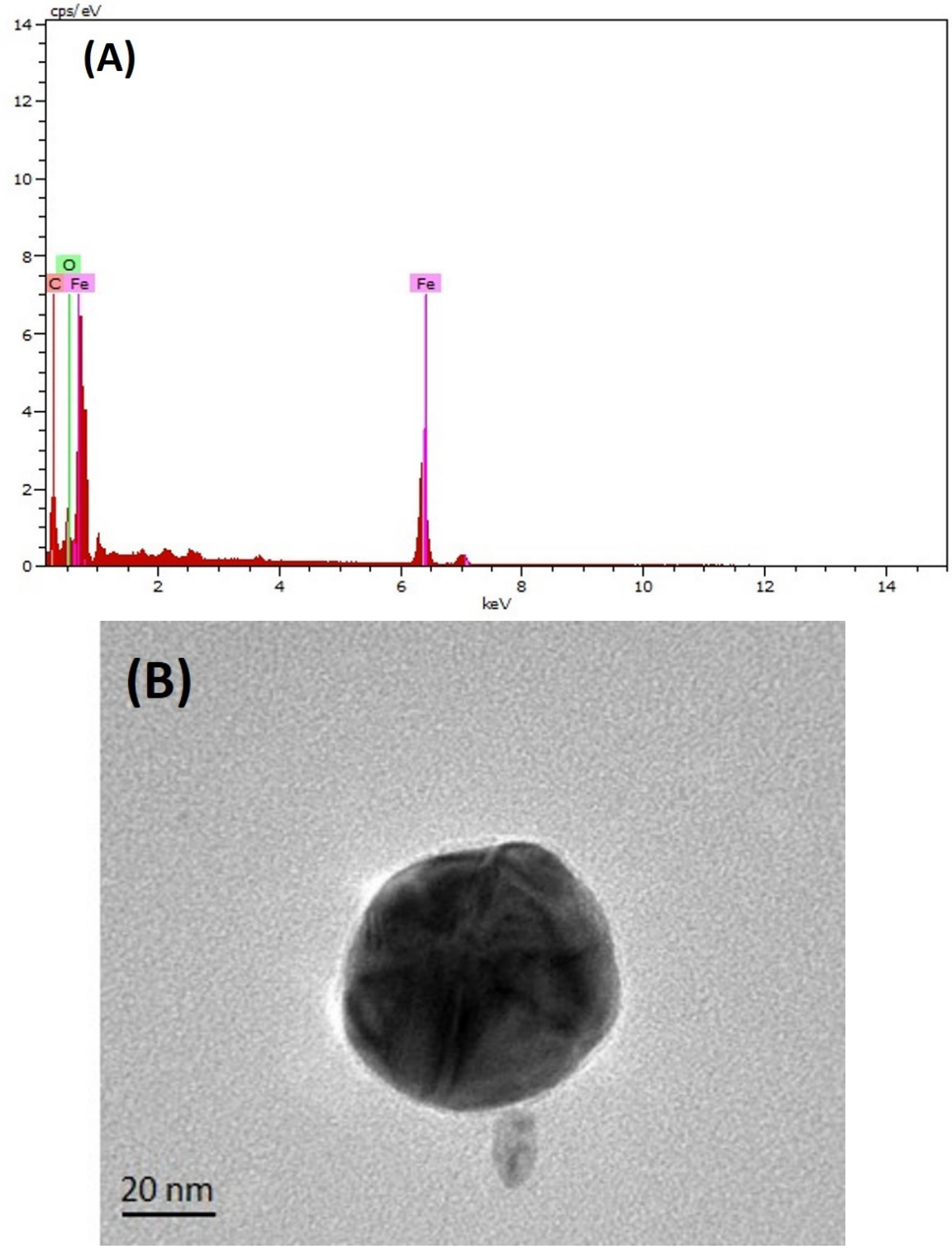

Fig. S1 EDX spectra of C-Fe_3O_4 NPs (a) and HR-TEM image of C-Fe_3O_4 NPs@OVA

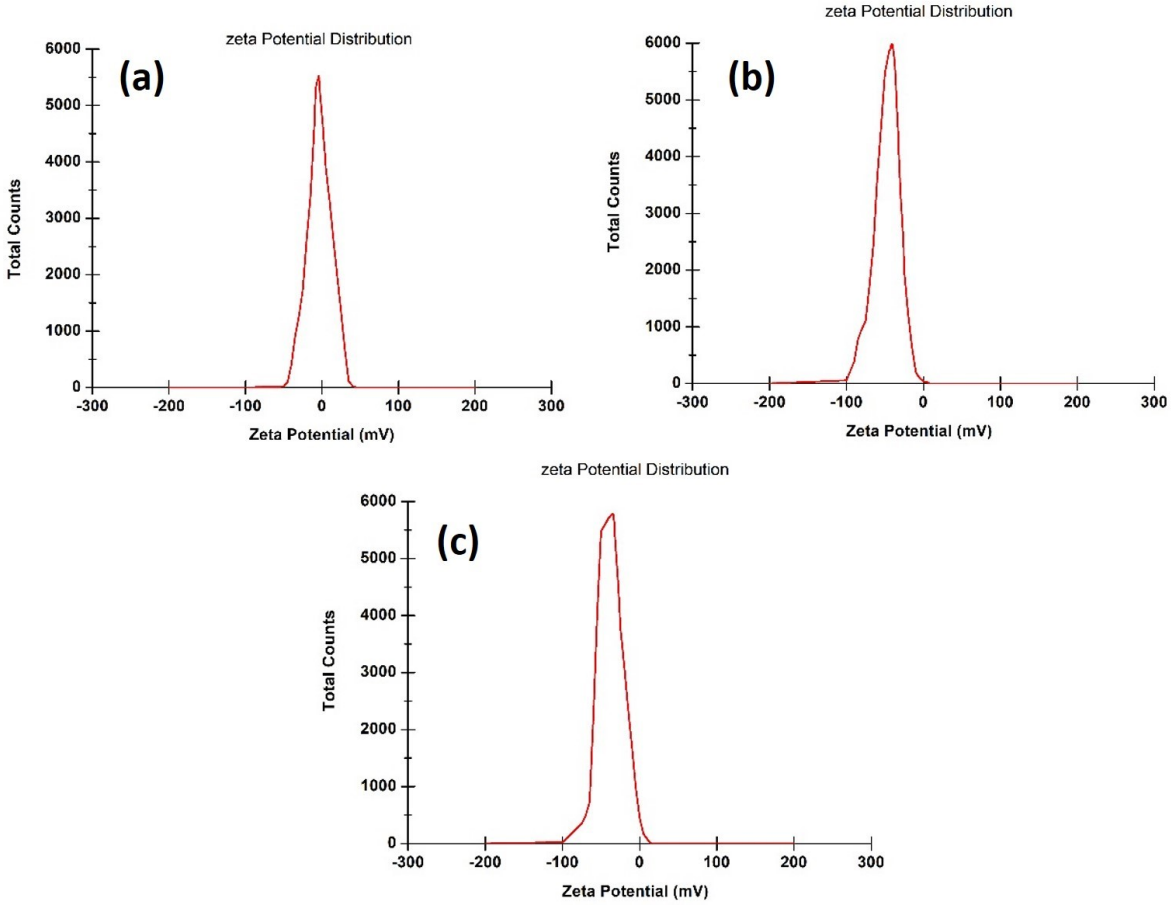

Fig. S2. The Zeta potential distribution of Fe_3O_4 NPs (a), C-Fe_3O_4 NPs (b) and C-Fe_3O_4 NPs@OVA (c)

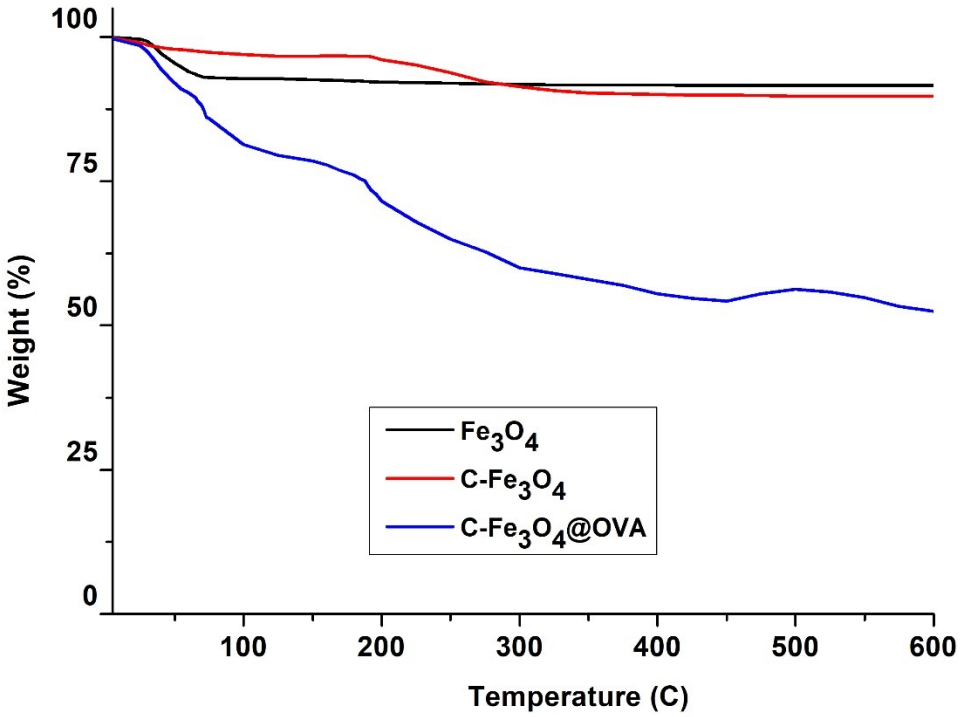

Fig. S3. Thermogram of Fe_3O_4 NPs (a), C-Fe_3O_4 NPs (b) and C-Fe_3O_4 NPs@OVA (c).

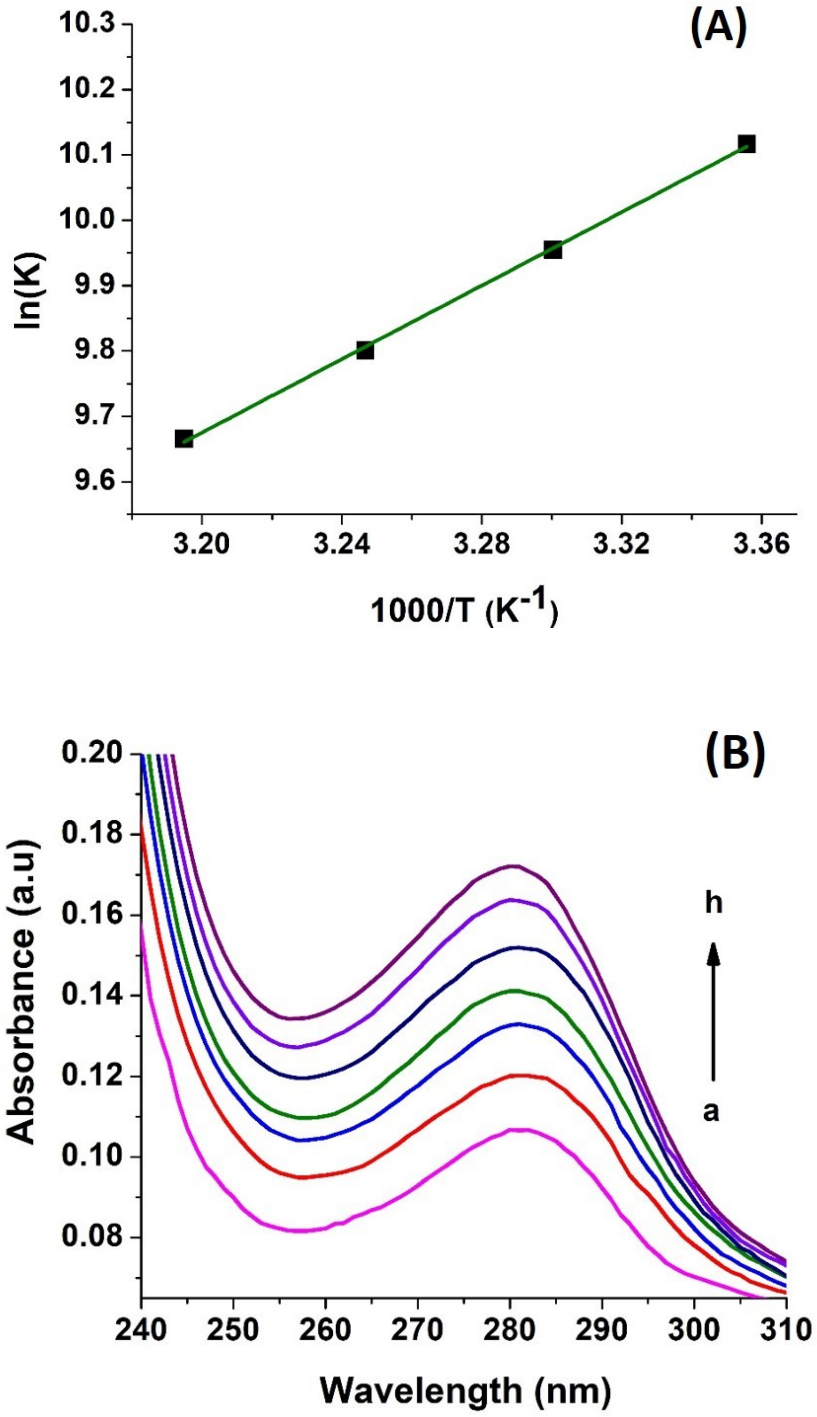

Fig. S4. Van't Hoff plot for the OVA-5-CQA system (A), UV-Vis absorption spectra of OVA (5.00×10^{-6} mol dm^{-3}) in the presence of various concentrations of C-Fe_3O_4 NPs at 298 K (B), [OVA]: = 5.00×10^{-6} mol dm^{-3}; [C-Fe_3O_4 NPs]: [a-i]: 0.00, 0.40, 0.80, 1.20, 1.60, 2.00, 3.00, 4.00 and 5.00×10^{-6} mol dm^{-3}.

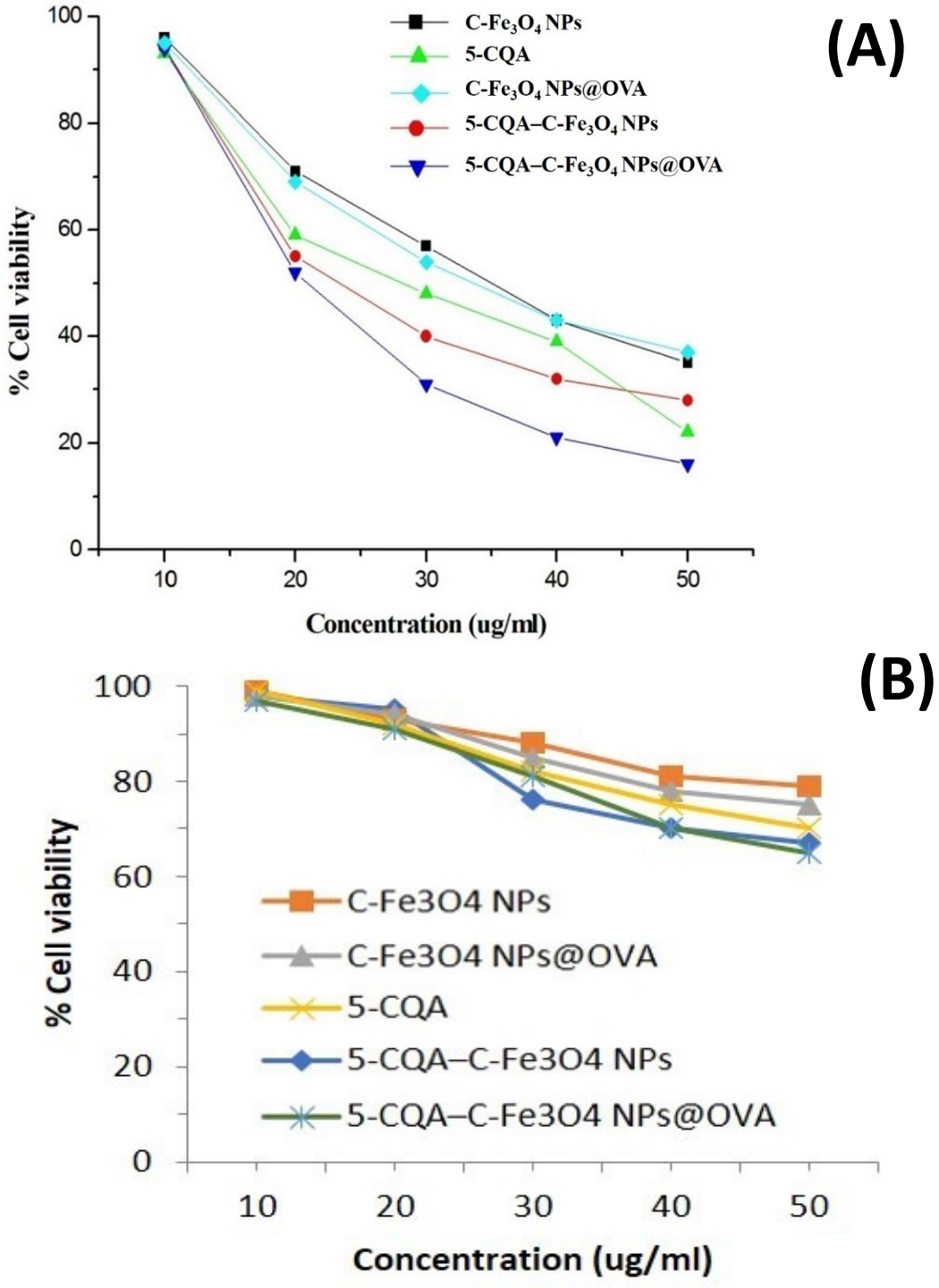

Fig. S5. (A) Cytotoxic effect of C-Fe_3O_4 NPs, 5-CQA, C-Fe_3O_4 NPs@OVA, 5-CQA encapsulated C-Fe_3O_4 NPs and 5-CQA encapsulated C-Fe_3O_4 NPs@OVA on the viability of MDA-MB-231 cells and (B) normal epithelial (HBL 100) cells

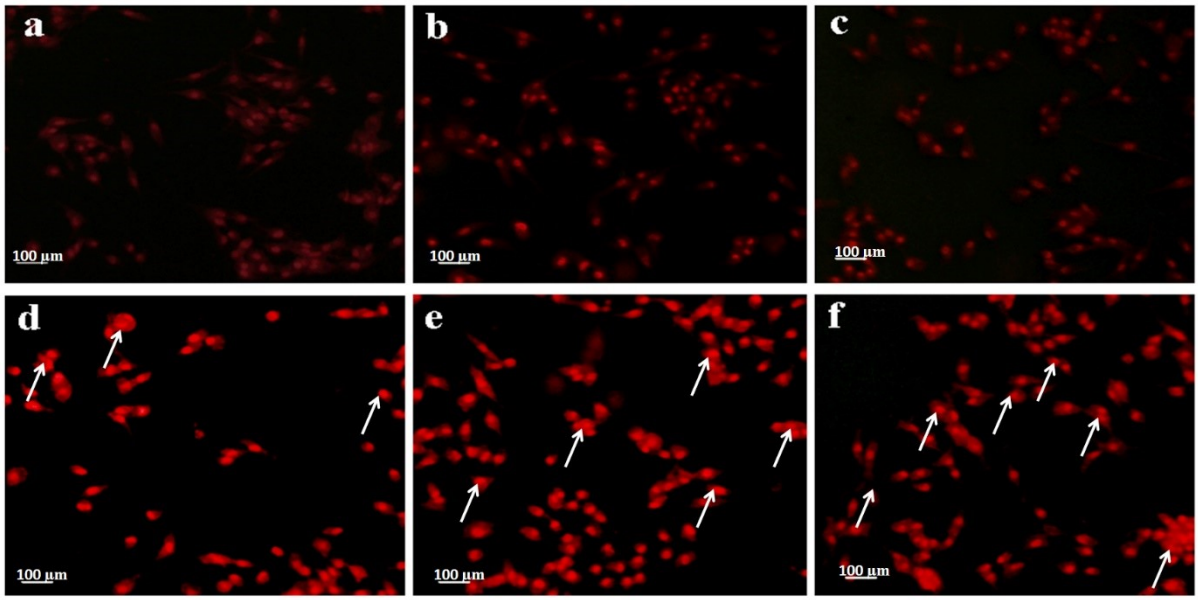

Fig. S6. PI apoptotic analysis of untreated and treated cells. Control (untreated cells) (a), C-Fe_3O_4 NPs (b), 5-CQA (c), C-Fe_3O_4 NPs@OVA (d), 5-CQA–C-Fe_3O_4 NPs (e), 5-CQA–C-Fe_3O_4 NPs@OVA (f) system treated MDA-MB-231 cells at 24 h. The scale bar represents 100 µm. White arrows in Fig. S6 indicate the apoptotic cells.