Supporting Information

Tumor Microenvironment Responsive FePt/MoS_2 Nanocomposites with Chemotherapy and Photothermal for Enhancing Cancer Immunotherapy Therapy

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Calculation of the photothermal conversion efficiency

The photothermal conversion efficiency of FePt/MoS_2 NPs were determined according to the previous report method.[1,2] The detailed calculation was given as following: 1 mL of FePt/MoS_2 NPs aqueous dispersion with different concentrations([Fe]=100, 80, 50 and 20 μg mL-1) were exposed to 808 nm NIR laser for 10 min, and then the laser was shut off to allow the system to cool down to room temperature.

Then, the photothermal conversion efficiency (η) value was calculated according to the equation 1:

$$\eta = \frac{Q_{in,mater}}{I(1-10^{-A_{808}})} \quad (1)$$

Where I is the laser power. A808 is the absorbance of the FePt/MoS_2 NPs at the wavelength of 808 nm. Where $Q_{in,mater}$ is the heat generation from FePt/MoS_2 NPs. During the photothermal heating process, total energy balance of this system as following equation 2:

$$mC_p \frac{dT}{dt} = Q_{in,mater} + Q_{in,sol} - Q_{out} \quad (2)$$

Where m and C_p are the mass and heat capacity, $Q_{in,sol}$ is the heat generation from water. Q_{out} is the energy loss to the surroundings. And the theory of heat transfer was calculated as following equation 3:

$$Q_{out} = hA(T - T_{surr}) \quad (3)$$

Where h is the heat transfer coefficient, A is the irradiated area of the container. T_{surr} is the temperature of surrounding (regarded as constant). In order to get the hA, a dimensionless driving force temperature θ is defined as follows equation 4:

$$\theta = \frac{T - T_{surr}}{T_{\max} - T_{surr}} \quad (4)$$

Where T_{max} is the equilibrium temperature and the hA can be deprived from the time constant τ as following equation 5:

$$\tau = \frac{mC_p}{hA} \quad (5)$$

Therefore, time constant is linear-fitted to be τs =285.5 s according to the linear time from the cooling period after 600 s vs Lnθ (Figure S3). Thus, based on the equation 5, the hA is deduced to be 16.56 mW oC-1. Thus photothermal conversion efficiency of FePt/MoS2 NPs can be calculated to be 32.69 % by equation (2) and (1).

1. Yin W, Yan L, Yu J, Tian G, Zhou L, Zheng X, et al. ACS Nano 2014; 8: 6922-33.

2. Liu X, Li B, Fu F, Xu K, Zou R, Wang Q, et al. Dalton Transactions 2014; 43: 11709-15.

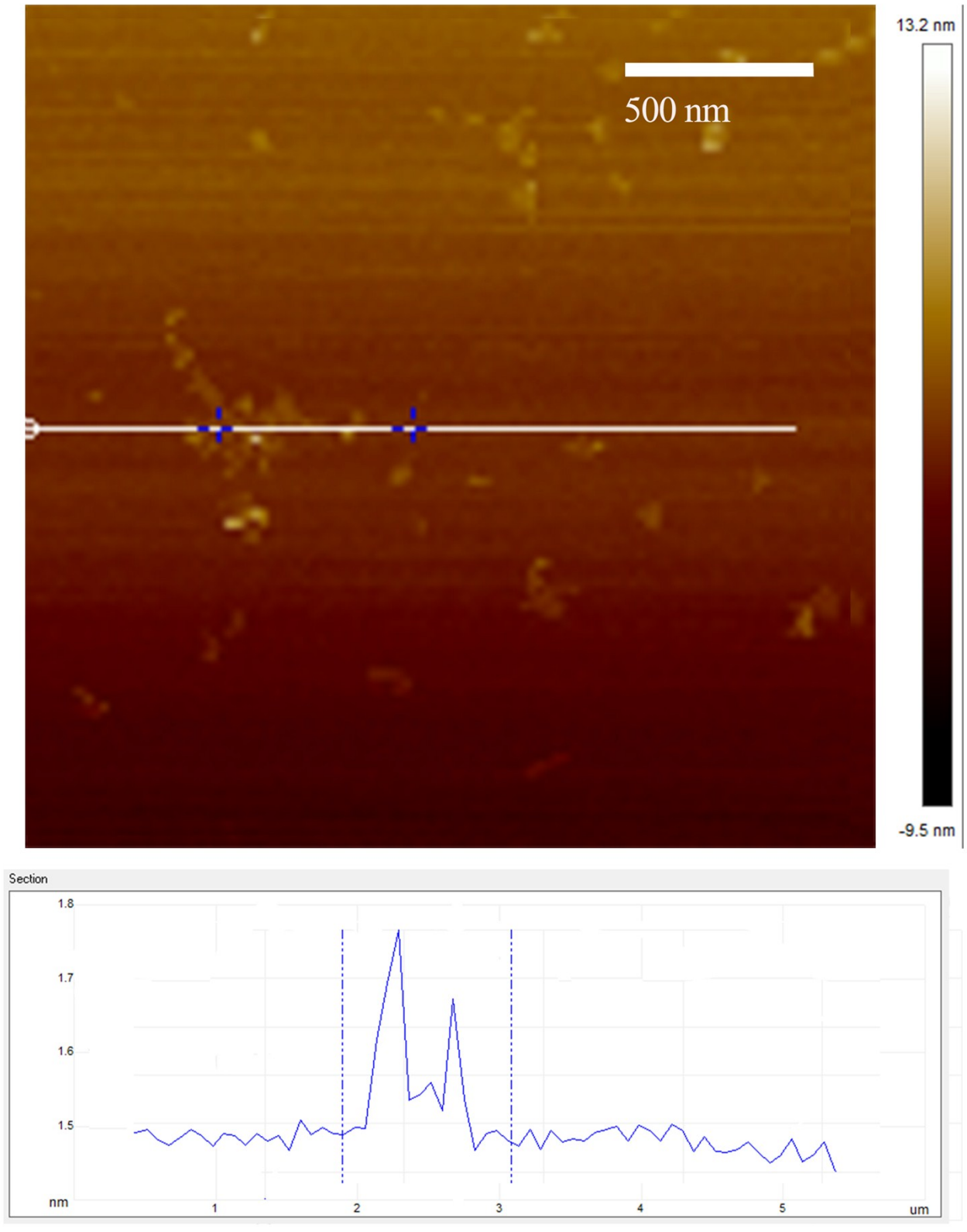

Figure S1. Atomic force microscopy (AFM) micrograph of MoS_2 nanosheets

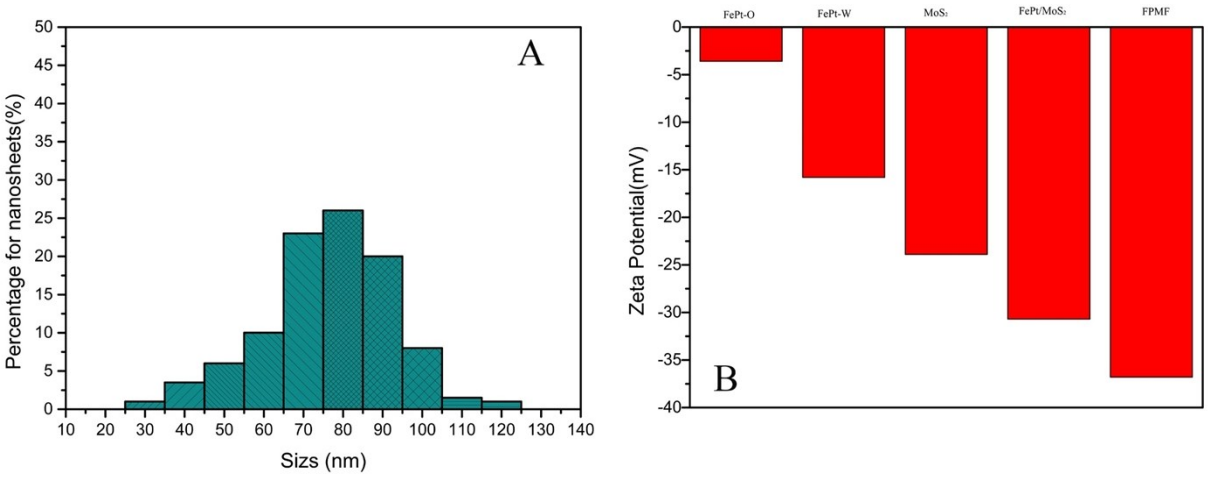

Figure S2. A: The size of FePt/MoS_2 nanocomposites. B: The Zeta of FePt-O, FePt-W, MoS_2, FePt/MoS_2 and FePt/MoS_2-FA nanocomposites solutions

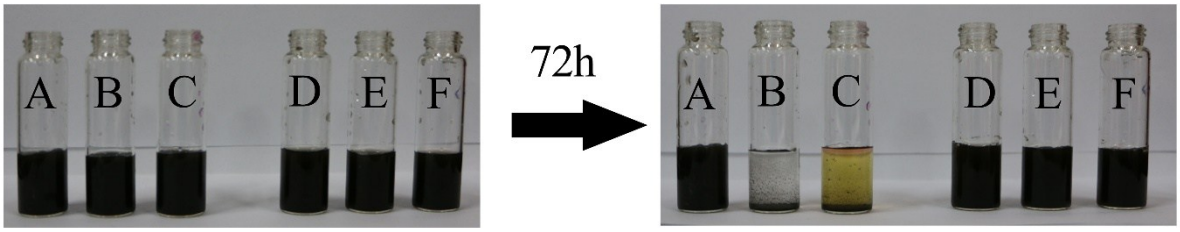

Figure S3. Stabilities of the as-prepared FePt/MoS_2 were dissolved in H_2O (A), PBS (B), and DMED medium (C) or FPMF NCs were dissolved in H_2O (D), PBS (E), and DMED medium (F) for 72 h, respectively

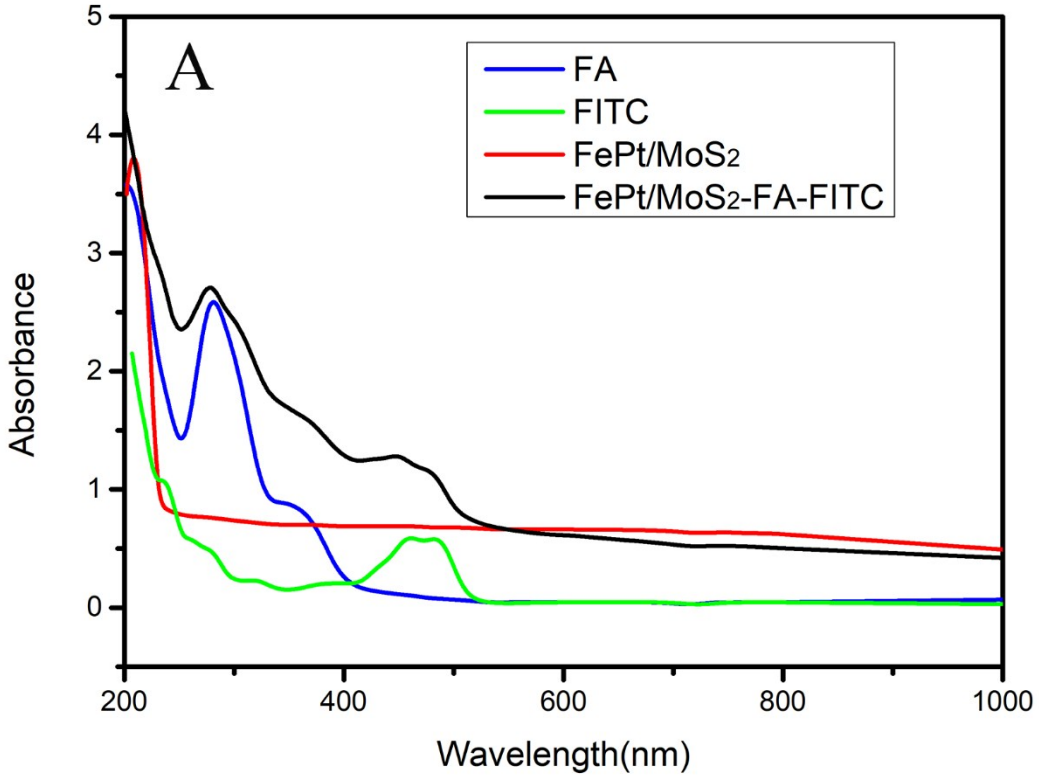

Figure S4. UV-Vis spectra of the as-synthesized FePt/MoS_2, FePt/MoS_2-FA-FITC, free HS-PEG-FA and free HS-PEG-FITC

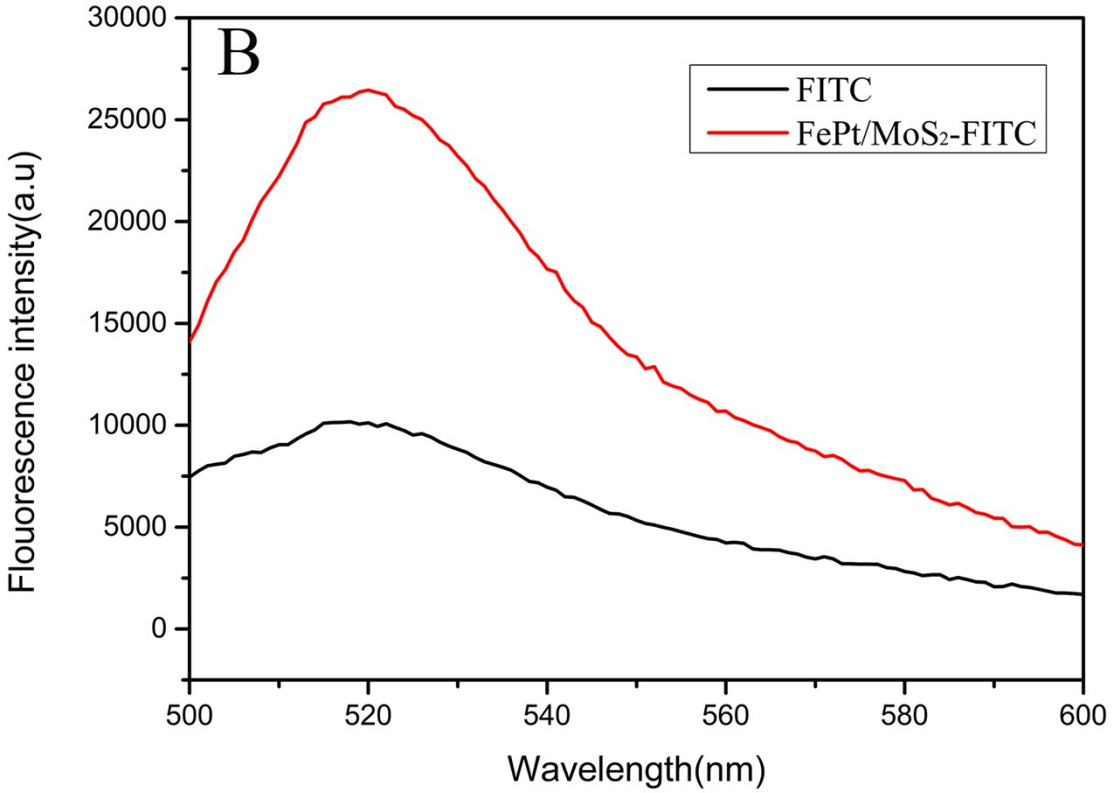

Figure S5. The fluorescence spectrum of FePt/MoS_2-FA-FITC and free HS-PEG-FITC

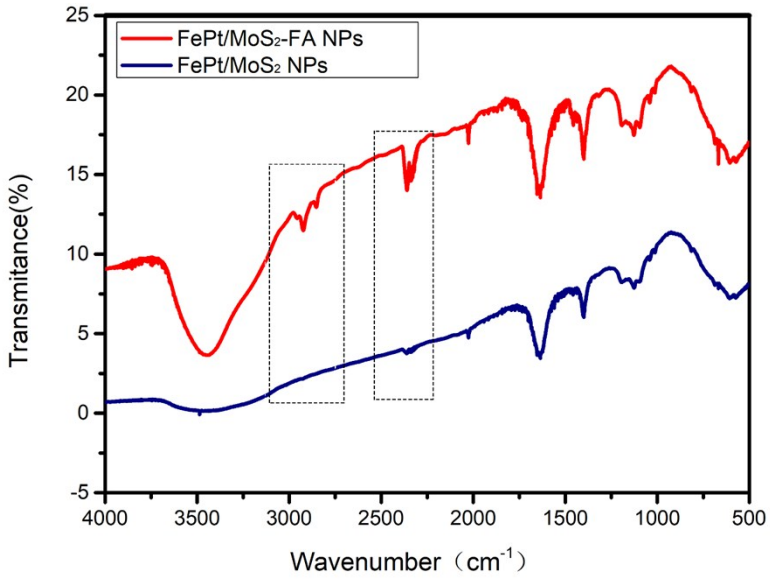

Figure S6. FT-IR of $FePt/MoS_2$ HNPs before and after conjugated with SH-PEG-FA

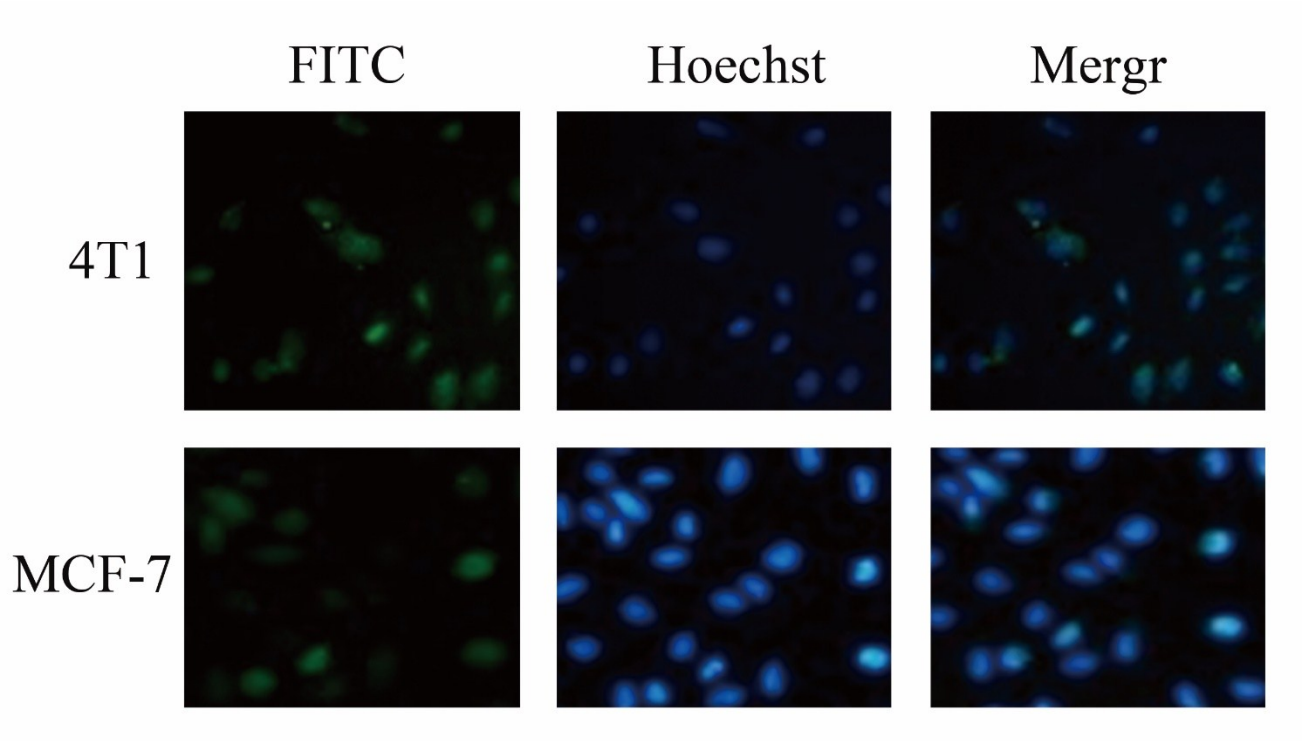

Figure S7. The fluorescence image of FePt/MoS_2-FA-FITC

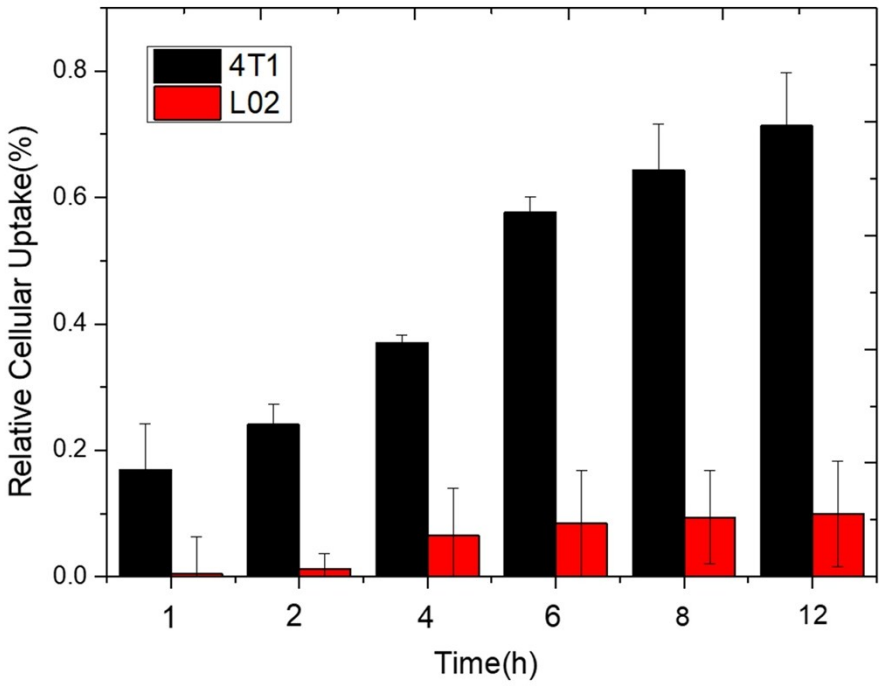

Figure S8. The relative cellular uptake of FePt/MoS_2 nanocomposites toward 4T1 and L02 cells under different incubation times at the Fe concentration of 80 μg mL^{-1}

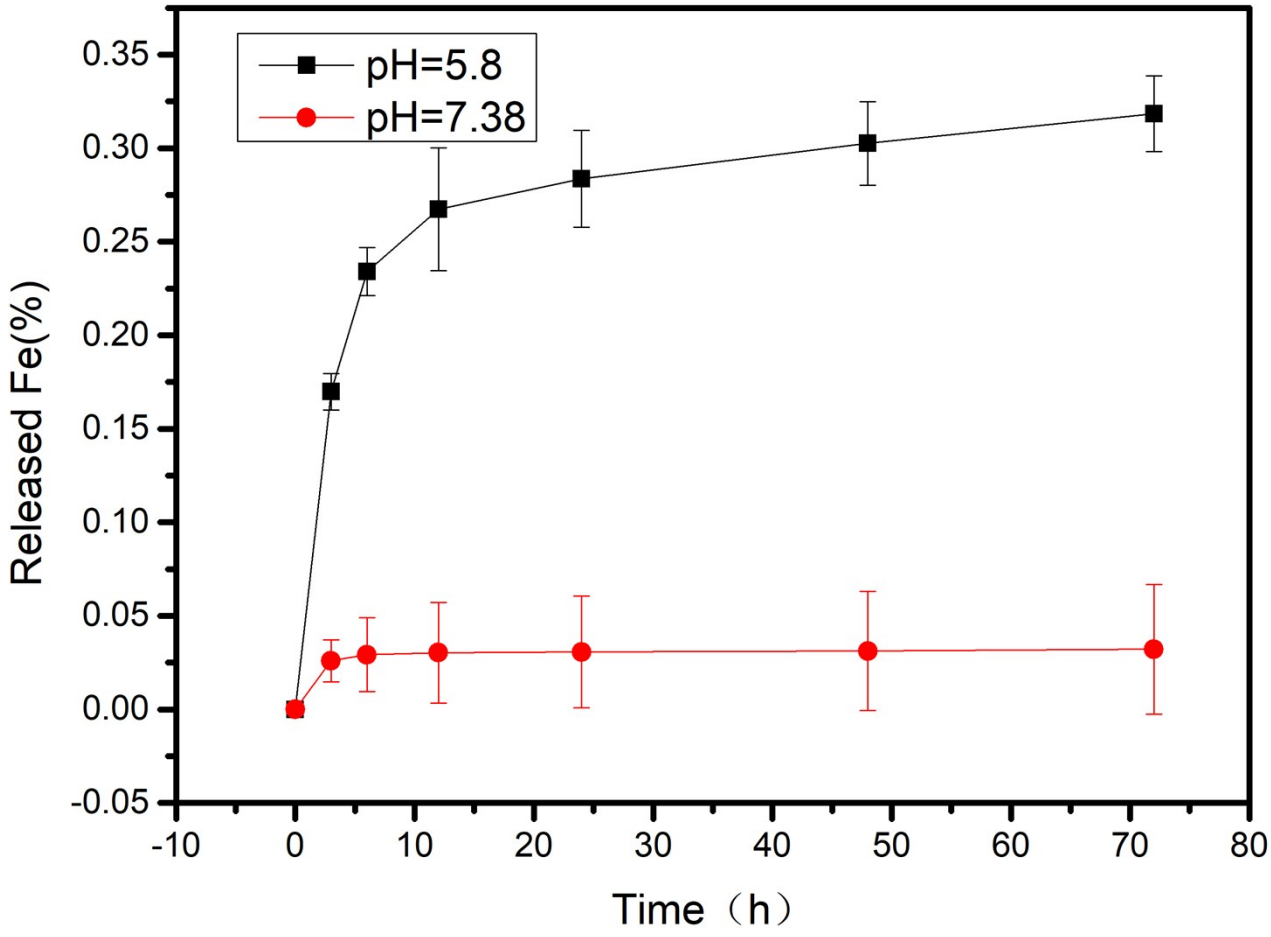

Figure S9. Situations of Fe releasing from FePt/MoS_2 HNPs with time in PBS (pH=5.8 and 7.38, respectively)

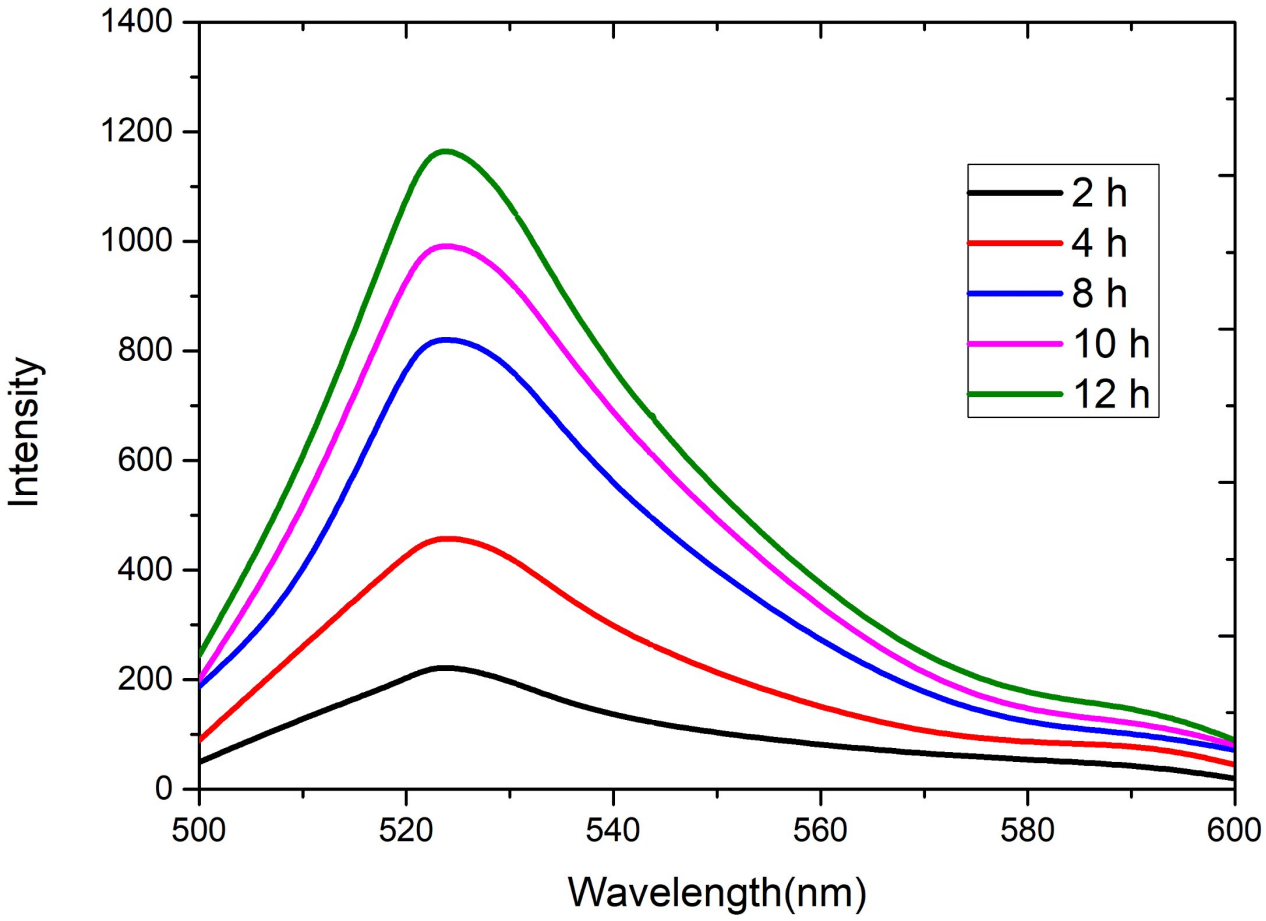

Figure S10. Time-dependent fluorescent intensity from DCFH-DA labeled 4T1 cells after being treated with FePt/MoS_2-FA at the Fe concentration of 80 mg mL^{-1}

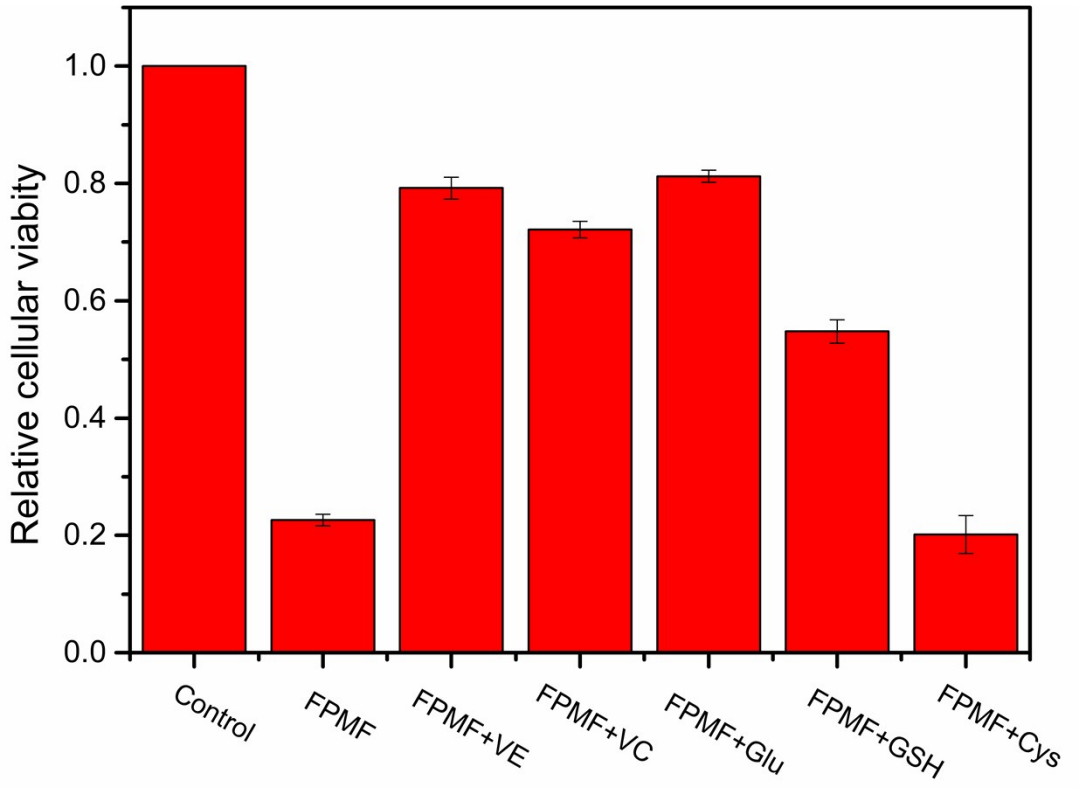

Figure S11. Viabilities of MCF-7 cells processed with FPMF NCs, FPMF NCs + VE, FPMF NCs + VC, FPMF NCs + Glu, FPMF NCs + GSH and FPMF NCs + Cys

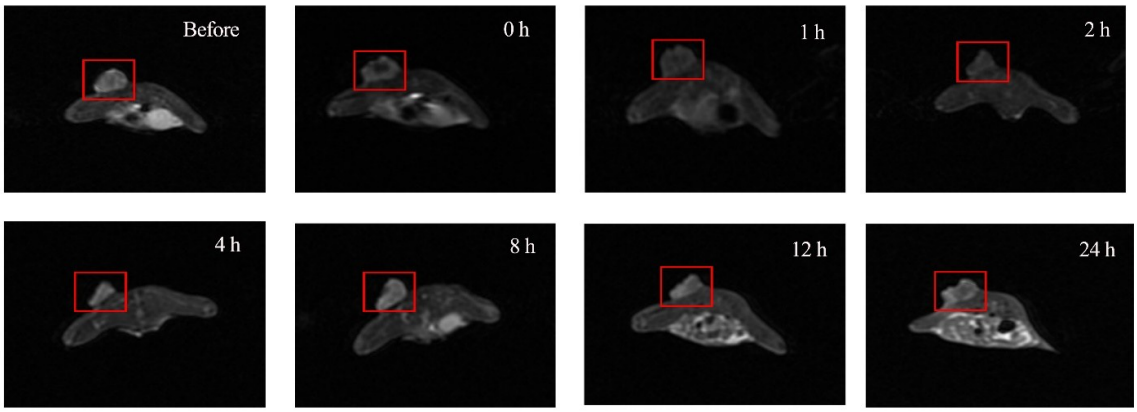

Figure S12. In vivo T2-weighted MR imaging (axial plane) of a 4T1 tumor-bearing mouse at different time intervals after intratumor injection with FPMF NCs. Tumor tissue was indicated with red pane

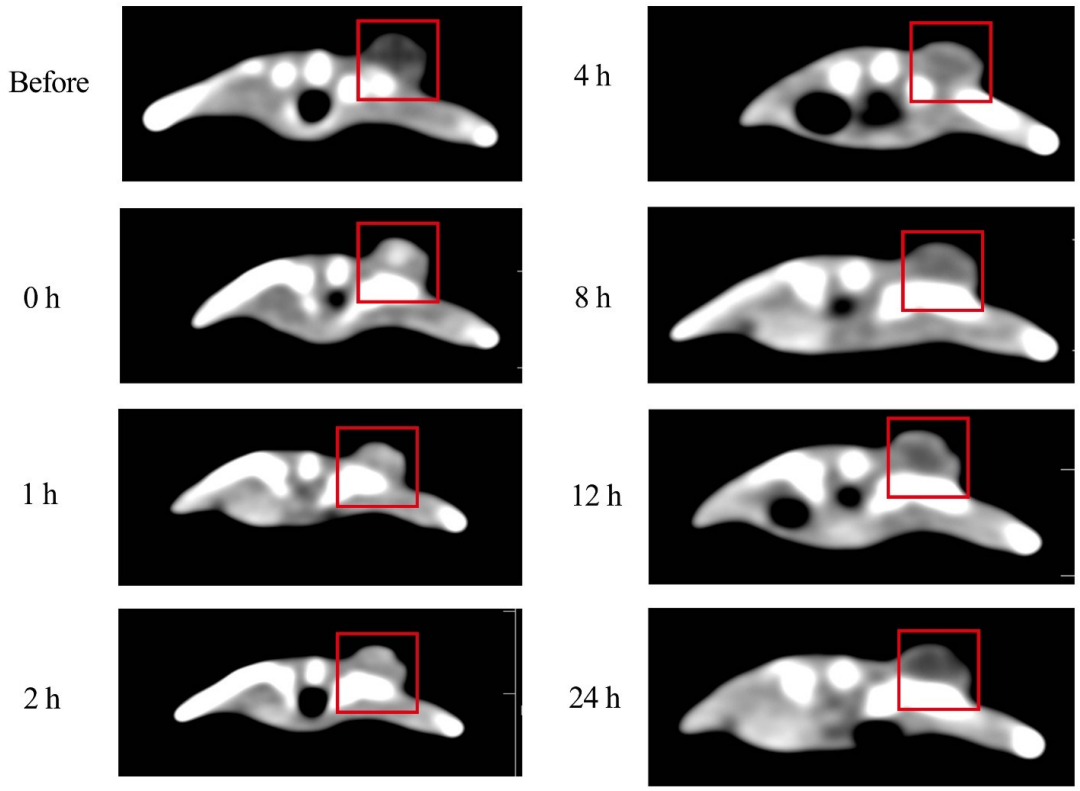

Figure S13. The CT images of the 4T1 tumor-bearing mouse taken before (0 h) and after (1, 2, 4, 8, 12 and 24 h) intratumor injection of FPMF NCs

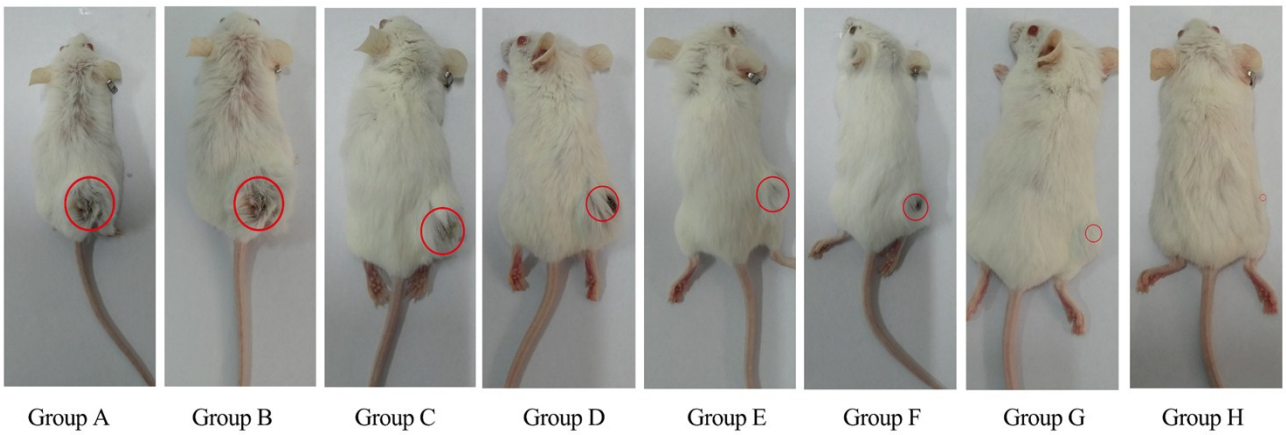

Figure S14. These images of mouse for different groups

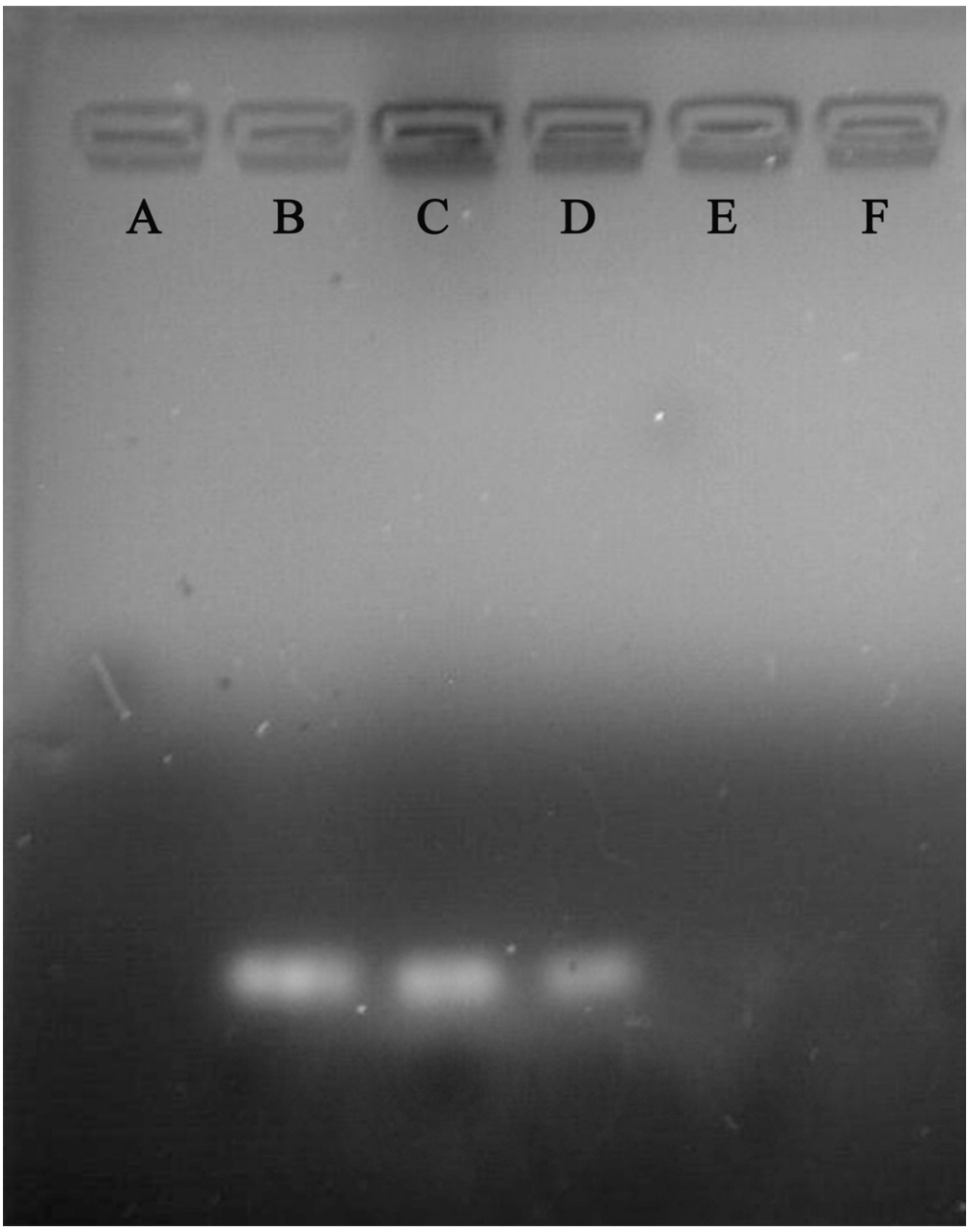

Figure S15. Agarose gel electrophoresis images of different nanocomposites (A: PBS; B: Free CpG ODN; C: The ratio of CpG ODN to FePt/MoS_2 was 1:5; D: The ratio of CpG ODN to FePt/MoS_2 was 1:10; E: The ratio of CpG ODN to FePt/MoS_2 was 1:20; F ： FePt/MoS_2)

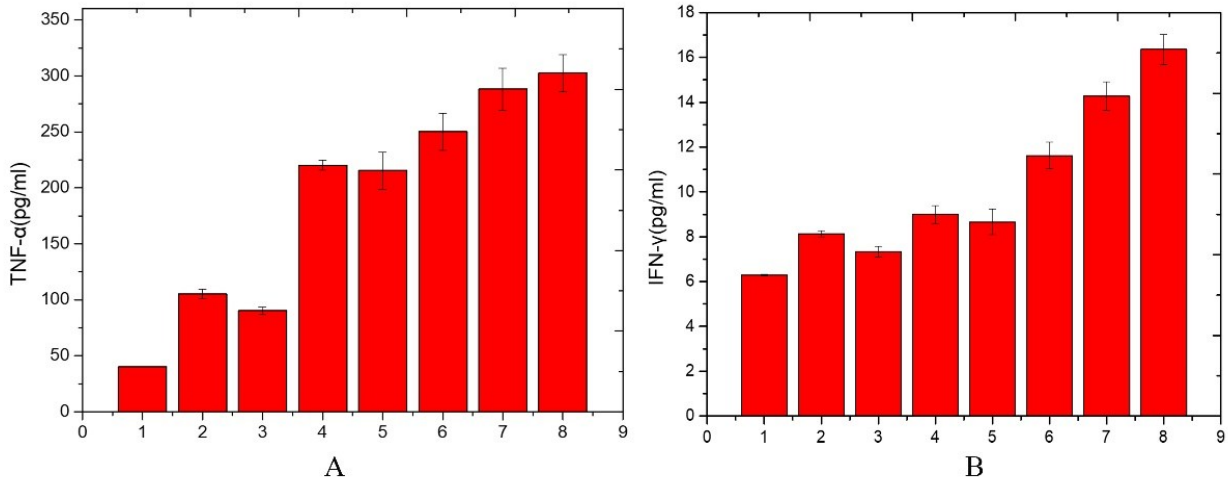

Figure S16. Cytokine levels in sera from mice at day 22 after treatment. (Group 1: PBS; 2: PBS with CpG ODN; 3: PBS with anti-CTLA4; 4: PBS with CpG ODN with anti-CTLA4; 5: FPMF@CpG ODN NCs; 6: FPMF@CpG ODN NCs with Laser; 7: FPMF@CpG ODN NCs with anti-CTLA4; 8: FPMF@CpG ODN NCs with anti-CTLA4 with Laser. n=5)