Supporting Information

Size and shape-dependent peroxidase-like catalytic activity of $MnFe_2O_4$ Nanoparticles and their applications in Highly efficient colorimetric detection of target cancer cell

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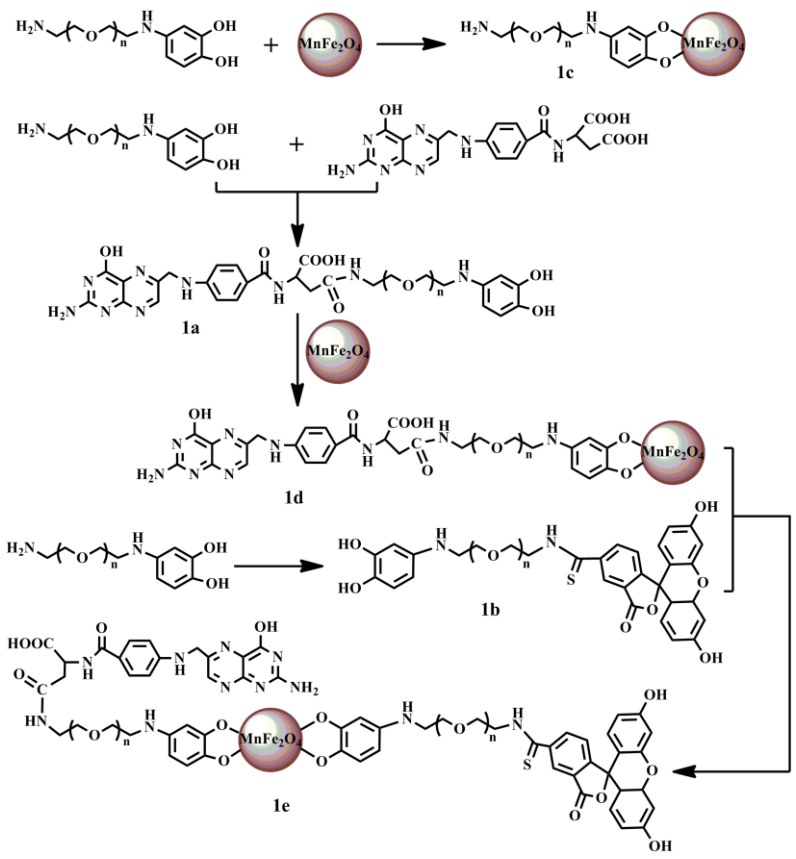
Synthesis of 16 nm $MnFe_2O_4$ NPs.

4 mmol of $Fe(acac)_3$ and 2 mmol of $Mn(acac)_2$ was dissolved in 15 mL of oleic acid. The reaction mixture was dehydrated at 120 ^oC for 1 h under N_2 atmosphere, then quickly heated to 330 ^oC, and aged at this temperature for 4 h. After the reaction, the solution was allowed to cool down to room temperature. The $MnFe_2O_4$ NPs were precipitated upon the addition of 50 mL of isopropyl alcohol and centrifuged. In order to remove the excess oleic acid on the surface of NPs, the NPs was washed by petroleum ether and ethanol mixed solution. Finally, the product was dispersed in hexane.

Synthesis of 18 and 27 nm $MnFe_2O_4$ NPs.

Under identical conditions, the 18 nm $MnFe_2O_4$ NPs and 27 nm $MnFe_2O_4$ Nps were synthesised. The only difference is that 18 nm $MnFe_2O_4$ NPs corresponds to 2 mmol of $Fe(acac)_3$ and 1 mmol of $Mn(acac)_2$, while 27 nm $MnFe_2O_4$ NPs corresponds to 8 mmol of $Fe(acac)_3$ and 4 mmol of $Mn(acac)_2$. Each $MnFe_2O_4$ NPs were precipitated upon the addition of 50 mL of isopropyl alcohol and centrifuged. In order to remove the excess oleic acid on the surface of NPs, the NPs was washed by petroleum ether and ethanol mixed solution. Finally, the product was dispersed in hexane.



Scheme S1. Synthetic route of DIB-PEH-NH-FA (**1a**), DIB-PEH-NH-FITC (**1b**), $MnFe_2O_4$-DIB-PEG-NH_2 (**1c**), $MnFe_2O_4$-DIB-PEG-NH_2-FA (**1d**) and $MnFe_2O_4$-DIB-PEG-NH-FA, FITC (**1e**).

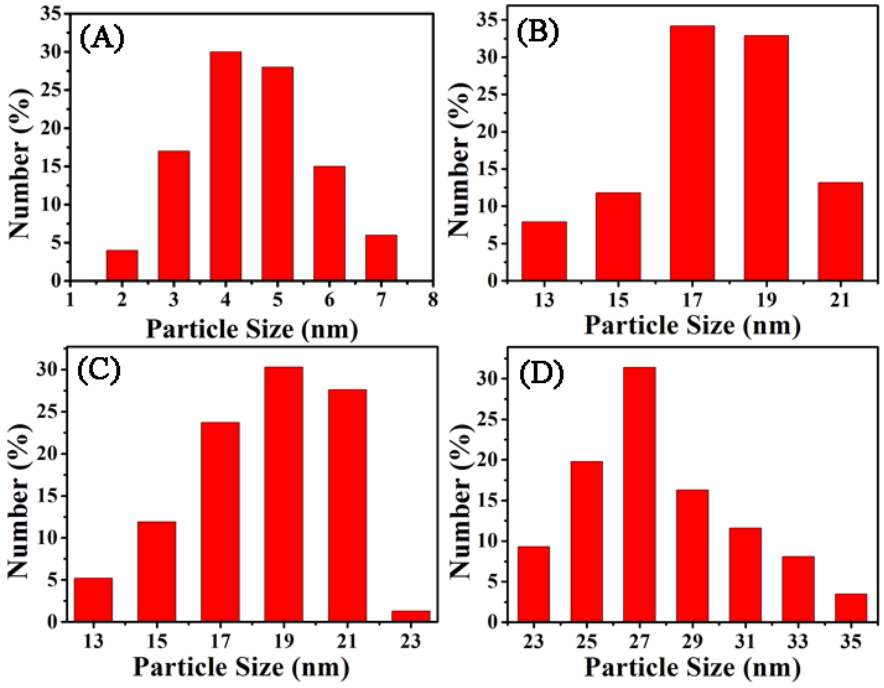


Figure S2. The size distribution histograms of as-prepared $MnFe_2O_4$ NPs with the different average sizes of (A) 4 nm, (B) 16 nm, (C) 18 nm, and (D) 27 nm.

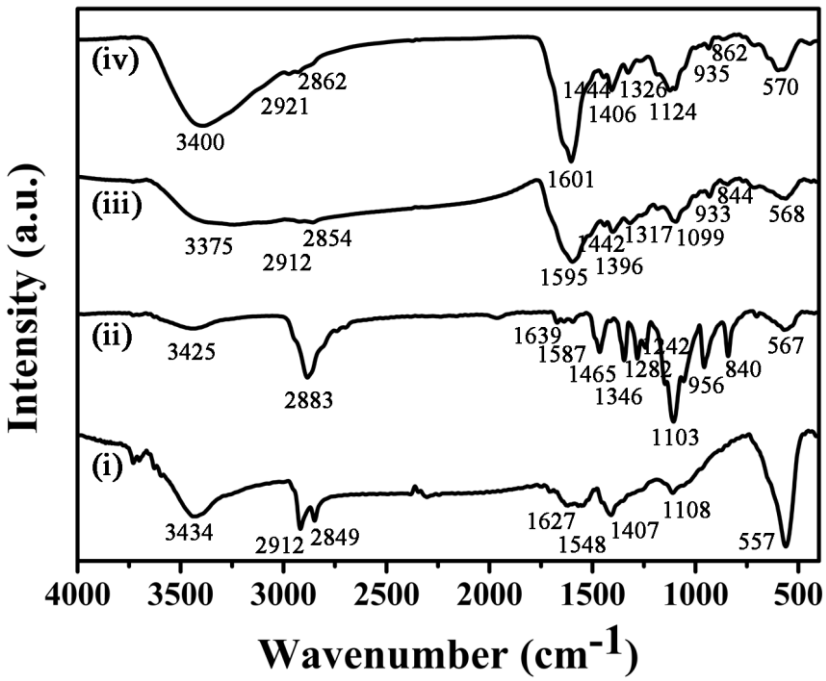


Figure S3. The IR spectra of (A) as-synthesized $MnFe_2O_4$ NPs, (B) $MnFe_2O_4$-DIB-PEG-NH_2 (**1c**), (C) $MnFe_2O_4$-DIB-PEG-NH_2-FA(**1d**) and (D) $MnFe_2O_4$-DIB-PEG-NH-FA, FITC (**1e**).

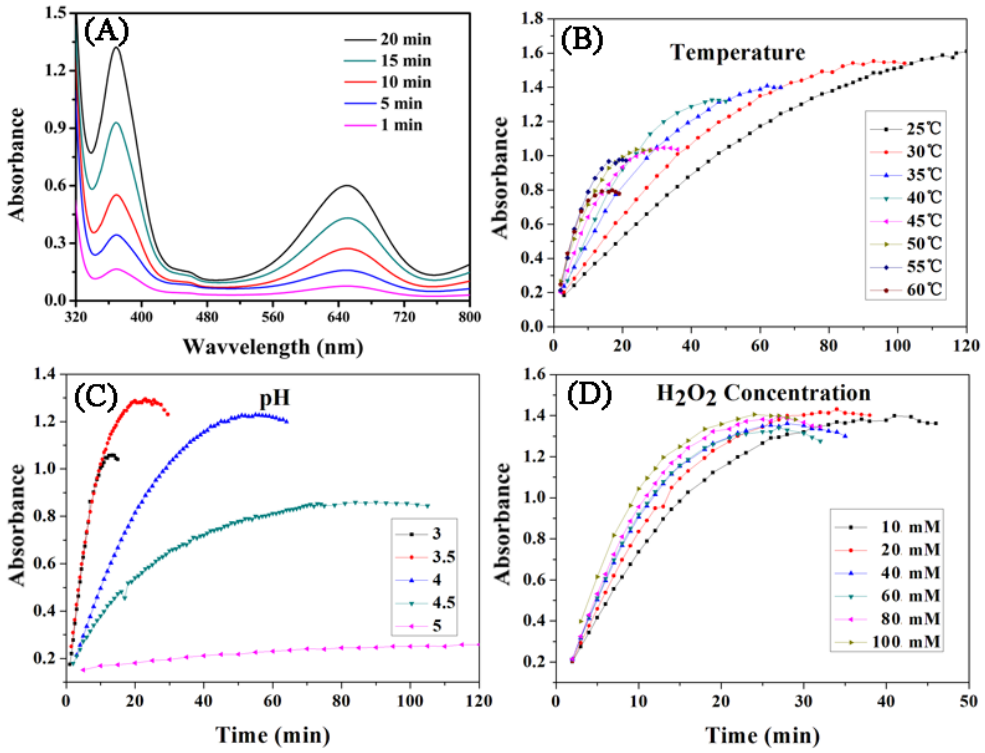


Figure S4. (A) UV absorbance curve of the HAc-NaAc solution (pH = 4.0) containing 10.0 mM H_2O_2 and 1.5 mM TMB, catalysed by the $MnFe_2O_4$-DIB-PEG-NH_2 (**1c**) with different reaction time; (B) showed an optimal temperature around 40 ℃, (C) optimal PH=3.5 and (D) optimal concentration of H_2O_2 was 0.10 mM.

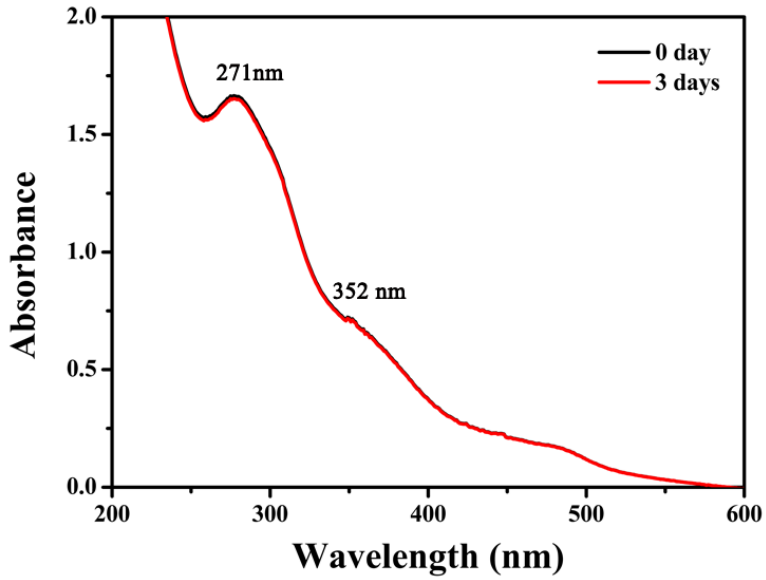


Figure S5. UV-vis spectra of 1d for 0 day (black line) and 3 days (red line).The absorption peak at 271 nm and 352 nm is attributable to FA.

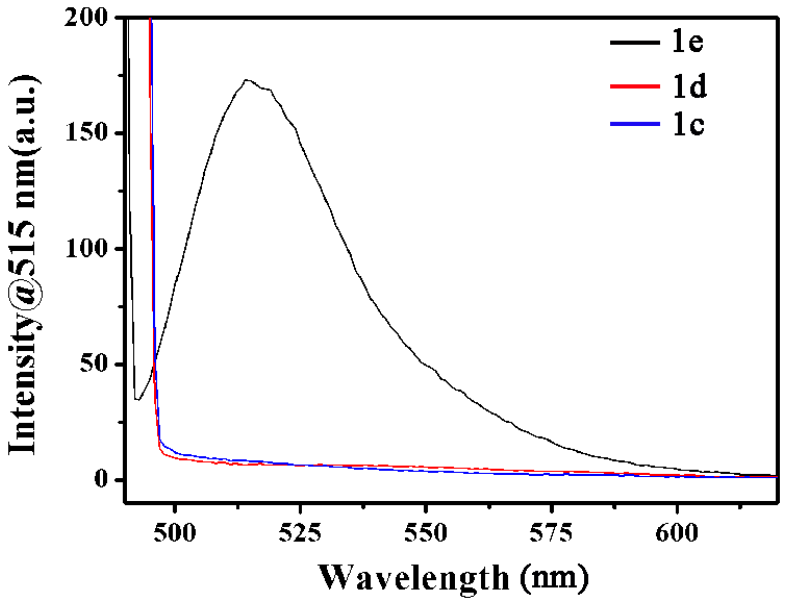


Figure S6. Fluorescence spectra of $MnFe_2O_4$-DIB-PEG-NH_2 (**1c**), $MnFe_2O_4$-DIB-PEG-NH_2-FA (**1d**) and $MnFe_2O_4$-DIB-PEG-NH-FA, FITC (**1e**) in aqueous solution.

Table S1. Comparison of the Kinetic Parameters of different NPs when changing the concentrations of TMB. K_m is the Michaelis constant, v_{max} is the maximal reaction rate.

$MnFe_2O_4$	K_m [mM]	v_{max} [M s^{-1}]
4 nm	1.46×10^{-3}	6.98×10^{-3}

16 nm	9.64×10^{-2}	3.53×10^{-4}
18 nm	2.58×10^{-2}	1.55×10^{-3}
27 nm	3.30×10^{-2}	7.30×10^{-4}

Table S2. Comparison of the Kinetic Parameters of different NPs when changing the concentrations of H_2O_2 (TMB as a substrate). K_m is the Michaelis constant, v_{max} is the maximal reaction rate.

$MnFe_2O_4$	K_m [mM]	v_{max} [M s^{-1}]
4 nm	0.112	7.15×10^{-3}
16 nm	0.543	5.15×10^{-4}
18 nm	0.242	4.94×10^{-3}
27 nm	0.304	1.76×10^{-3}

Table S3. Comparison of the Kinetic Parameters of Fe_3O_4 (4 nm), dumbell Au-Fe_3O_4 and $MnFe_2O_4$ (4 nm) when changing the concentrations of TMB (TMB as a substrate). Km is the Michaelis constant.

Nanoparticles	*K*m[mM]
Fe_3O_4	0.062
dumbell Au-Fe_3O_4	0.021
$MnFe_2O_4$	0.00146