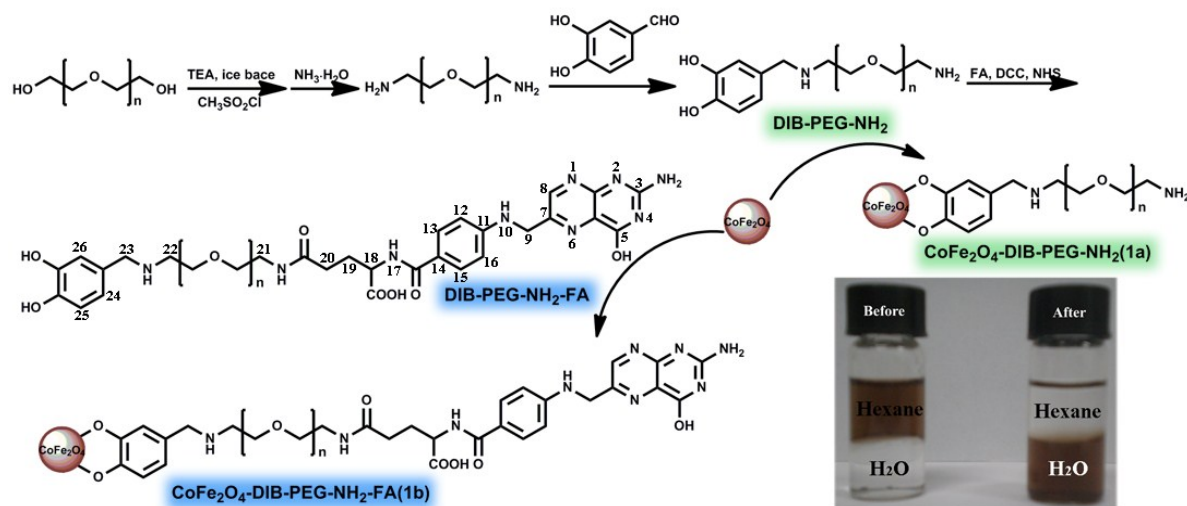# Supporting Information

A Simple Route to $CoFe_2O_4$ Nanoparticles with Shape and Size Control and their Tunable Peroxidase-Like Activity

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Scheme S1. Synthesis of PEG-3, 4-dihydroxybenzylamine (DIB-PEG-NH_2), $CoFe_2O_4$-DIB-PEG-NH_2 (**1a**) and $CoFe_2O_4$-DIB-PEG-NH_2-FA (**1b**).
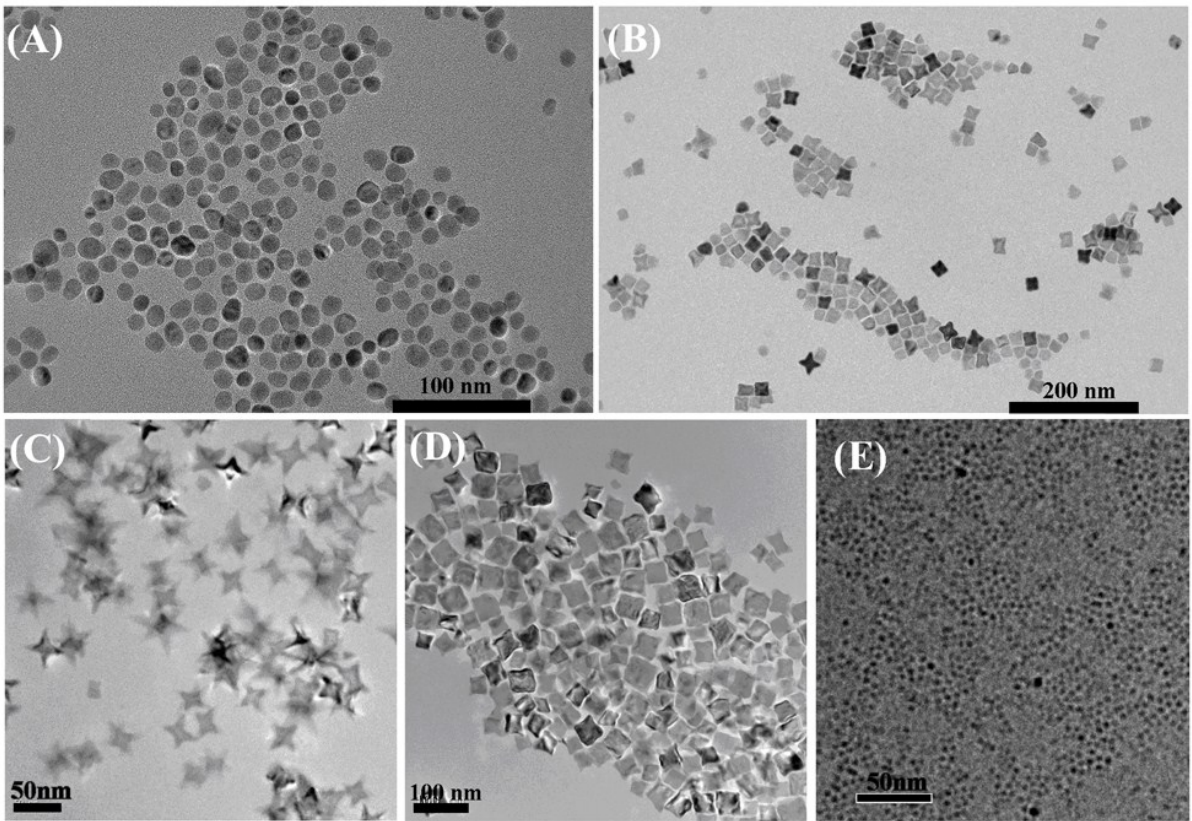
Figure S1. TEM image of CoFe$_2$O$_4$ nanoparticles. (A) ~ 13.8±4.6 nm, (B) ~24.5±5.3 nm, (C) ~ 32.1±4.2 nm, (D) ~ 45.2±15.1 nm and (E) ~ 4.1±0.3 nm.
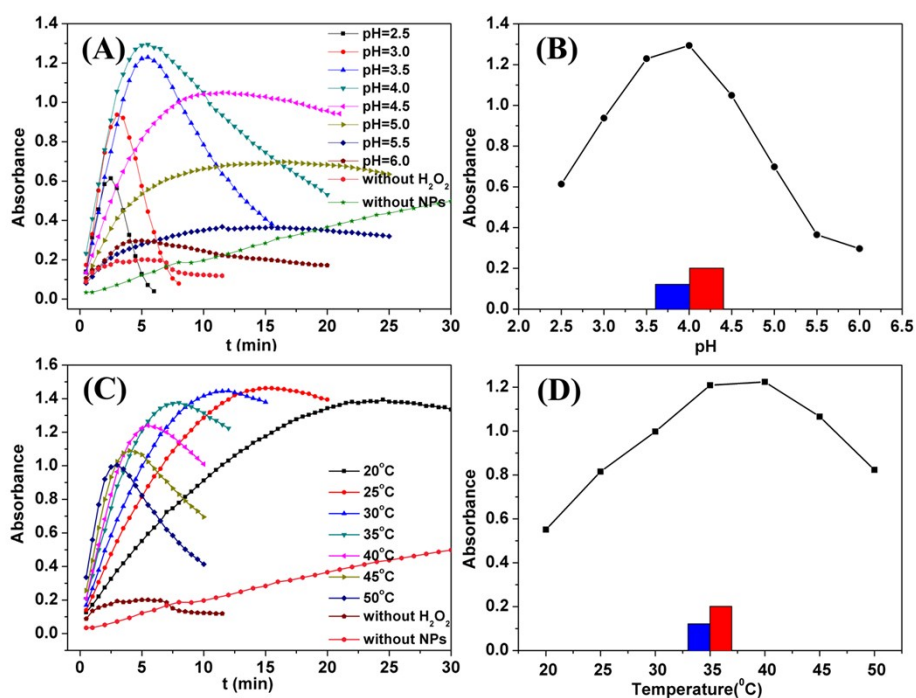
Figure S2. The catalytic activity of the CoFe$_2$O$_4$ NPs is dependent on pH, temperature and the concentration of substrate. In order to investigate the best experimental condition, we measured the peroxidase-like activity of CoFe$_2$O$_4$ NPs while (A) varying the pH from 2.5 to 6.0, (C) the temperature from 20 ^{0}C to 50 ^{0}C and compared the results over the same concentration of subsequent (B and D).
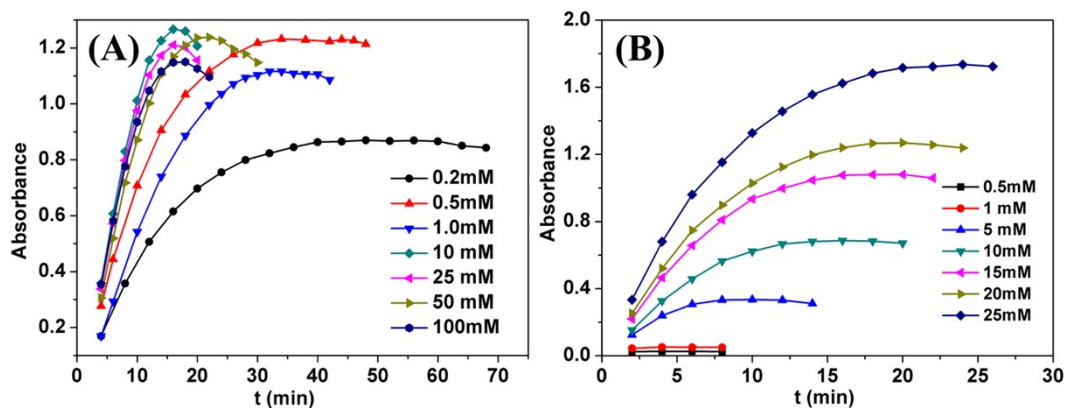

Figure S3. (A) The time-dependent UV absorbance curve of the HAc-NaAc solution (pH = 4.0) containing different concentration of H$_2$O$_2$ and 1.5 mM TMB in the presence of an equal number of CoFe$_2$O$_4$ NPs. (B) The time-dependent UV absorbance curve of the HAc-NaAc solution (pH = 4.0) containing different concentration of TMB and 10 mM H$_2$O$_2$ in the presence of an equal number of CoFe$_2$O$_4$ NPs.
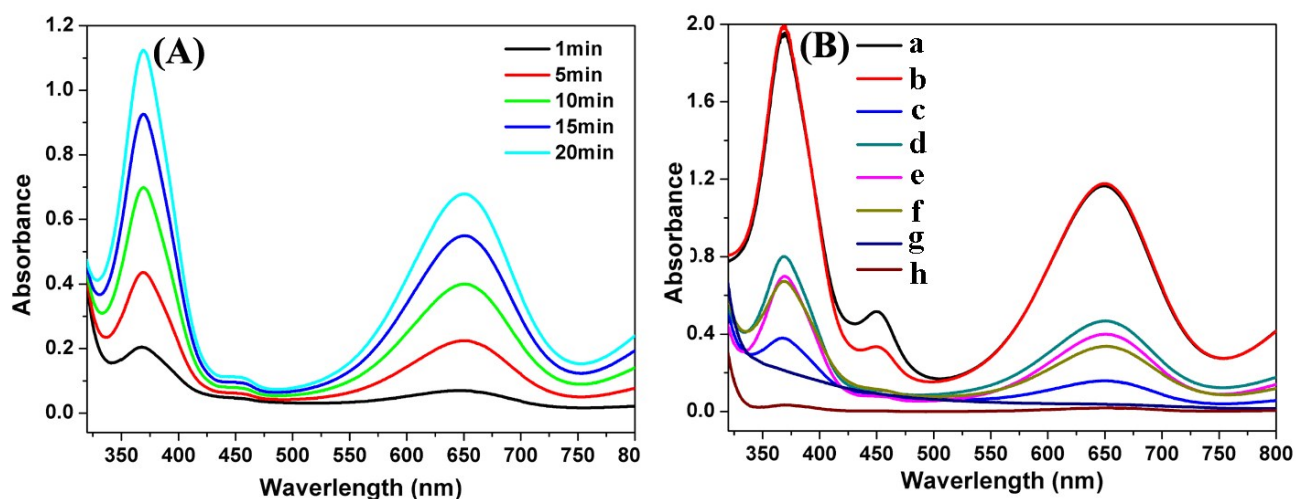
Figure S4. UV-vis spectra of the HAc-NaAc solution (pH = 4.0) containing 10 mM H_2O_2 and 1.5 mM TMB while (A) at different time, and (B) in the presence of different nanoparticles in 10 min(a. 4.2 ± 0.2 nm Fe_3O_4, b. 4.1 ± 0.3 nm $CoFe_2O_4$, c. 13.8 ± 4.6 nm $CoFe_2O_4$, d. 24.5 ± 5.3 nm $CoFe_2O_4$, e. 32.1 ± 4.2 nm $CoFe_2O_4$, f. $\sim 45.2\pm15.1$ nm $CoFe_2O_4$, g. without H_2O_2 and h. without NPs).
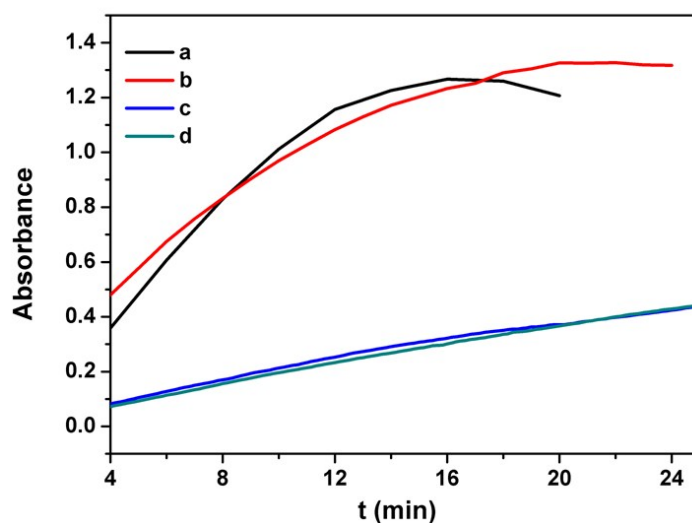

Figure S5. The time-dependent UV absorbance curve of the HAc-NaAc solution (pH = 4.0) containing 10.0 mM H_2O_2 and 1.5 mM TMB in the presence of an equal number of $CoFe_2O_4$ NPs (a. 4.1 ± 0.3 nm $CoFe_2O_4$, b. 4.2 ± 0.2 nm Fe_3O_4) and iron ions leaching into solution (c. iron leaching from 4.2 ± 0.2 nm Fe_3O_4 and d. iron leaching from 4.1 ± 0.3 nm $CoFe_2O_4$). It demonstrated that $CoFe_2O_4$ activity does not result from iron leaching.

Table S1. 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.

CoFe$_2$O$_4$	K_m[mM]	V_{max}[M/min]
4.1±0.3 nm	0. 00645	0. 08258
13.8±4.6 nm	0. 05537	0. 01586
24.5±5.3 nm	0. 01725	0. 06163
32.1±4.2 nm	0. 02427	0. 04052
45.2±15.1 nm	0. 03476	0. 03881

Table S2. 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.

CoFe$_2$O$_4$	K_m[mM]	V_{max}[M/min]
4.1±0.3 nm	0. 03551	0. 50178
13.8±4.6 nm	0. 22769	0. 02629
24.5±5.3 nm	0. 03934	0. 07688
32.1±4.2 nm	0. 06607	0. 05522
45.2±15.1 nm	0. 11073	0. 06253

Table S3. Comparison of the Kinetic Parameters of HRP, Fe$_3$O$_4$ (4 nm) and CoFe$_2$O$_4$ (4 nm) when changing the concentrations of H_2O_2 (TMB as a substrate). K_m is the Michaelis constant.

Nanoparticles	K_m[mM]
HRP	0. 062
Fe$_3$O$_4$	0. 0096
CoFe$_2$O$_4$	0. 0065