Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.


# Supporting Information

## $Co_3O_4$ nanocrystals as an efficient catalase mimic for colorimetric detection of glutathione

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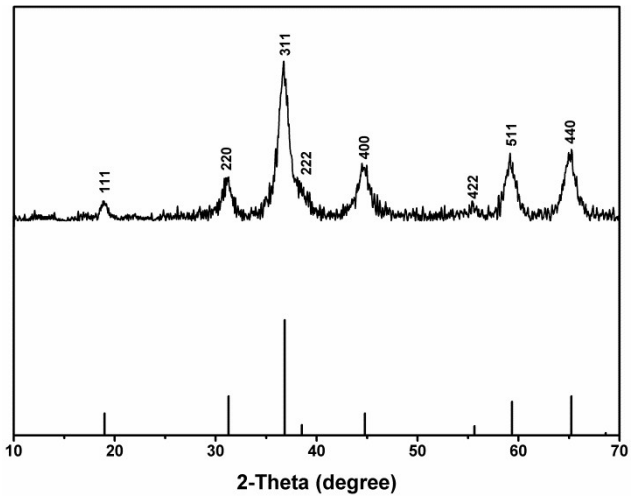


**Fig. S1.** XRD patterns $Co_3O_4$ nanocrystals.

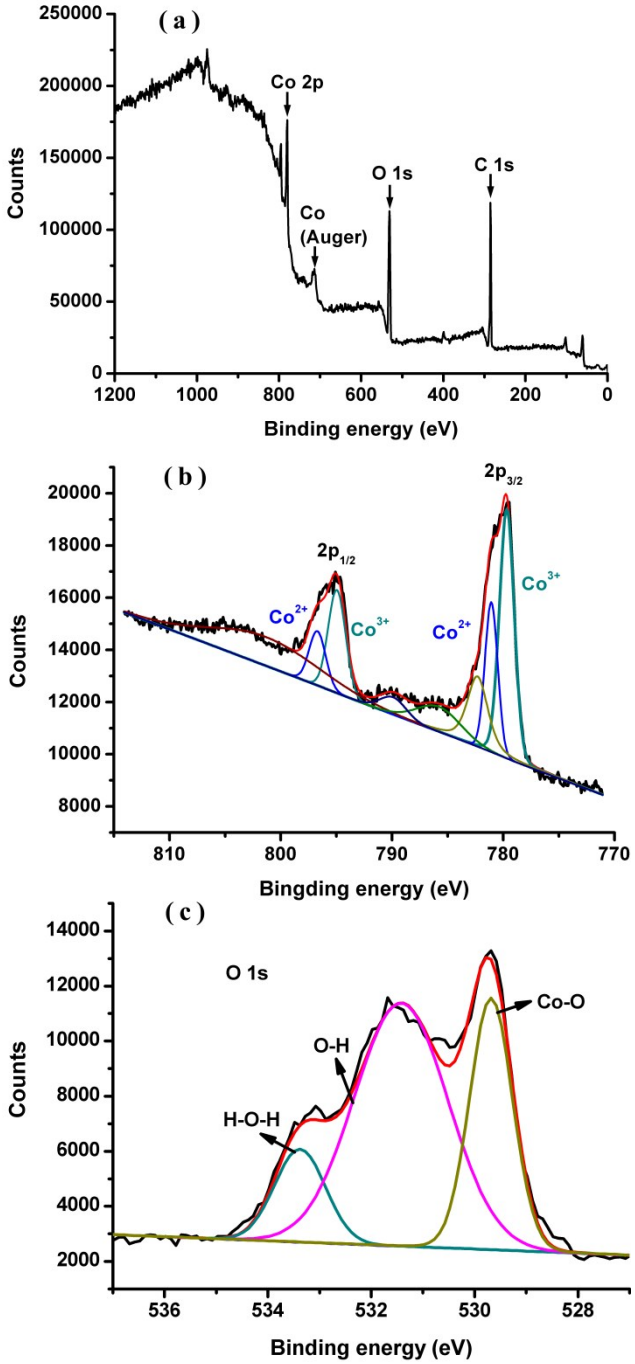


**Fig. S2.** XPS spectra of the obtained $Co_3O_4$ nanocrystals. (a) Survey XPS spectrum (b) High-resolution Co 2p spectrum. (c) High-resolution O 1s spectrum.

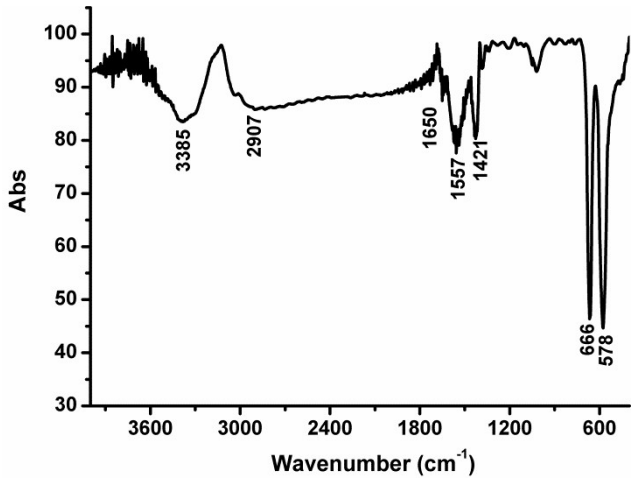


**Fig. S3.** FTIR spectrum for $Co_3O_4$ nanocrystals.

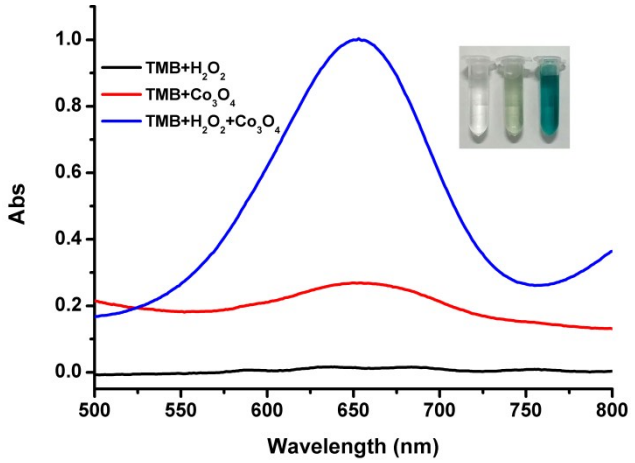


**Fig. S4.** UV−vis spectra at reaction time of 5 min in different systems, inset is the photograph of the solution at a reaction time of 5 min in different reaction systems. From left to right: TMB +$H_2O_2$, TMB +$Co_3O_4$ nanocrystals and TMB + $H_2O_2$ + $Co_3O_4$ nanocrystals in a pH 5.0 acetate buffer at 25 $^oC$.

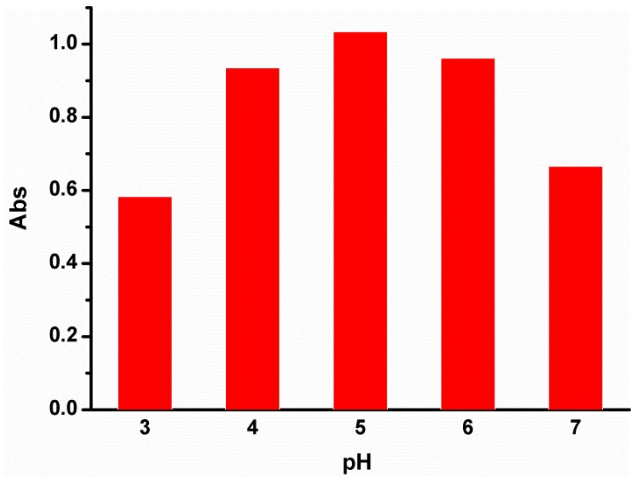


**Fig. S5.** Effect of pH on catalytic activity of the $Co_3O_4$ nanocrystals. Assay conditions: 0.5 mM TMB, 5 mM $H_2O_2$, 20 μg/mL $Co_3O_4$ nanocrystals, 5 min.

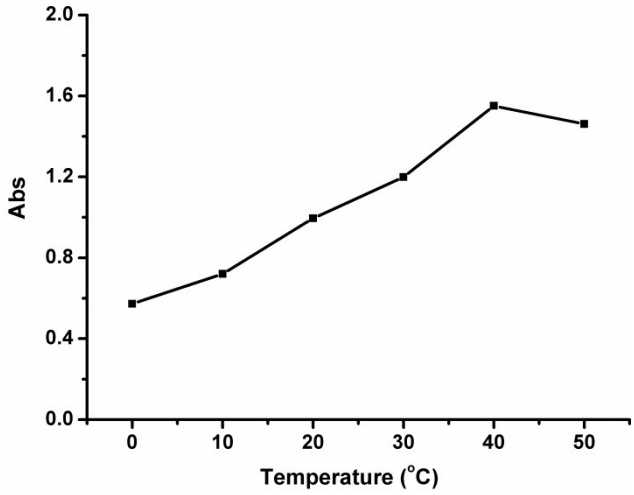


**Fig. S6.** Dependence of catalytic activity on temperature. Assay conditions: 0.5 mM TMB, 5 mM $H_2O_2$, 20 μg/mL $Co_3O_4$ nanocrystals, 5 min.

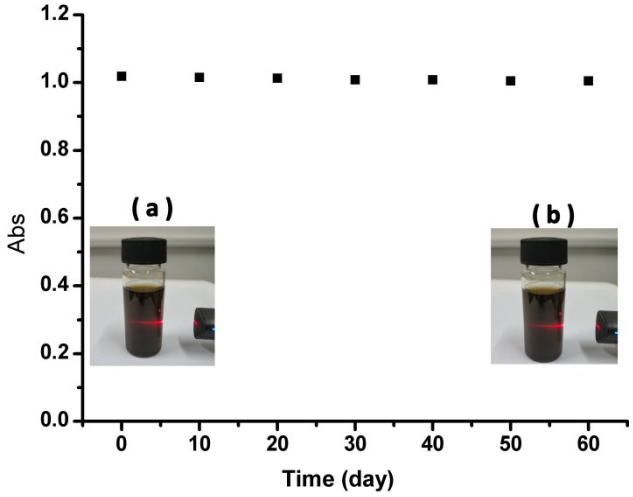


**Fig. S7.** Stablity of the $Co_3O_4$ nanocrystals in two months. Assay conditions: 0.5 mM TMB, 5 mM $H_2O_2$, pH 5.0, 5 min. Inset: photograph of 20 μg/mL $Co_3O_4$ nanocrystals (a) freshly prepared, (b) after two months

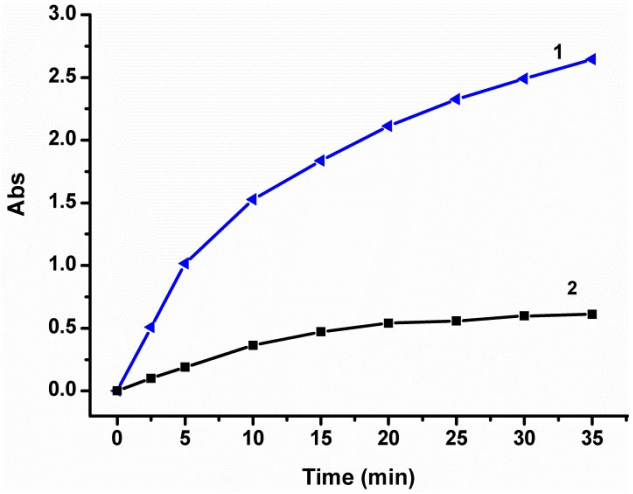


**Fig. S8.** Time-dependent absorbance changes at 652 nm in the presence of (1) $Co_3O_4$ nanocrystals or (2) commercial 30 nm $Co_3O_4$ nanoparticle. Assay conditions: 0.5 mM TMB, 5 mM $H_2O_2$, 20 μg/mL catalyst, pH 5.0.

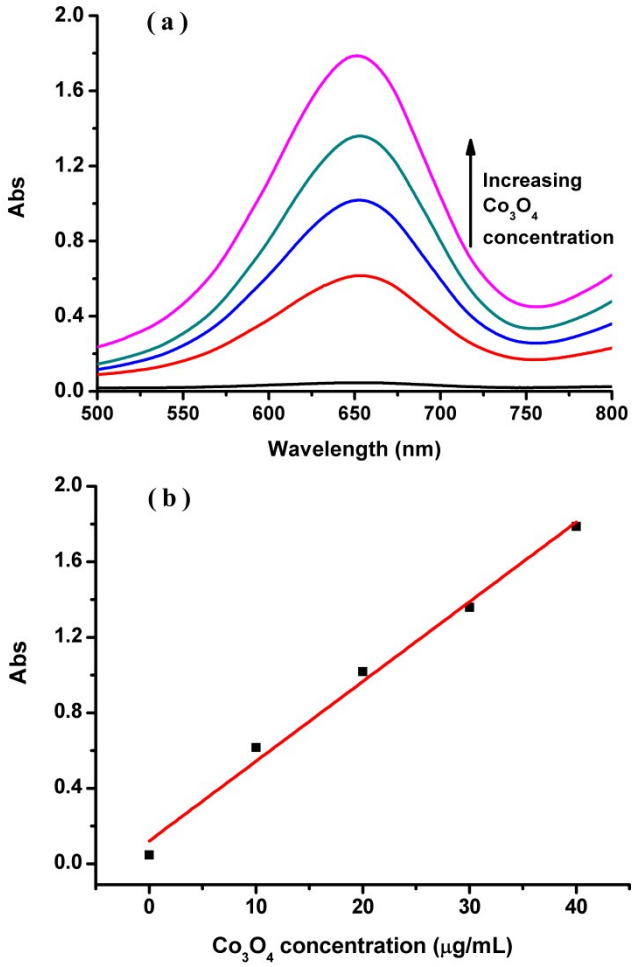


**Fig. S9.** Effect of the amount of $Co_3O_4$ nanocrystals. Assay conditions: 0.5 mM TMB, 5 mM $H_2O_2$, pH 5.0, 5 min.

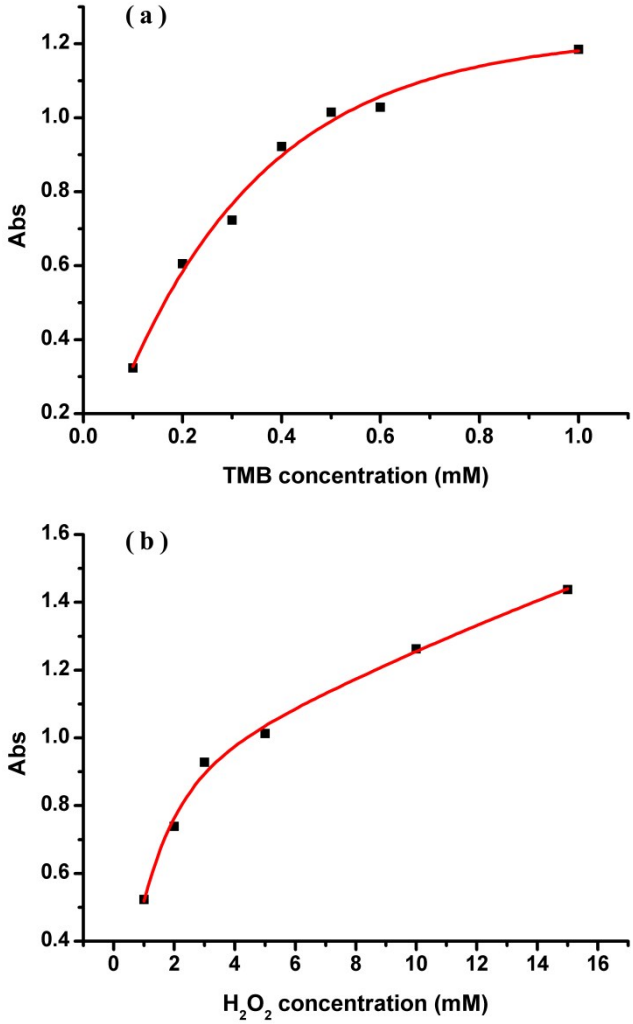


**Fig. S10.** Steady-state kinetics measurements of the $Co_3O_4$ nanocrystals. (a) The concentration of $H_2O_2$ was 5 mM and the TMB concentration varied. (b) The concentration of TMB was 0.5 mM and the $H_2O_2$ concentration varied. Assay conditions: pH 5.0, 20 μg/mL $Co_3O_4$ nanocrystals.

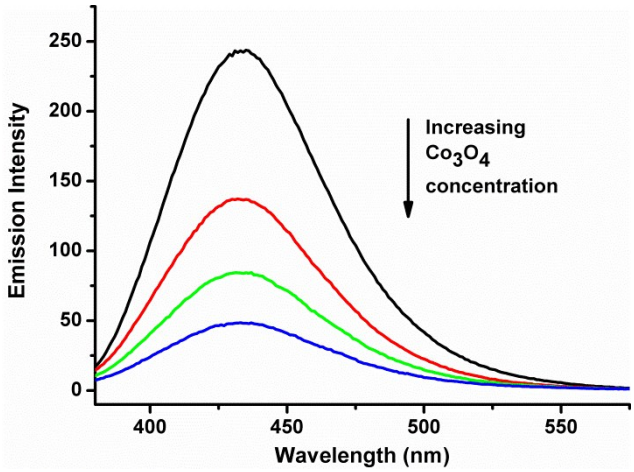


**Fig. S11.** Effects of $Co_3O_4$ nanocrystals on the changes of $^{\bullet}OH$ with terephthalic acid as the fluorescence probe. Assay conditions: 5 μM terephthalic acid, 5 mM $H_2O_2$, 0-30 μg/mL $Co_3O_4$ nanocrystals, pH 5.0, 5 min.

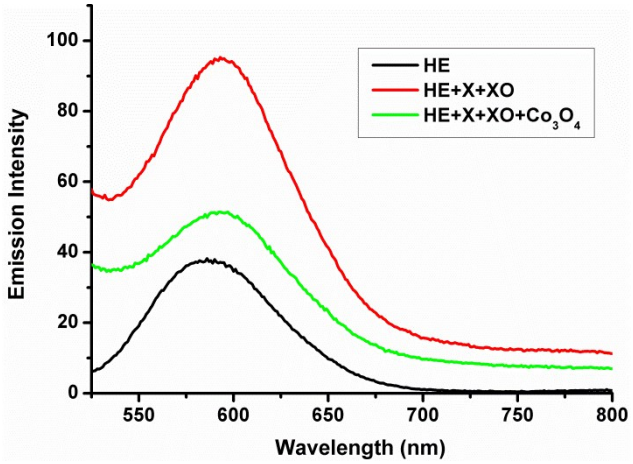


**Fig. S12.** Effects of $Co_3O_4$ nanocrystals on the changes of $^{\bullet}O_2^-$ with dihydroethidium as the fluorescence probe. Assay conditions: 5 μM terephthalic acid, 1 mM X, 1 U/mL XO, 0.1 mM DTPA, 30 μg/mL $Co_3O_4$ nanocrystals.

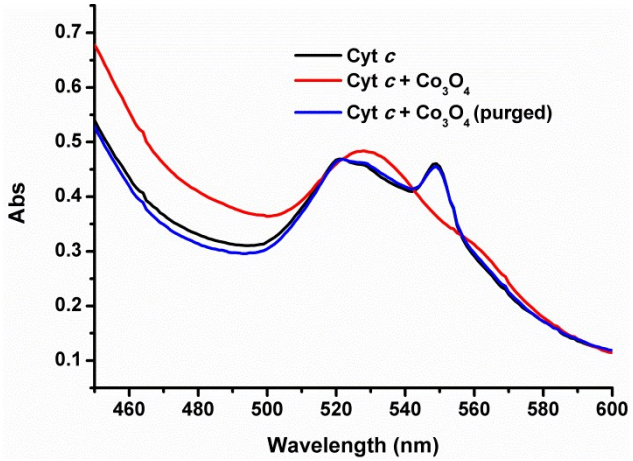


**Fig. S13.** UV−vis spectrum of Cyt *c*, Cyt *c* reacted with $Co_3O_4$ nanocrystals and Cyt *c* reacted with $Co_3O_4$ nanocrystals under deoxygenated condition.

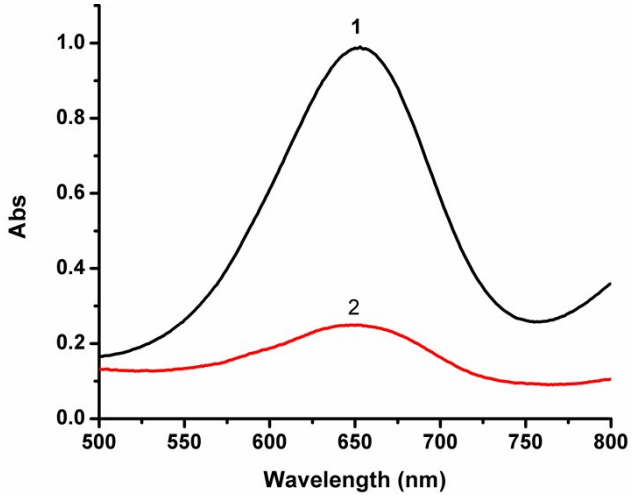


**Fig. S14.** UV−vis spectrum of oxTMB (line 1) which was obtained by UV irradiation of a mixed solution of TMB and $H_2O_2$ and oxTMB reacted with 40 μM GSH (line 2) for 5 minutes.

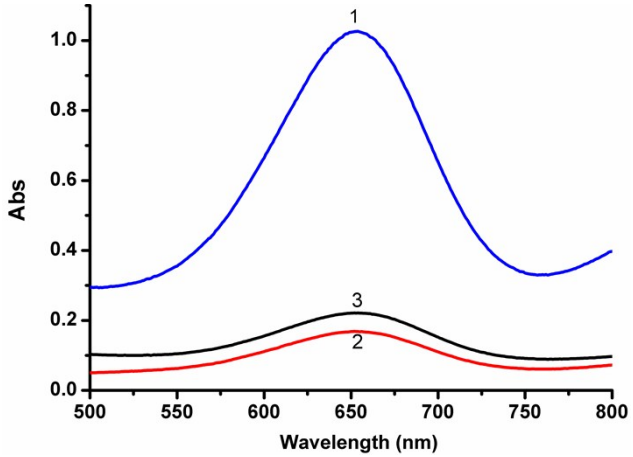


**Fig. S15.** UV−vis spectrum of $Co_3O_4$-$H_2O_2$-TMB system (line 1), $Co_3O_4$-$H_2O_2$-TMB system upon the addition of 40 μM GSH (line 2) and $Co_3O_4$(GSH pretreated)-$H_2O_2$-TMB system upon the addition of 40 μM GSH (line 3).

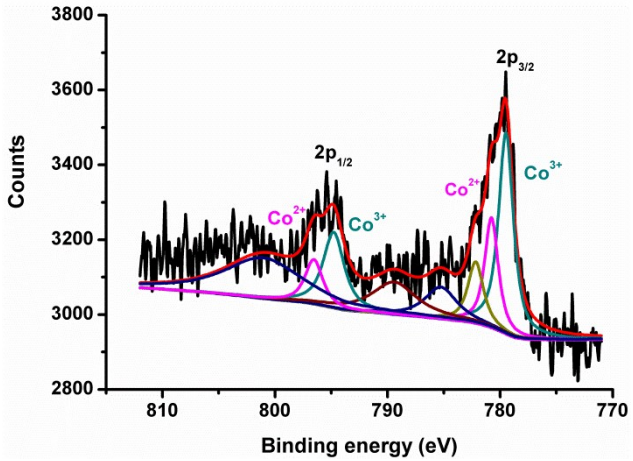


**Fig. S16.** High-resolution Co 2p spectrum of GSH pretreated $Co_3O_4$ nanocrystals

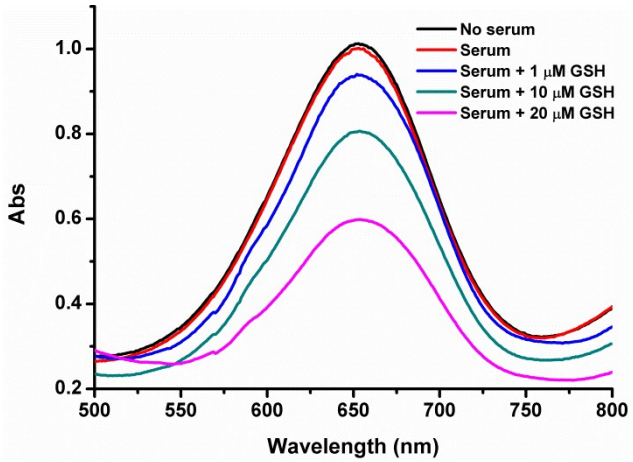


**Fig. S17.** GSH detection in serum sample. Assay conditions: 5 μM terephthalic acid, 5 mM $H_2O_2$, 20 μg/mL $Co_3O_4$ nanocrystals, pH 5.0, 5 min. Serum was diluted for 1000 times.

**Table S1.** Comparison of the Michaelis-Menten constant (Km) and maximum reaction rate (Vm).

| catalyst | Km (mM) | | Vm (M $s^{-1}$) | | ref |
|---|---|---|---|---|---|
| | TMB | $H_2O_2$ | TMB | $H_2O_2$ | |
| HRP | 0.434 | 3.70 | $10\times10^{-8}$ | $8.71\times10^{-8}$ | 7, 17 |
| $Co_3O_4$ nanocrystals | 0.49 | 1.90 | $16\times10^{-8}$ | $12.7\times10^{-8}$ | This work |