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

Supporting Information

A one-pot and modular self-assembly strategy for high-performance organized enzyme cascade bioplatform based on dual-functionalized protein-PtNP@ mesoporous iron oxide hybrid

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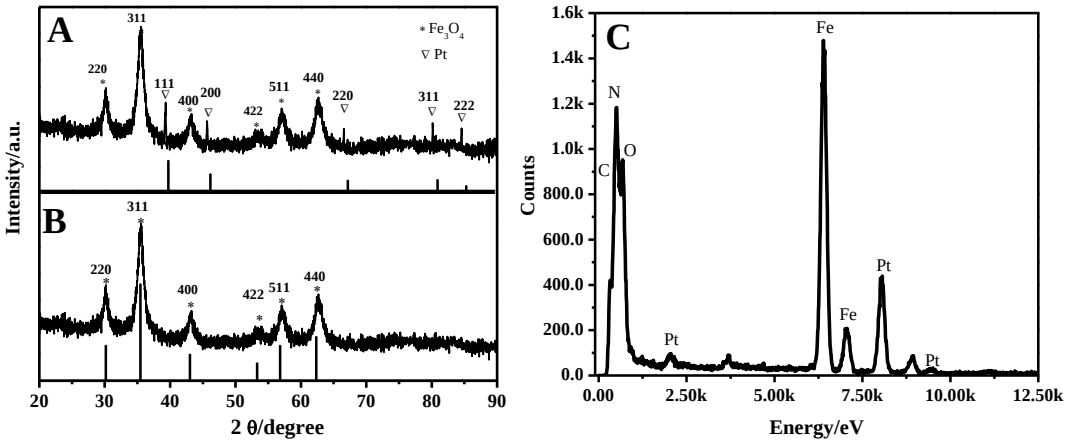

Fig. S1. XRD patterns of CM-PtNP/ m-Fe_3O_4 nanohybrid (A) and m-Fe_3O_4 (B). The nether lines in A and B correspond to the standard position and the relative intensities for the crystals of Pt (JCPDS 04-0802) and Fe_3O_4 (JCPDS 19-0629), respectively. (C) The EDX spectroscopy of CM-PtNP/ m-Fe_3O_4 nanohybrid.

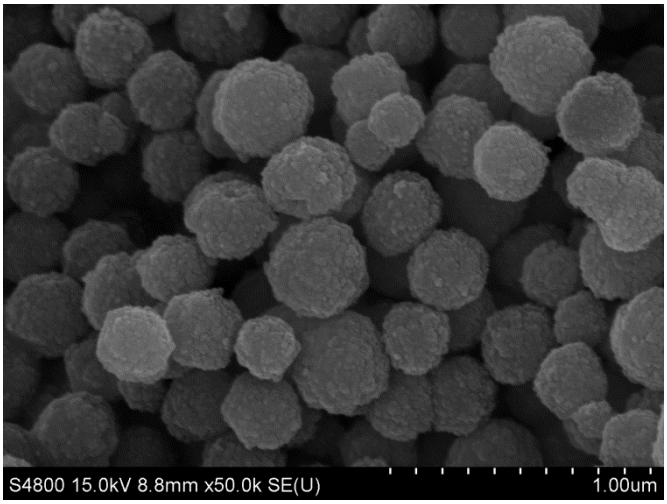

Fig. S2. SEM images of CM-PtNP/ m−Fe_3O_4 nanohybrid.

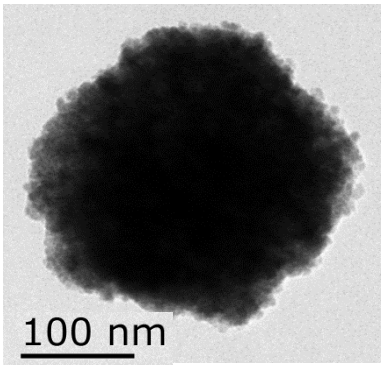

Fig. S3. TEM images of m-Fe_3O_4 NPs.

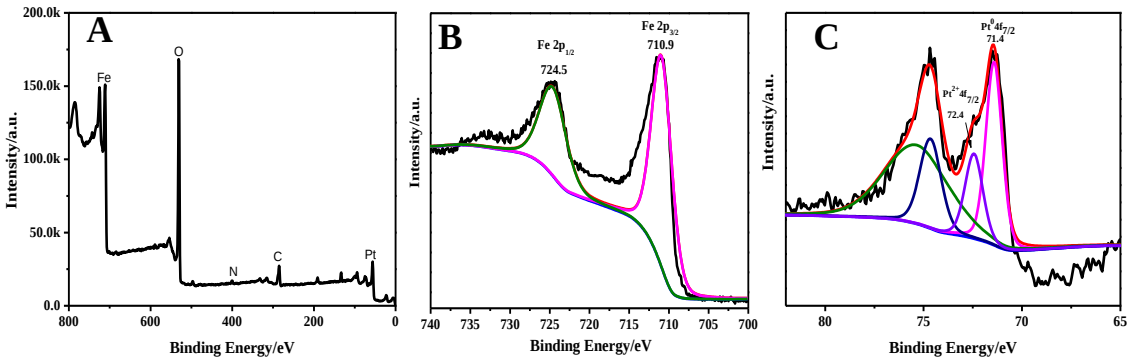

Fig. S4. (A) XPS spectra of survey scan of CM-PtNP/ m−Fe_3O_4 nanohybrid. High-resolution Fe 2p (B) and Pt $4f_{7/2}$ (C) XPS spectra of the hybrid.

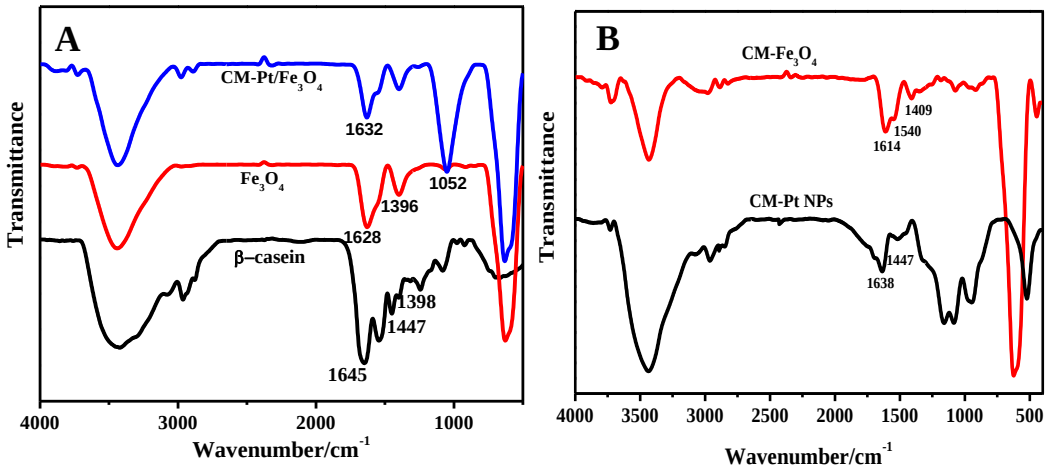

Fig. S5. (A) FTIR spectra of β-casein, m−Fe_3O_4 and CM-PtNP/ m−Fe_3O_4 nanohybrid. (B) FTIR spectra of CM / m−Fe_3O_4 and CM-PtNP.

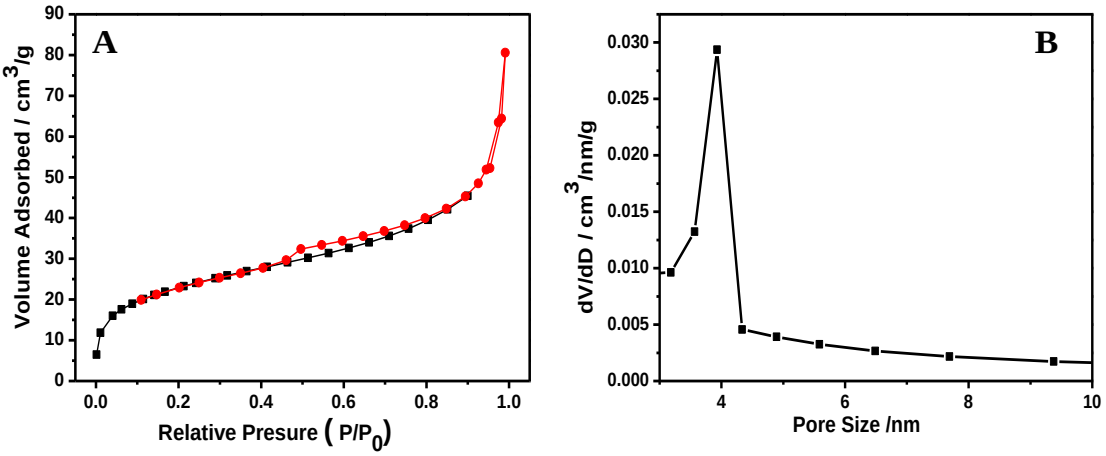

Fig. S6. (A) N_2 adsorption-desorption isotherm of CM-PtNP/ m−Fe_3O_4 nanohybrid and (B) the corresponding pore size distribution.

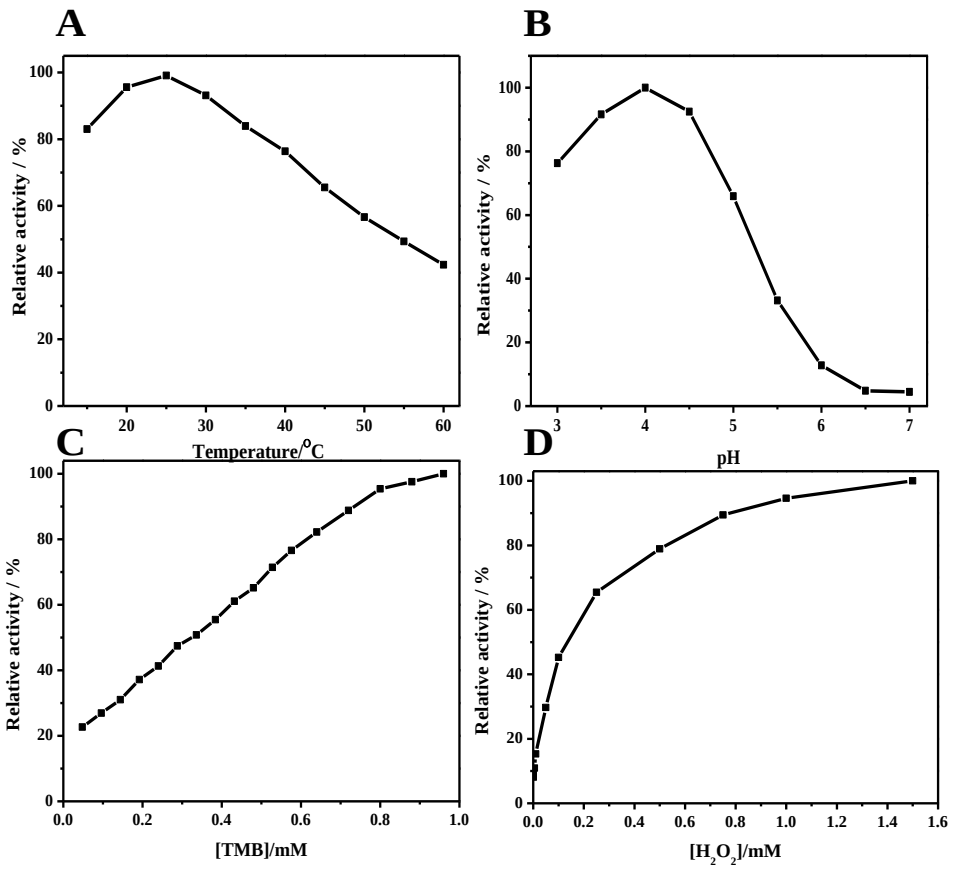

Fig. S7. Effect of temperature (A), pH (B), TMB concentration (C) and H_2O_2 concentration (D) on the peroxidase-like activity of the CM-PtNP/ m−Fe_3O_4 nanohybrid.

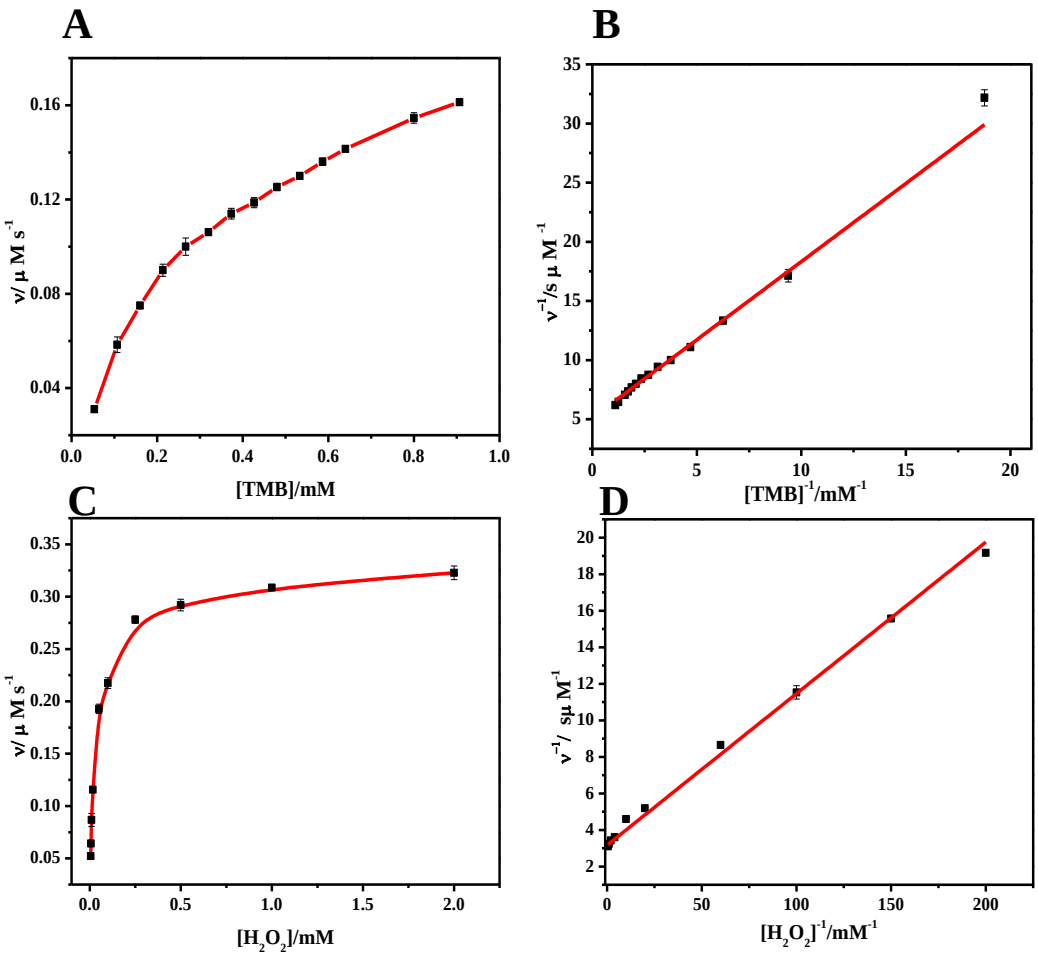

Fig. S8. (A, C) Correlation of initial reaction velocity with the concentration of one substrate (H_2O_2 or TMB) fixed and the other varied. (B, D) The double-reciprocal plots of (A) and (C).

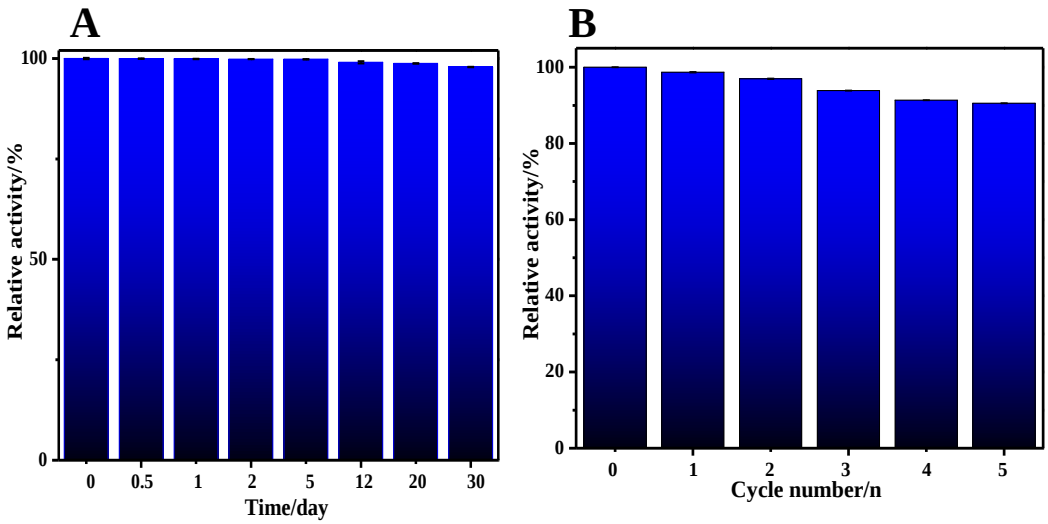

Fig. S9. Relative activity of CM-PtNP/m−Fe_3O_4 nanohybrid after stored in refrigerator at 4 ℃ for one month (A) and recycling five times (B).

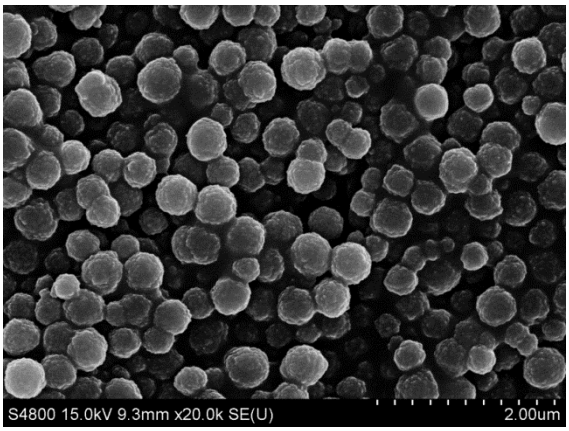

Fig. S10. SEM images of CM-PtNP/ m−Fe_3O_4 nanohybrid after repeated uses.

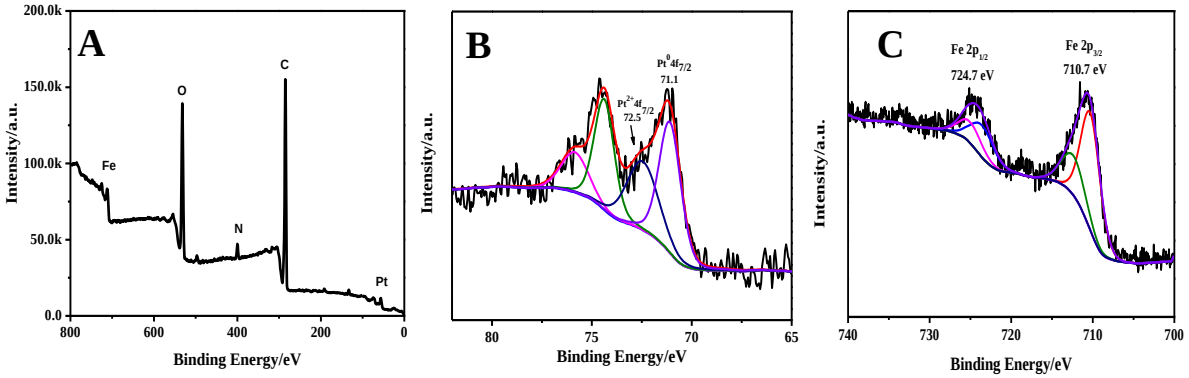

Fig. S11. (A) XPS spectra of survey scan of ChOx/CM-PtNP/ m−Fe_3O_4 nanohybrid. High-resolution Pt $4f_{7/2}$ (B) and Fe 2p (C) XPS spectra of the hybrid.

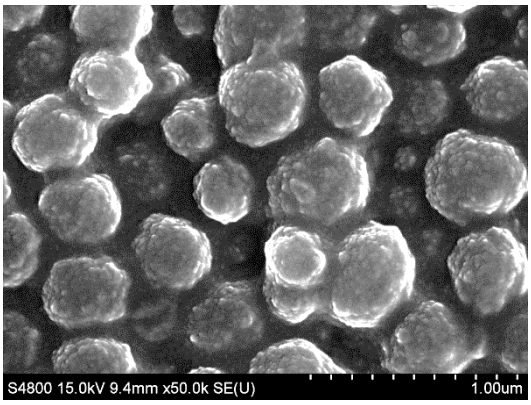

Fig. S12. SEM image of ChOx/CM-PtNP/ m−Fe_3O_4 nanohybrid.

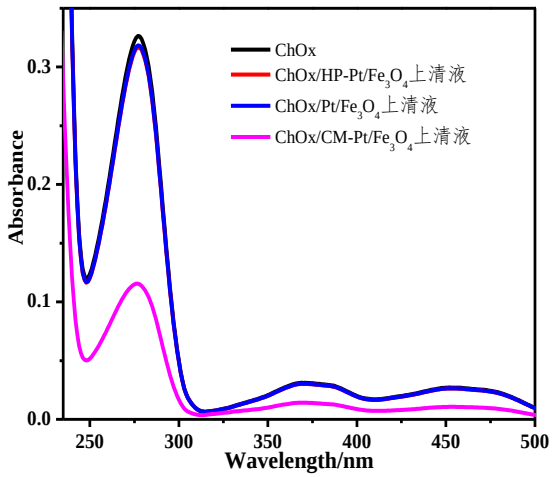

Fig. S13. UV-vis absorbance spectra of ChOx before (black) and after blending with CM-PtNP/m-Fe_3O_4 (pink), CEH-Pt/m-Fe_3O_4 (red) and Pt/m-Fe_3O_4 nanohybrids (blue).

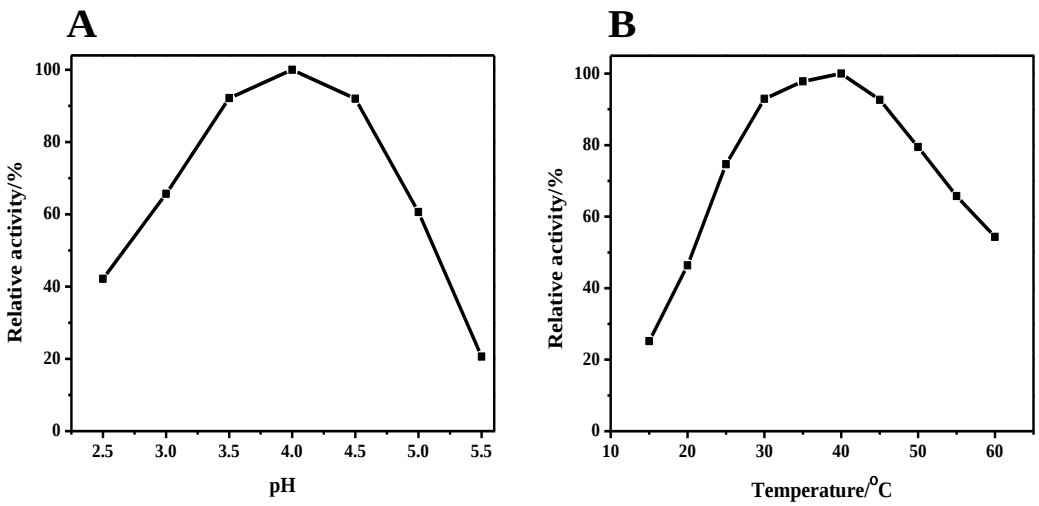

Fig. S14. Effect of pH (A) and temperature (B) on the ChOx/CM-PtNP/Fe_3O_4 nanohybrid cascade platform. [TMB]=0.8 mM，[cholesterol]=0.5 mM

Table S1 Comparison of the apparent Michaelis-Menton constant (K_m) and maximum reaction rate (V_{max}) of CM-PtNP@m−Fe_3O_4 nanohybrid.

Enzyme	K_m (mM)		V_{max} (10^{-8} M)		Reference
	TMB	H_2O_2	TMB	H_2O_2	
HRP	0.434	3.7	10.0	8.71	1
CM-Pt NPs	0.052	63.86	16.4	29.0	2
m−Fe_3O_4	-	458.9	-	0.31	3
CM-PtNP@m−Fe_3O_4	0.257	0.036	19.5	31.5	This work

Table S2 Comparison of different nanozymes for H_2O_2 detection by colorimetric method.

H_2O_2 sensing systems	Liner range (μM)	Detection limit (μM)	Reference
Co_4N NWs	0.5-30	0.024	4
3D graphene/Fe_3O_4-Au NPs	20-190	12	5
Cu(HBTC)-1/Fe_3O_4-Au NPs	2.86-71.43	1.10	6
FeHPO	57.4-525.8	1.0	7
Au@TiO_2	5-100	4	8
$Ce(OH)CO_3$	0-80	0.3	9
N-GQDs	2-1170	5.3	10
CM-PtNP/Fe_3O_4	0.01-1000	0.001	This work

Table S3 Comparison of different nanozymes for cholesterol detection.

Nanozyme	Liner range (μM)	Detection limit (μM)	Steps	Reference
Au@Ag NPs	0.3–300	0.15	Two	11
Pt/PCNs	25– 500	8.3	Two	12
MoS_2NRs/Au NPs	40 –1000	15	Two	13
Graphene QDs	20–600	6.0	Two	14
PB/MWCNT	4 – 100	3.01	Two	15
MWCNT@rGONR	20-1000	10	Two	16
BNNS@CuS	10–100	2.9	Two	17
MoS_2 nanosheet	2–200	0.76	Two	18
DNAzymes	1-30	0.1	Two	19
Fe_3O_4@MIL-100(Fe)	2-50	0.8	Two	20
Fe_3O_4/ ChOx / silica	10–250	5	One	21
ChOx/CM-PtNP /Fe_3O_4	0.1-400	0.05	One	This work

Table S4 Detection of cholesterol in serum samples using the proposed method.

Sample	Cholesterol concentration determined by our method (mM)	Cholesterol concentration obtained by the hospital (mM)	RSD (n=5，%)
1	4.39	4.36	2.01
2	3.05	3.07	1.84
3	4.79	4.80	1.59

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