Electronic supplementary information (ESI)

Colorimetric determination of biothiols with AuNPs@MoS_2 NSs as peroxidase mimetic enzyme

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Content

Experimental Section

Kinetic assay

The steady-state kinetic parameters were examined to analyze the catalytic performance of AuNPs@MoS_2 NSs. The experiment was performed by varying the concentration of H_2O_2 from 0.02 to 0.12 mmol·L^{-1} while the TMB concentration was fixed at 1.0 mmol·L^{-1}. The experiment was also conducted by varying the working concentration of TMB from 0.2 to 1.2 mmol·L^{-1} while the working concentration of H_2O_2 was fixed at 0.1 mmol·L^{-1}. The absorbance of 652 nm of the reaction was recorded for 10 min (at an interval of 1 min). Then obtained the kinetic parameters by Lineweaver–Burk double-reciprocal formula from the Michaelis–Menten equation:

$$\frac{1}{V} = \frac{K_m}{V_{max}[S]} + \frac{1}{V_{max}}$$

in which V is the initial velocity, K_m is the Michaelis constant, and V_{max} is the maximal reaction velocity, and [S] is the concentration of substrate.

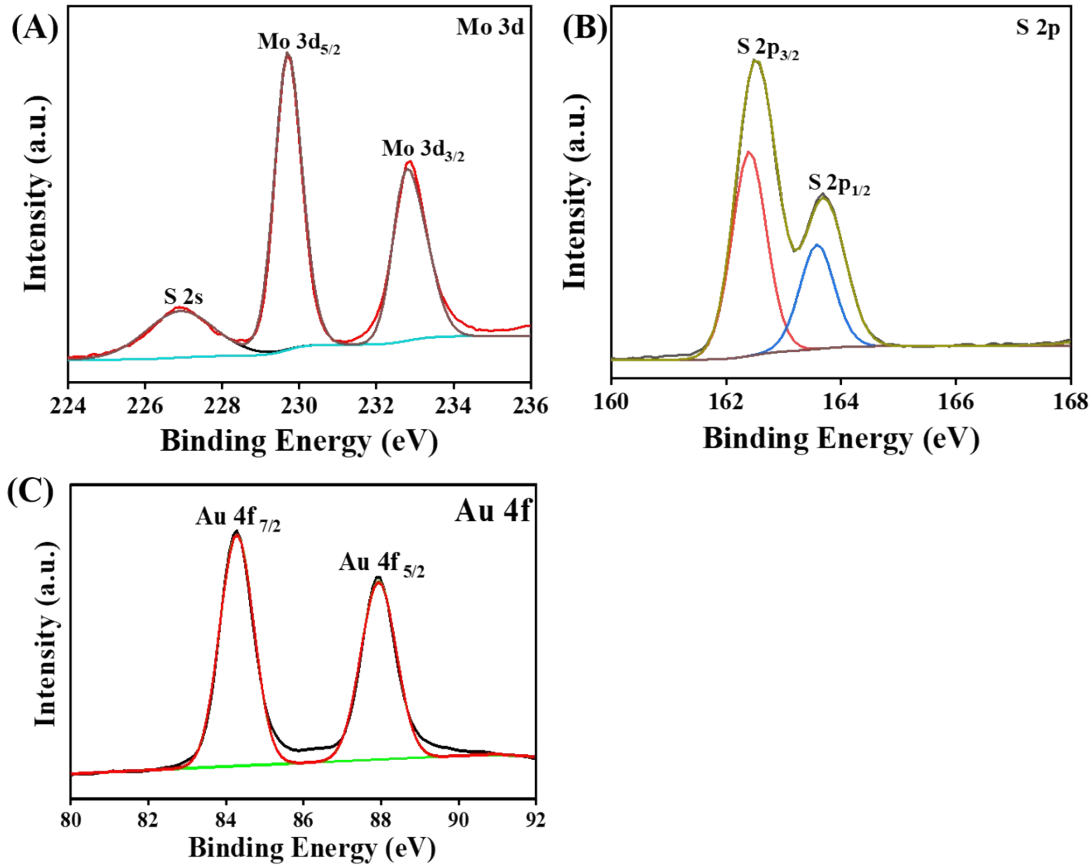

Fig. S1 XPS high-resolution spectra of AuNPs@MoS_2 NSs: (A) Mo 3d, (B) S 2p and (C) Au 4f

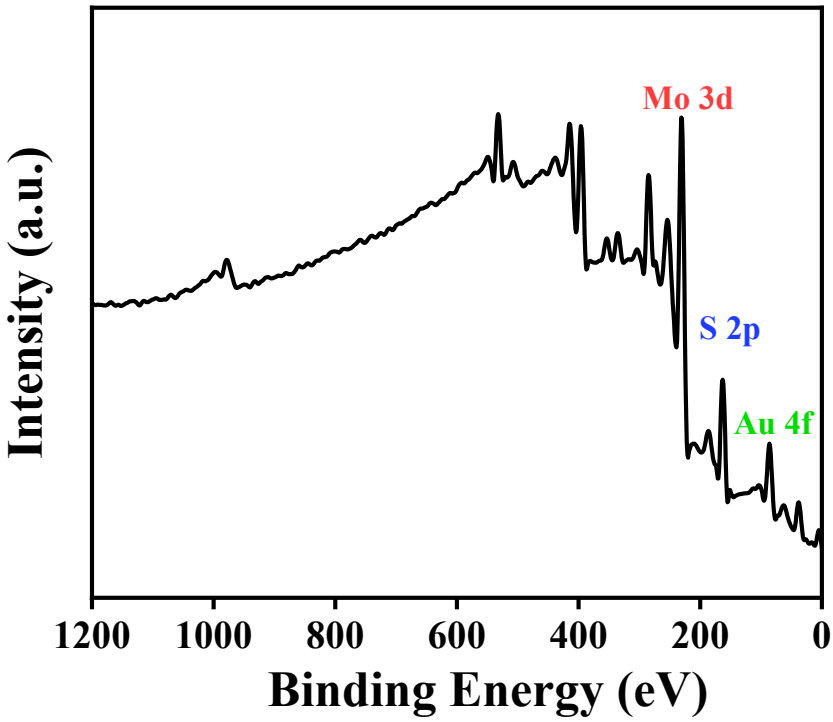

Fig.S2 XPS spectra of AuNPs@MoS_2 NSs s after the catalyze reaction

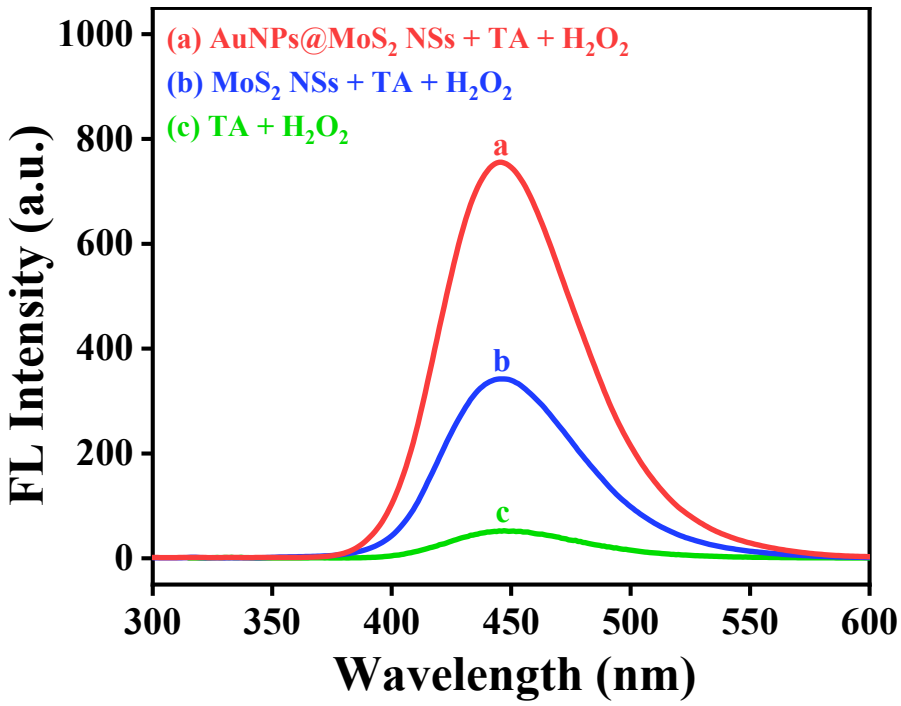

Fig.S3 Fluorescence spectra of different reaction systems. Experimental conditions: 1.0 μg·mL^{-1} AuNPs@MoS_2 NSs or MoS_2 NSs; 0.5 mmol·L^{-1} TA; 1.0 mmol·L^{-1} H_2O_2; pH 4.0 HAC-NaAc buffer; incubated at 30 °C for 12 h (in dark).

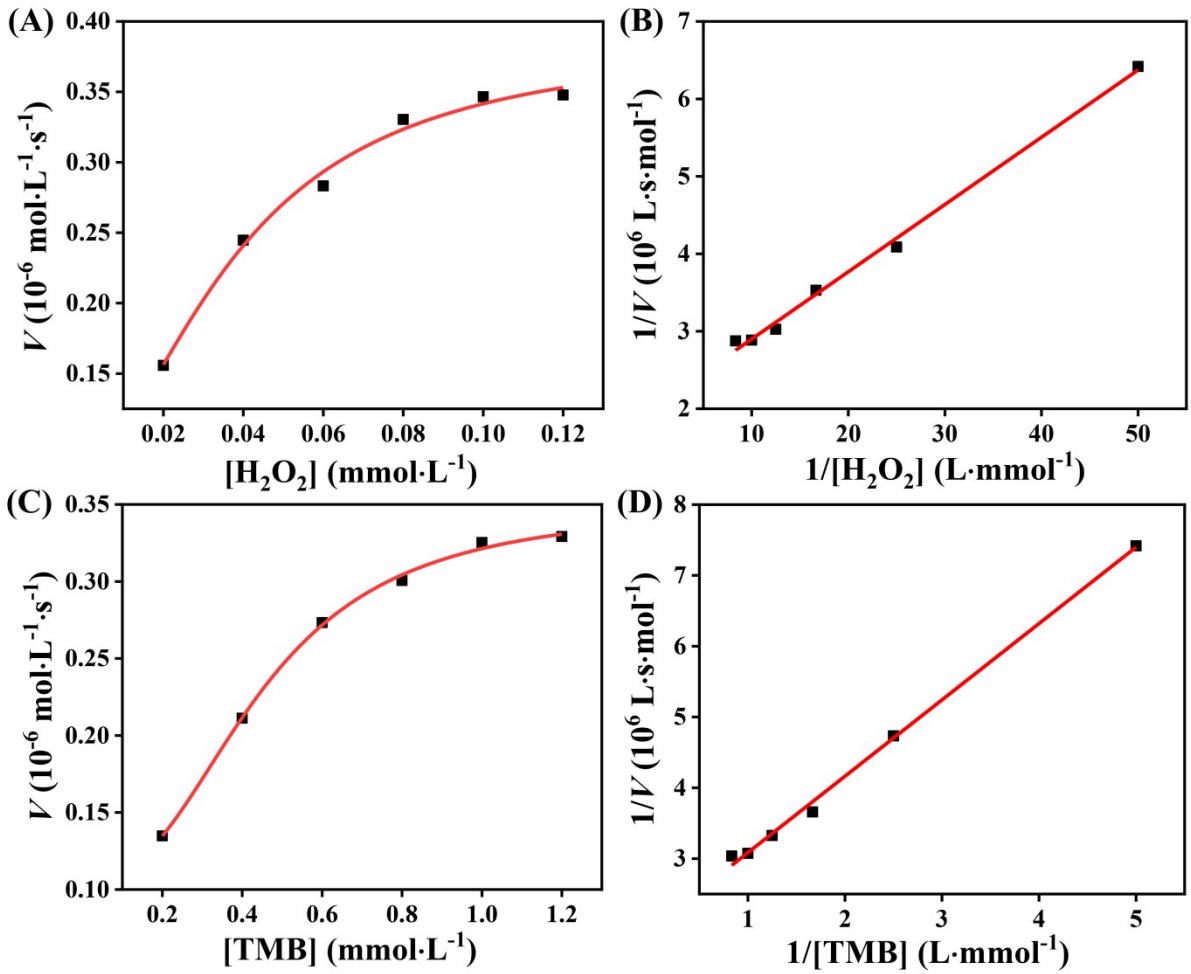

Fig.S4 Steady-state kinetic assay of AuNPs@MoS_2 NSs by using (A, C) Michaelis-Menten curves and (B, D) Lineweaver-Burk plots. (A, B) The concentration of TMB was 1.0 mmol·L^{-1} and H_2O_2 concentration was varied. (C, D) The concentration of H_2O_2 was 0.1 mmol·L^{-1} and TMB concentration was varied.

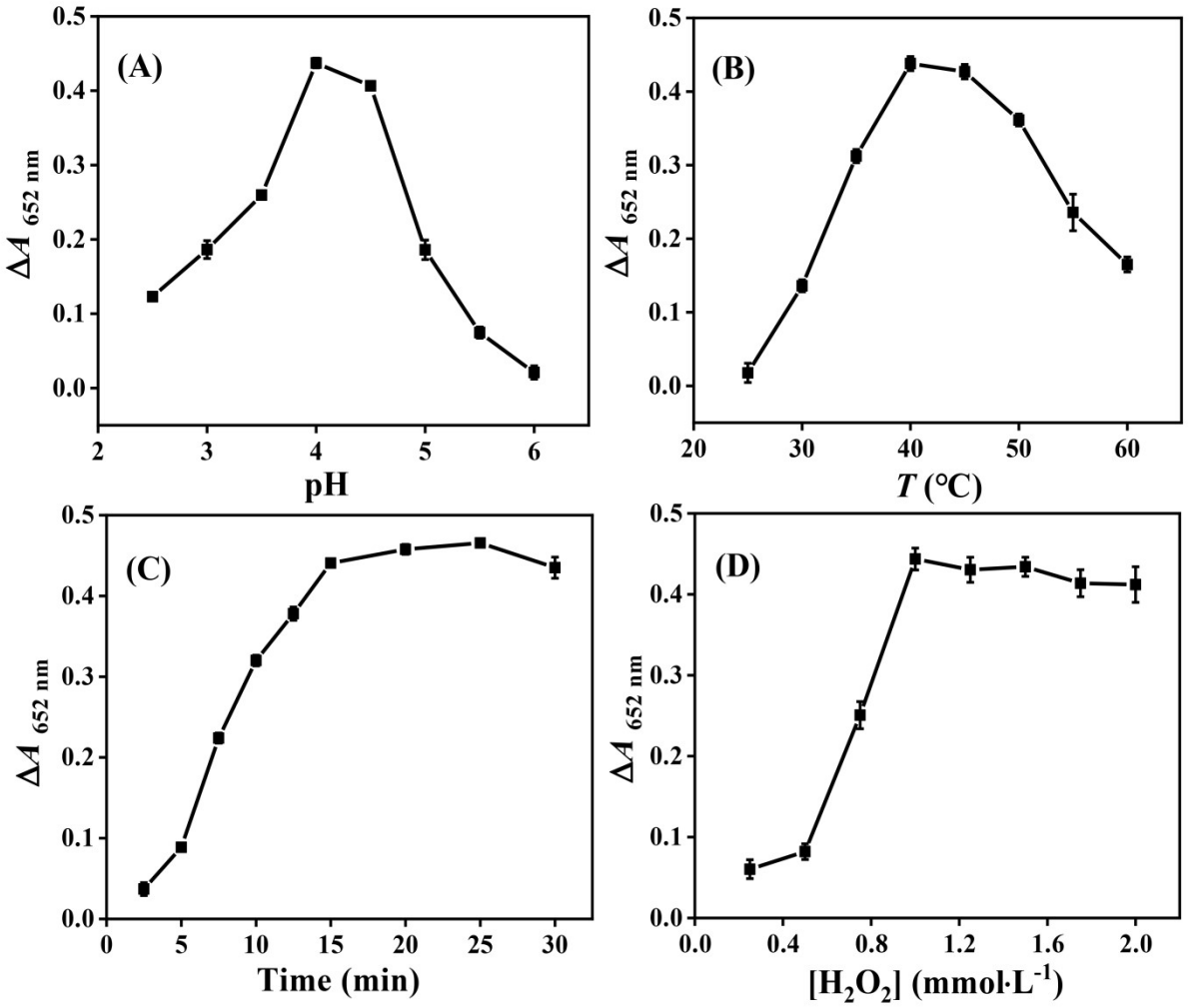

Fig.S5 The effects of (A) pH value, (B) temperature, (C) time and (D) the concentration of H_2O_2 on the catalytic activity AuNPs@MoS_2 NSs. Experimental conditions: 1.0 μg·mL^{-1} AuNPs@MoS_2 NSs; 1.0 mmol·L^{-1} TMB; 50 μmol·L^{-1} Hcy.

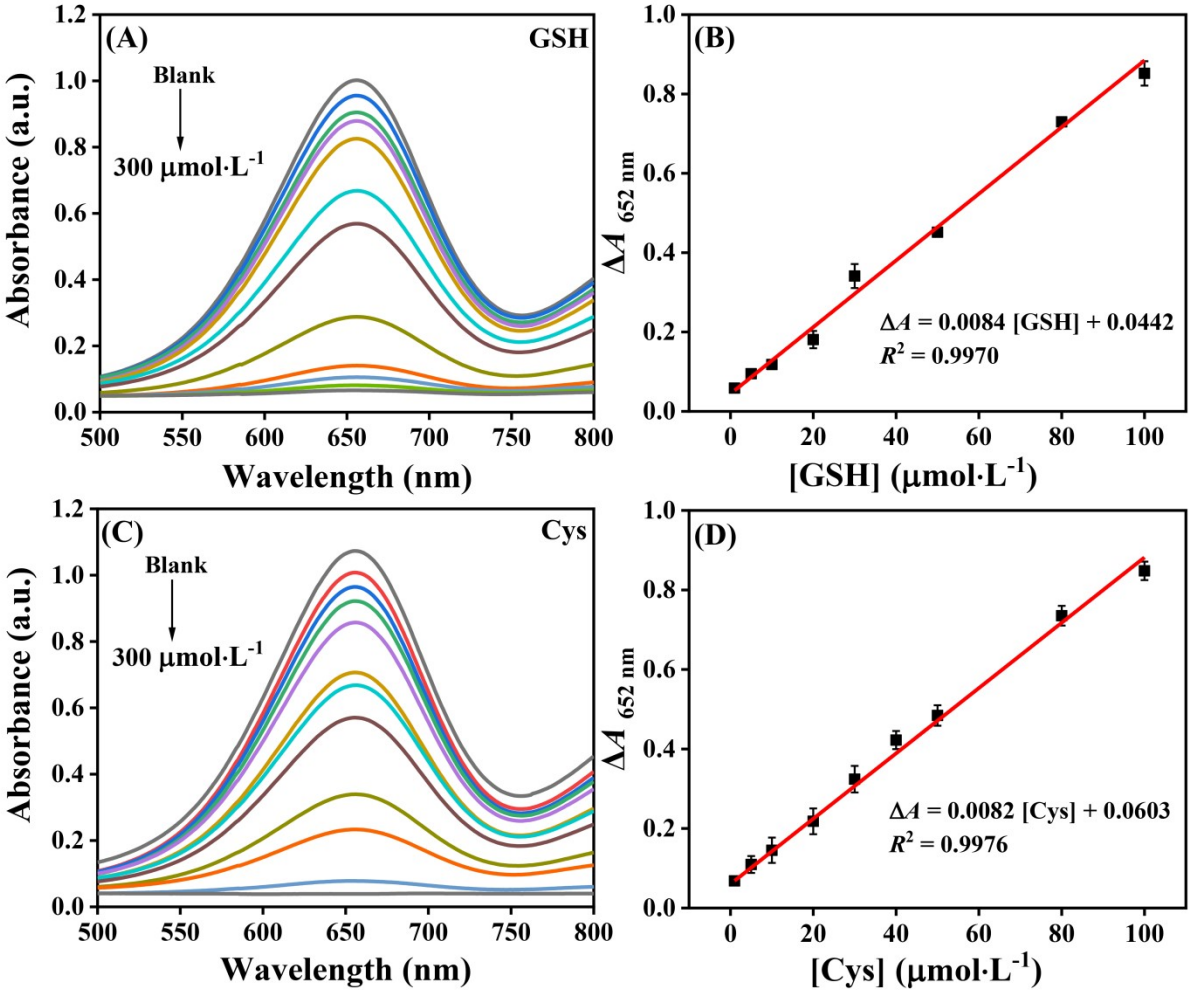

Fig.S6 UV-vis absorption spectra in the presence of various (A) GSH, (C) Cys concentrations. The linear relationship between $\Delta A_{652\ nm}$ and (B) GSH, (D) Cys concentration

Table S1 Comparison of the kinetic parameters of AuNPs@MoS_2 NSs, HRP and MoS_2 NSs.

Materials	K_m (mmol·L^{-1})		V_{max} (10^{-8} mol·L^{-1}·s^{-1})		Ref.
	TMB	H_2O_2	TMB	H_2O_2	
VS_2 NSs	0.28	3.49	0.416	0.557	1
GQDs	8	0.01	0.117	7.3	2
PPy NPs	0.293	0.184	2.99	3.65	3
M-CQDs	0.219	0.431	0.882	0.046	4
HRP	0.434	3.702	10.0	8.71	5
MoS_2 NSs	0.082	2.30	7.86	9.86	6
AuNPs@MoS_2 NSs	0.043	0.537	49.2	49.8	This work

Table S2 Comparison of performance of colorimetric method for Hcy, GSH and Cys detection.

Target	Nanomaterials	Linear range (μmol·L^{-1})	LOD (μmol·L^{-1})	Ref.
Hcy	MIL-53(Fe)	0.3 ~ 20	0.1	7
	IrO_2/rGO	0.1 ~ 50	0.083	8
	Silver halides	10 ~ 100	9.0	9
	$Cu_2(OH)_3NO_3$	5 ~ 40	0.099	10
	Ce-MOF	0 ~ 40	0.143	11
	AuNPs@MoS_2 NSs	1 ~ 100	0.93	This work
GSH	NiO NFs	20 ~ 100	1.1	12
	TiO_2/MoS_2	0.05 ~ 1	0.05	13
	Por-$ZnFe_2O_4$/rGO	2 ~ 40	0.76	14
	CDs@ZIF-8-a	0 ~ 100	1.04	15
	Pt_{10}-LP NCs	4 ~ 140	0.37	16
	AuNPs@MoS_2 NSs	1 ~ 100	0.71	This work
Cys	VS_4	5 ~ 100	2.5	17
	rGO-GP	2 ~ 30	0.1	18
	0.10CeO_2/CoO NC	5 ~ 10	3.71	19
	CB-CQDs	0.5 ~ 20	0.4	20
	MOF Eu-pydc	0 ~ 4	0.28	21
	AuNPs@MoS_2 NSs	1 ~ 100	0.73	This work

Table S3 Determination of Hcy in healthy volunteers' serum samples

Samples	Added (μmol·L^{-1})	Total found (μmol·L^{-1})	Recovery (%)	RSD (n = 3, %)
1	10.0	10.03	100.3	4.1
	50.0	50.22	100.4	2.3
2	10.0	9.825	98.25	3.3
	50.0	50.58	101.2	3.9
3	10.0	9.773	97.73	4.0
	50.0	50.17	100.3	2.4

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