Electronic Supplementary Information

for

Hemin functionalized MoS_2 nanosheets: enhanced peroxidase-like catalytic activity with a steady state in aqueous solution

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1. Comparison of catalytic activities of hemin and hemin/MoS_2-NSs

The control experiment used to explore the catalytic activity of hemin to 3, 3', 5, 5'-tetramethylbenzidine (TMB) oxidation in the presence of H_2O_2 was carried out. However, it can be seen from Fig. S1A that hemin molecules show rapid aggregation in aqueous solution, making it hard to explore their catalytic activities in aqueous solution. Furthermore, hemin can be dissolved in 5% ethanol solution with satisfying result. In order to compare the catalytic activities of hemin and hemin/MoS_2-NSs, the spectra of TMB reaction solutions (5% ethanol) in the presence of hemin (curve b, Fig. S1B) and hemin/MoS_2-NSs (curve c, Fig. S1B) were recorded after reaction for 10 min. It was found that when compared to pure hemin, as-prepared hemin/MoS_2-NSs exhibit higher peroxidase-like activity to TMB oxidation in the presence of H_2O_2.

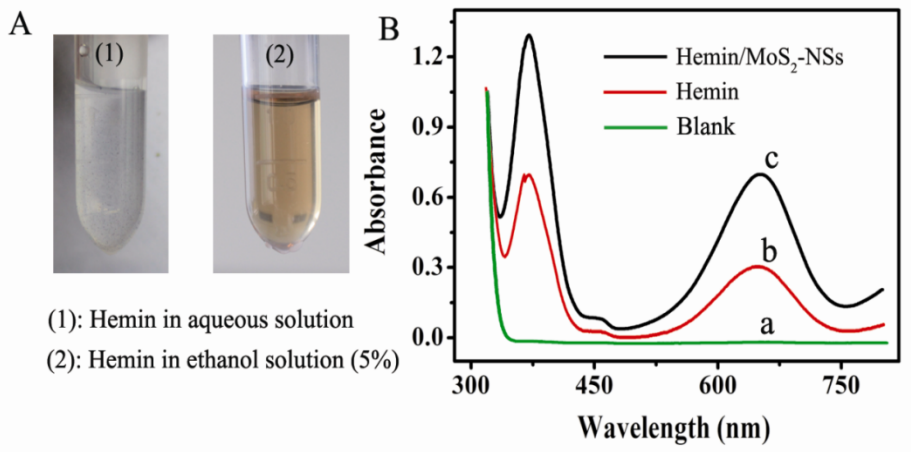

Fig. S1 (A) photographs of hemin dissolved in aqueous solution and 5% ethanol solution. (B) UV-vis absorption spectra of blank TMB reaction solutions (a), and in the presence of 12.0 μg mL^{-1} hemin (b) or 12.0 μg mL^{-1} hemin/MoS_2-NSs (c) after reaction for 10 min. TMB reaction solution contains 2 mM H_2O_2, 0.5 mM TMB, BR buffer (pH 4.0), and 5% ethanol.

2. Calculation of Michaelis-Menten constant

The Michaeli-Menten constant was calculated using Lineweaver-Burk plots of the double reciprocal of the Michaelis-Menten equation, $1/v = K_m/V_m\ (1/[S] + 1/K_m)$, where v is the initial velocity, V_m represents the maximal reaction velcocity, [S] corresponds to the concentration of substrate, and K_m is the Michaelis-Menten constant.

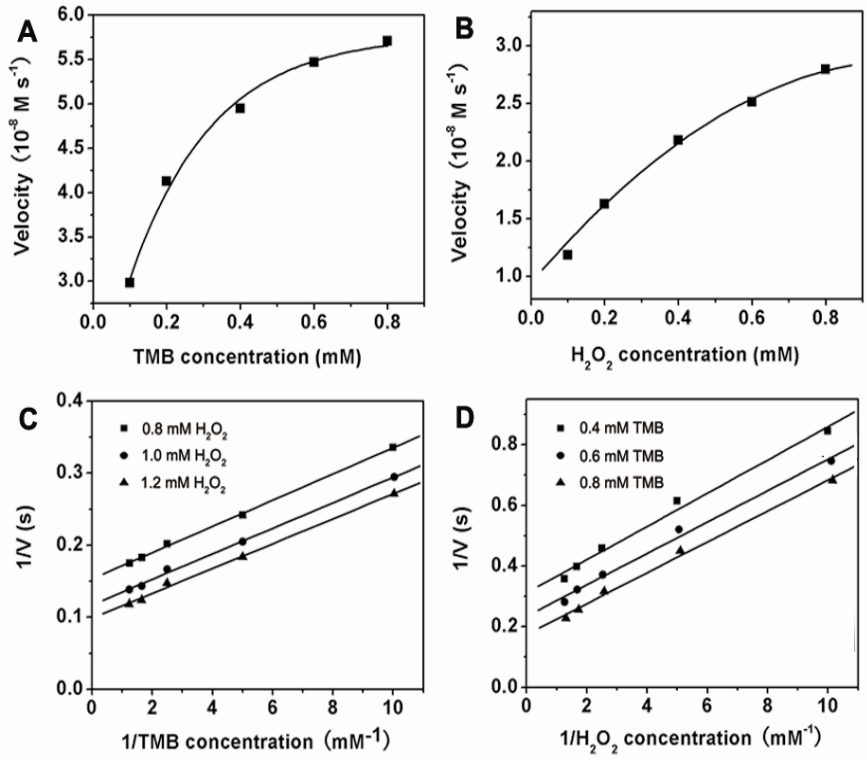

Fig. S2 Steady-state kinetic assay of hemin/MoS_2-NSs artificial enzyme. The velocity of the reaction was measured using 20 μg mL^{-1} hemin/MoS_2-NSs in BR buffer solution (pH 4.0) at 25℃. (A) The concentration of H_2O_2 was 0.8 mM and TMB concentration was varied. (B) The concentration of TMB was 0.4 mM and H_2O_2 concentration was varied. (C, D) Double-reciprocal plots of activity of hemin/MoS_2-NSs at a fixed concentration of one substrate versus different concentrations of the second substrate for H_2O_2 or TMB.

Table S1. A list of a series of H_2O_2 sensors based on nanomaterials owning peroxidase-like activity.

Catalyst	Method	Linear range (μM)	Detection limit (μM)	Ref.
g-C_3N_4[(1)]	Spectrphotometry	5 – 30	0.9	[S1]
WC NRs[(2)]	Spectrphotometry	0.2 – 80	0.06	[S2]
GO-COOH[(3)]	Spectrphotometry	0.05 – 1	0.05	[S3]
GO-Fe_3O_4	Spectrphotometry	1 – 50	0.32	[S4]
rGO[(4)]-CFs[(5)]	Spectrphotometry	2 – 100	0.3	[S5]
Hemin-SWCNT[(6)]	Spectrphotometry	0.5 – 200	0.2	[S6]
Hemin@MOF[(7)]	Spectrphotometry	5 – 200	2	[S7]
Hemin-GNs[(8)]	Spectrphotometry	0.05 – 500	0.03	[S8]
Hemin-GNs	Electroanalysis	0.5 – 400	0.2	[S8]
Hemin-OMC[(9)]	Electroanalysis	2 – 250	0.3	[S9]
Hemin/MoS_2-NSs	Spectrphotometry	0.2 – 4	0.043	This work

[(1)] g-C_3N_4: graphite-like carbon nitride; [(2)] WC NRs: tungsten carbide nanorods; [(3)] GO-COOH: carbon-modified graphene oxide; [(4)] rGO: reduced graphene oxide; [(5)] CFs: $CoFe_2O_4$ ferrite nanocubes; [(6)] SWCNT: single-walled carbon nanotubes; [(7)] MOF: metal-organic framework; [(8)] GNs: graphene nanosheets; [(9)] OMC: ordered mesoporous carbon

Table S2. Influence of foreign substances on the detection of 2.0 μM H_2O_2 using the developed sensor.

Foreign substance	Concentration (mM)	Chang in absorption signal (%)[a]
KCl	500	-4.7
NaCl	500	-5.7
$CaCl_2$	100	-5.6
Dopamine	20	-5.6
Uric acid	20	-3.3
Glucose	20	-6.3
Cysteine	5	-3.8
Ascorbic acid	5	-5.8
ClO^-	0.1	+1.7
$Cr_2O_7^{2-}$	0.1	+3.3

[a] The average value of five experiments

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