Supplementary materials

Molybdenum disulfide grafted carbon nanotubes for the electrochemical detection of acetaminophen with ultra-sensitivity

(2 Texts, 4 Tables, 4 Figures, 7 Pages)

Siying Fu[a,b,#], Juan Li[c,#], Kunru Liu[d], Huan Tao[b], Wenyan Guo[d], Qingbing Zha[a,b*], Jinhua Li[b,e*], Zhi Li[e*]

[a] *Department of Clinical Laboratory Medicine, The Sixth Affiliated Hospital of Jinan University, Dongguan, 523000, PR China*

[b] *Department of Clinical Laboratory Medicine, Department of Ultrasound, The First Affiliated Hospital of Jinan University, Guangzhou, 510630, PR China*

[c] *School of Stomotolgy, Jinan University, Guangzhou, 510632, PR China.*

[d] *Department of Clinical Laboratory Medicine, General Hospital of Southern Theater Command PLA, Guangzhou, 510010, PR China*

[e] *Department of Ultrasound, Guangdong Provincial Key Laboratory of Spine and Spinal Cord Reconstruction, The fifth Affiliated Hospital of Jinan University (Heyuan Shenhe people's Hospital), Heyuan, 517000, PR China*

[*] Corresponding authors: zhaqingbb@sina.com (*Q.Z.*); lijinhua@jnu.edu.cn *(J.L.)*; zhili@jnu.edu.cn *(Z.L.)*

[#] These authors contributed equally to this work.

Text S1. Chemicals

The carbon nanotubes (CNTs) is purchased from Xianfeng Reagent Co., Ltd (Nanjing, China). Heptamolybdate tetrahydrate ($(NH_4)_6Mo_7O_{24}\cdot 4H_2O$), thiourea ($CH_4N_2S$), Disodium hydrogen phosphate (Na_2HPO_4), sodium dihydrogen phosphate (NaH_2PO_4), ethanol, potassium ferrocyanide ($K_4[Fe(CN)_6]$), and potassium ferricyanide ($K_3[Fe(CN)_6]$) were bought from Sinopharm Chemical Reagent Beijing Co. Ltd (Beijing, China). 0.1 M phosphate buffer were prepared by Na_2HPO_4 and NaH_2PO_4, then adjusted to the required pH values with HCl or NaOH solution. Glassy carbon electrode was purchased from Aida Hengsheng Technology Development Co., Ltd (Tianjin, China).

Text S2. Characterization

The structure of the samples is investigated by X-ray diffraction (XRD, D2 PHASER, Bruker, Germany). The transmission electron microscopic (TEM, JEOL JEM-2100F) and atomic force microscope (AFM, Bruker Dimension Icon) were used to explore the morphology of the samples. The elemental composition and organic functional group of the sample were tested by X-ray photoelectron spectroscopy (XPS) (K-Alpha+, Thermo). The real samples of APAP were also analyzed by high performance liquid chromatography (HPLC, Shimadzu) with an Agilent Poroshell 120 column (2.1 mm× 100 mm, 2.7 μm).

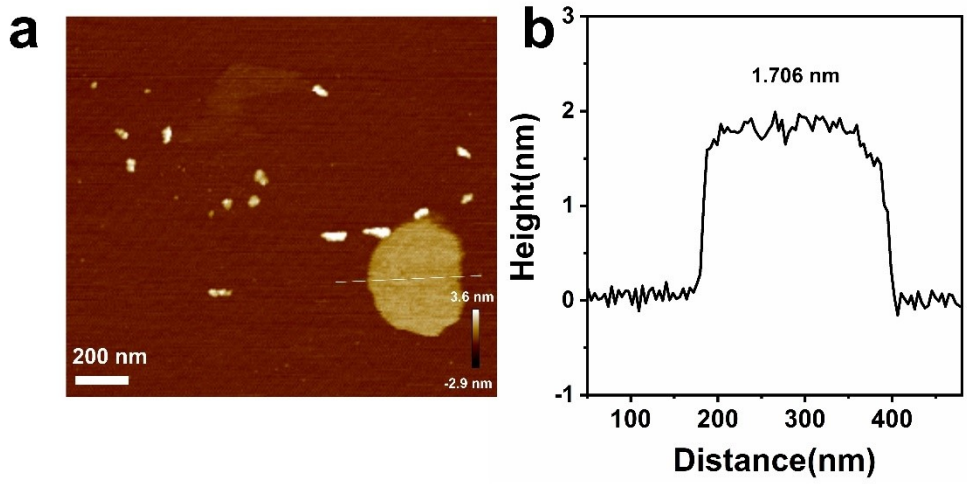

Fig. S1 AFM images of MoS_2.

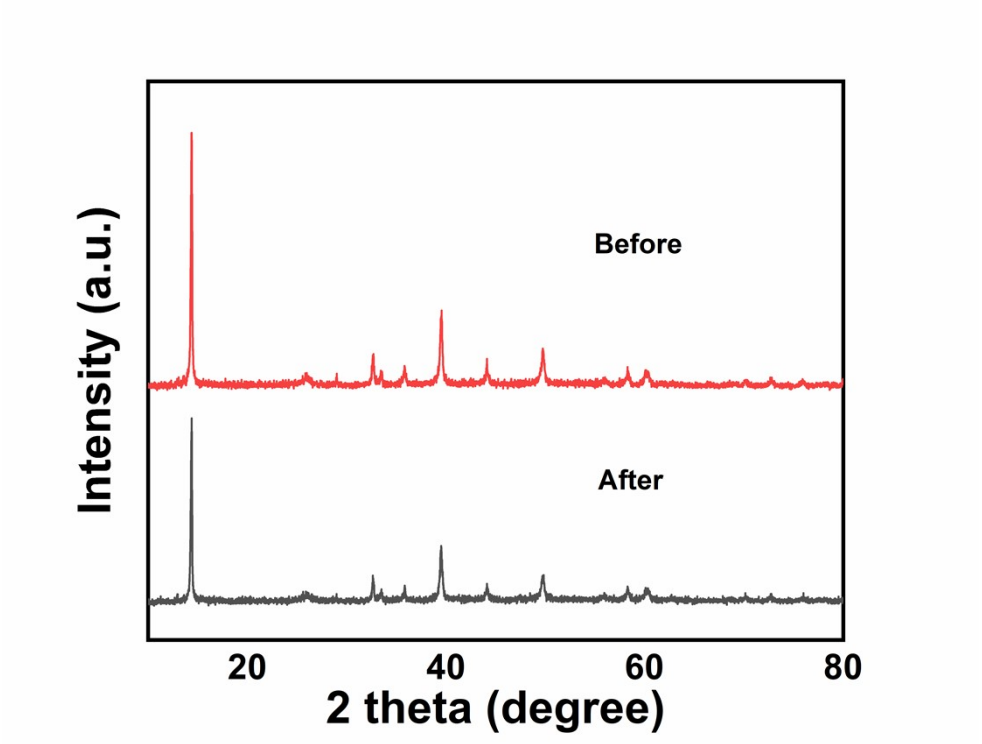

Fig. S2 XRD patterns of MoS_2/CNTs before and after reactions.

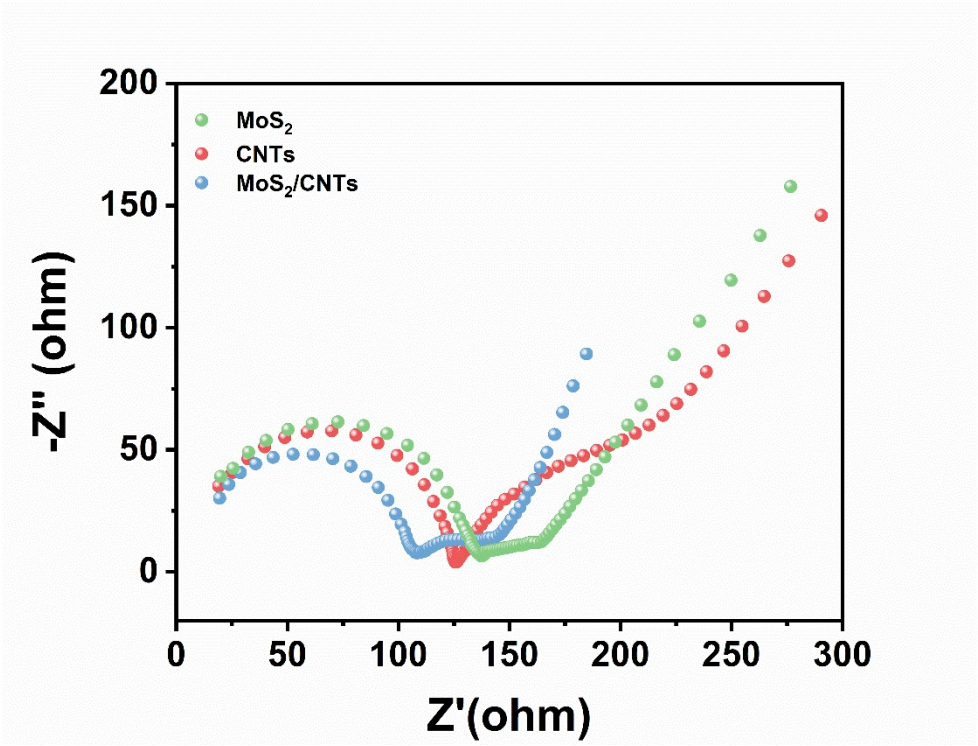

Fig. S3 Nyquist plots of MoS_2 (green curves), CNTs (red curves), MoS_2/CNTs (blue curves) in 2.5 mM $K_3[Fe(CN)_6]/K_4[Fe(CN)_6]$ solution containing 0.1 M KCl.

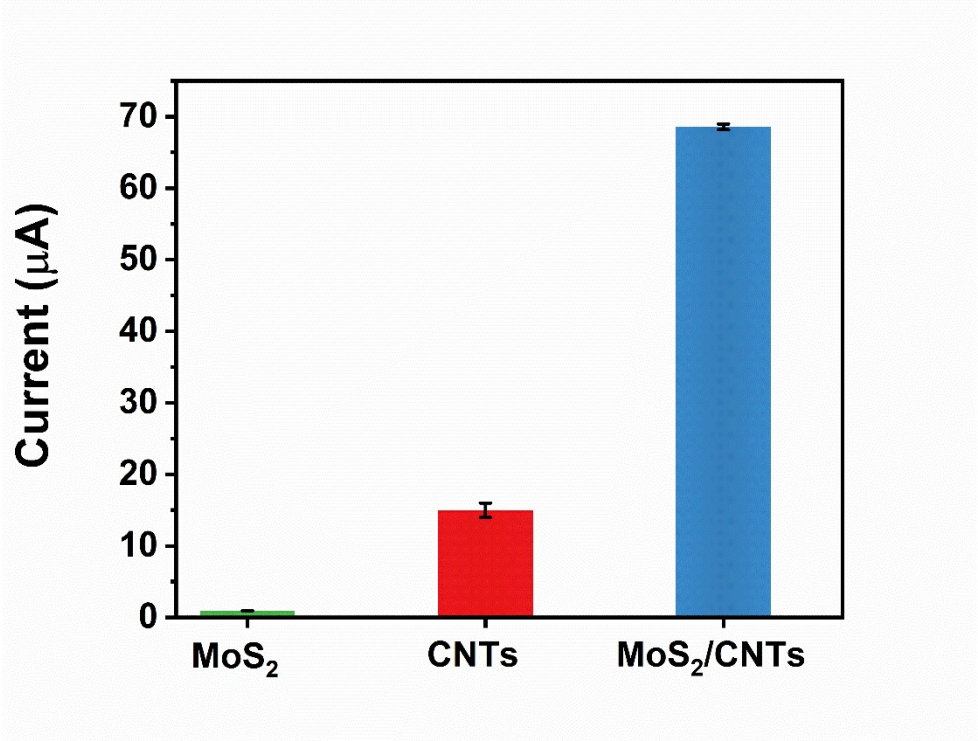

Fig. S4 CVs of corresponding histograms of different sensors in solution containing 0.1 M phosphate buffer (pH = 6.8).

Table S1. Comparison of different sensors for the detection of APAP.

Electrode	Detection method	LOD (μM)	Linear range (μM)	Sensitivity value ($\mu A\ nm^{-1}cm^{-2}$)	Refs
PEDOT/GO/GCE	CV	0.57	10–60	/	[1]
f-MWCNT/GCE	DPV	0.6	3–300	/	[2]
Poly(taurine)-MWCNT/GCE	DPV	0.5	1–100	3324.3	[3]
AuNP-PGA-SWCNT/PET	DPV	1.18	8.3–145.6	/	[4]
MWCNT/GCE	SWV	9×10^{-5}	0.0002–15	/	[5]
MWCNT-NF/GCE	DPV	0.052	9.9–74.1	36.3	[6]
P-NC/GCE	DPV	0.5	3–110	17776.9	[7]
ZnO/SnO2-PEDOT/PET	CA	0.562	2–591	59.1	[8]
CoPc-flav-f-MWCNTs GCE	SWV	1	0.975–1000	57.1	[9]
CoPc-bo-f-MWCNTs GCE	SWV	15	15.6–1000	36.4	[9]
MoS_2/CNTs /GCE	DPV	0.43	0.07–10 and 10–150	16.4	This work

Table S2. Interference effects on the detection of 40 μM APAP in 0.1 M phosphate buffer (pH = 6.5).

Interference	Concentration (μM)	RSD (%)
KBr	400	0.8
NaCl	400	0.9
KCl	400	0.5
$NaNO_2$	400	1.6
$C_6H_{12}O_6$	400	0.5
UA	400	0.4
AA	400	0.1

Table S3. Detection of APAP in real samples.

Sample	Added (μM)	Found (μM)	Recovery (%)	RSD (%)
Tap water	2	1.87	93.5	2.4
	4	4.37	109.3	12.2
	6	5.82	97	2.7
	8	7.53	94.1	3.9
Urine	2	2.06	103	4.2
	4	3.85	96.3	10
	6	5.53	92	2.3
	8	7.23	90.4	2.8

Table S4. Real samples detection of APAP by HPLC method.

Sample	Added (μM)	Found (μM)	Recovery (%)	RSD (%)
Tap water	2	1.89	94.5	4.6
	4	3.80	95	1.7
	6	6.35	105	7.8
	8	7.41	92.6	7.4
Urine	2	2.11	105.5	3.7
	4	3.79	94.8	1.4
	6	5.42	90.3	6.5
	8	7.30	91.3	6.2

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