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Supporting Information

MoS_2 phase transition-assisted sensitive detection of cholesterol on the Copper oxide@Molybdenum disulfide nanocomposite

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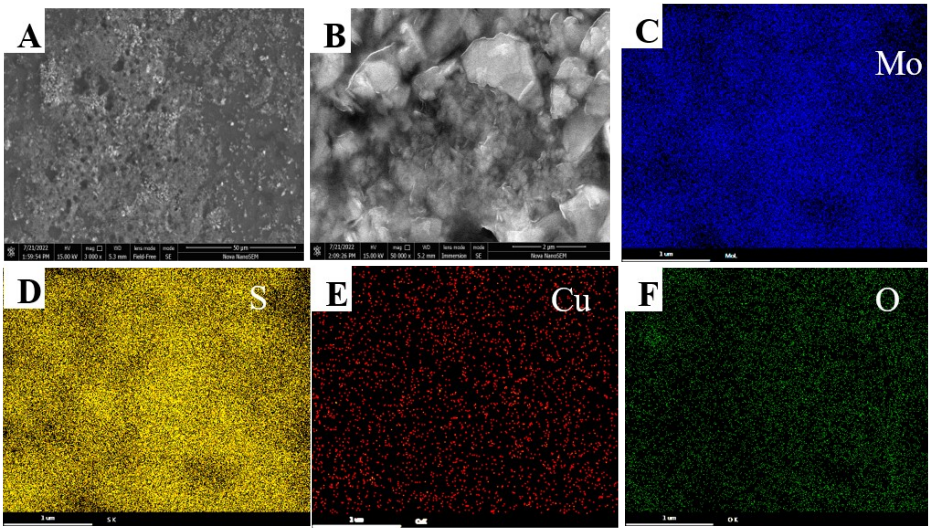
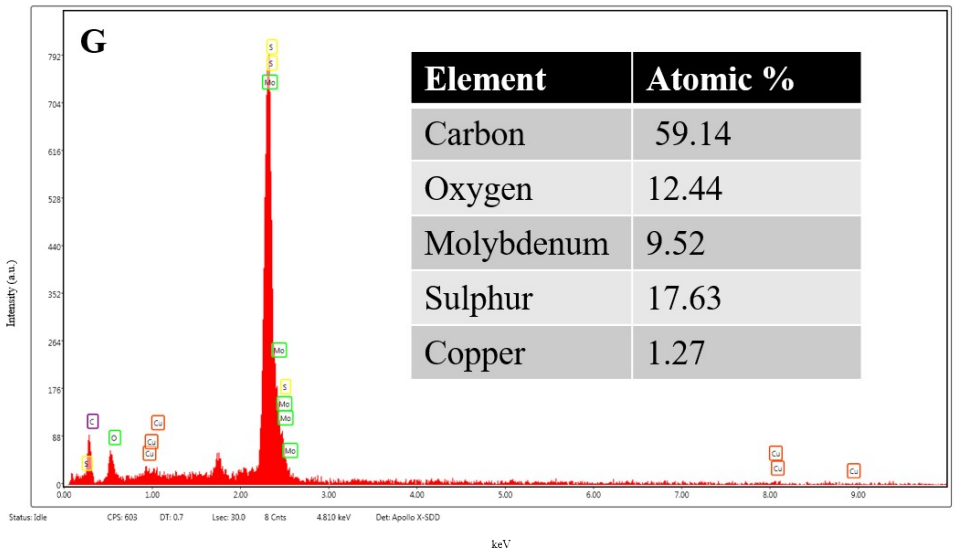




Element	Atomic %
Carbon	59.14
Oxygen	12.44
Molybdenum	9.52
Sulphur	17.63
Copper	1.27

Fig. S1. (A) SEM image of $CuO@MoS_2$, (B) SEM field image for mapping, (C, D, E, and F) EDS mapping images for the elements Mo, S, Cu, and O. (G) EDS spectra of $CuO@MoS_2$.

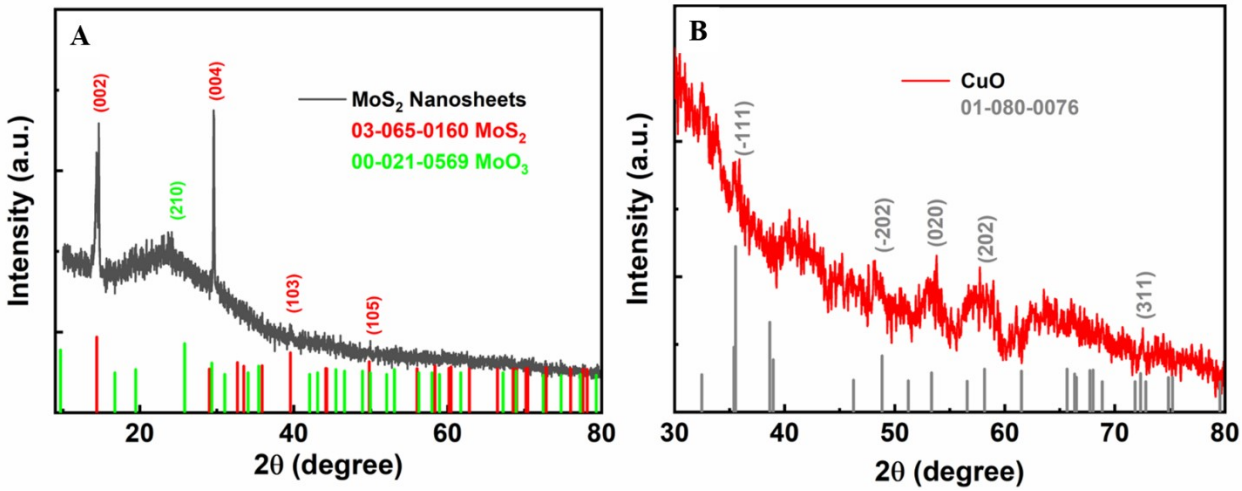


Fig. S2. XRD patterns and corresponding JCPDS data for (A) MoS_2 nanosheets and (B) CuO nanoparticles.

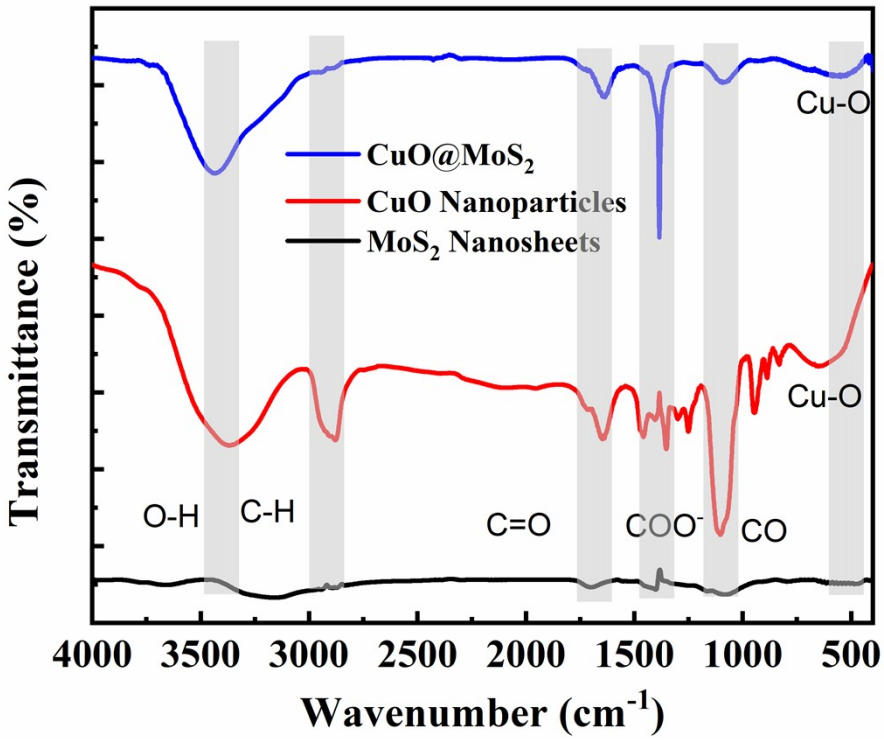


Fig. S3. FT-IR spectra of MoS_2 nanosheets, CuO nanoparticles, and $CuO@MoS_2$.

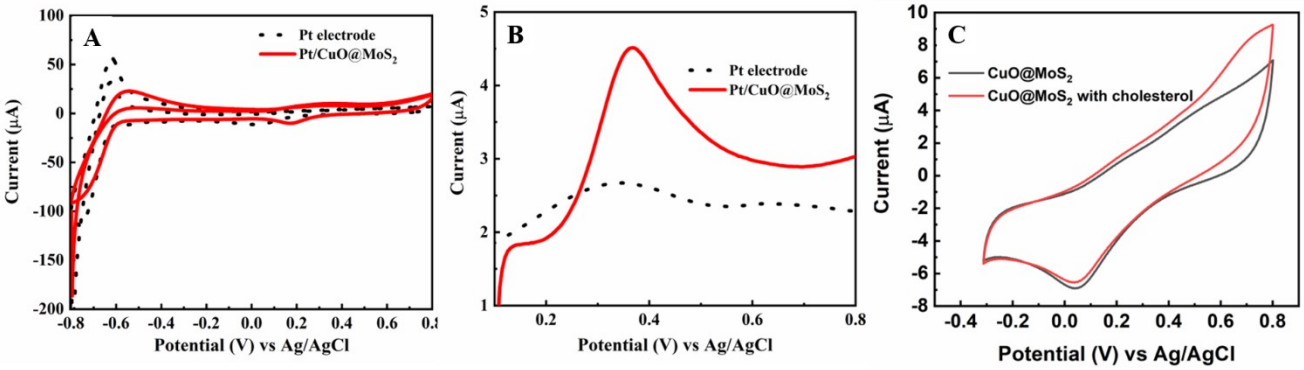
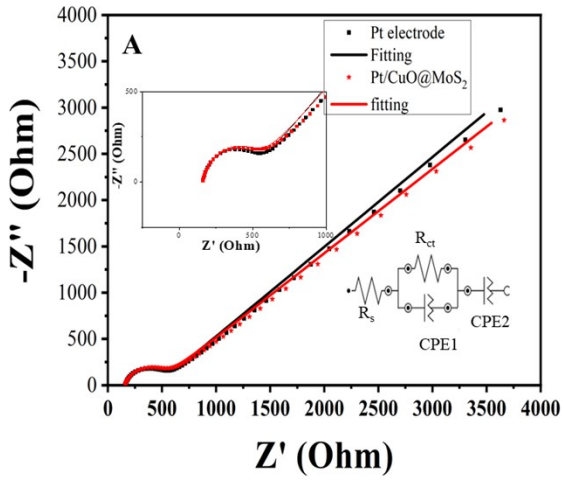


Fig. S4: (A) CV of Pt electrode and $CuO@MoS_2$, (B) DPV of Pt electrode and $CuO@MoS_2$, and (C) CV of $CuO@MoS_2$ with and without cholesterol in 0.1 M PBS.



B

Electrode	Rs (Ω)	Rct (Ω)	N of CPE 1	N of CPE 2
Pt	154	305	0.939	0.49
Pt/CuO@MoS$_2$	151	287	0.95	0.471

Fig. S5: (A) Nyquist plot of (EIS) of Pt electrode and $Pt/CuO@MoS_2$ in 5×10^{-3} mol L^{-1} $K_3[Fe(CN)_6]$ and 0.1 mol L^{-1} KCl. (B) Equivalent circuit element values corresponding to the fitting of the EIS data of the Pt electrode and its modification with $CuO@MoS_2$.

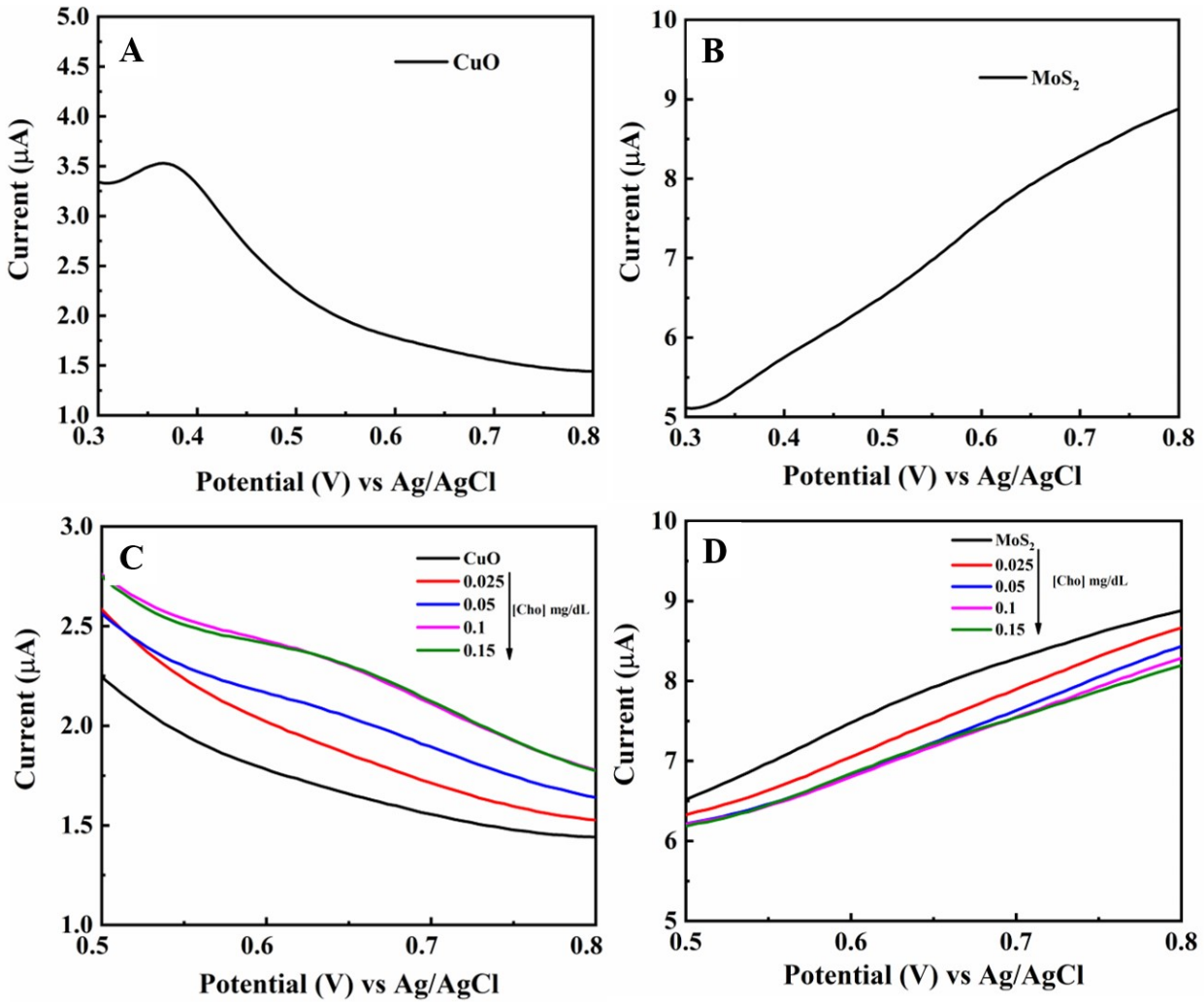


Fig. S6. Electrochemical response of (A) CuO, and (B) MoS_2 modified electrode in the potential window of 0.3 to 0.8 V in PBS. Effect of cholesterol addition on the Pt electrode modified with (C) CuO and (D) MoS_2.

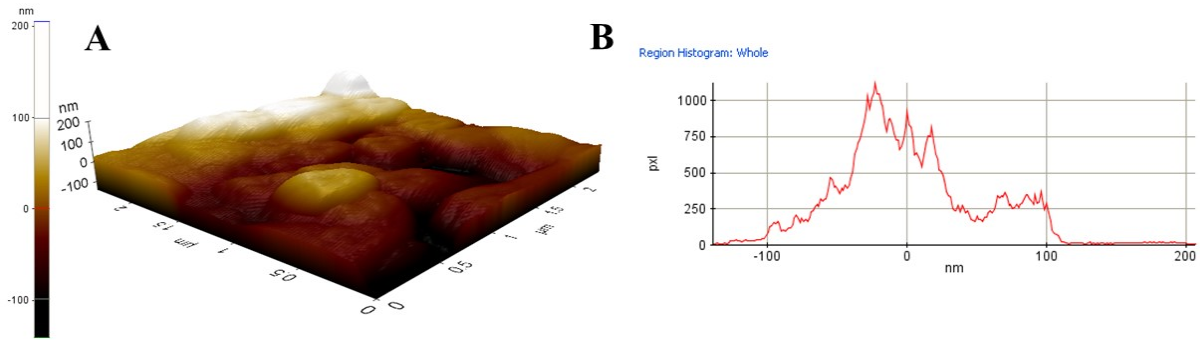


Fig. S7. AFM image of $CuO@MoS_2$ after cholesterol detection (A) Topography (B) Corresponding height profiles.

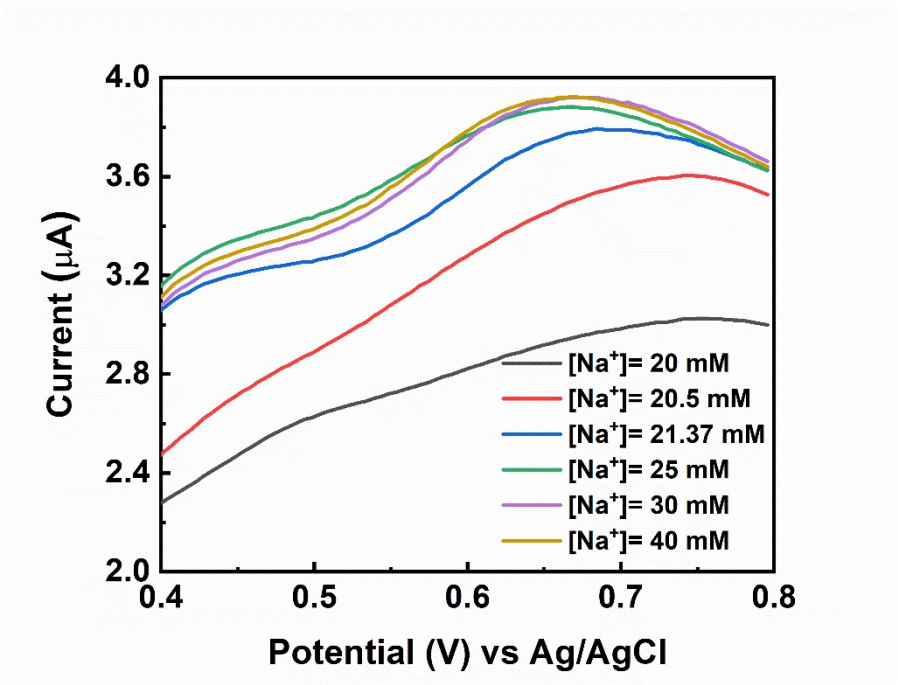


Fig. S8. The DPV response of 0.3 mg/dL cholesterol on the $CuO@MoS_2$ sensor in varying $[Na^+]$ buffer solutions.

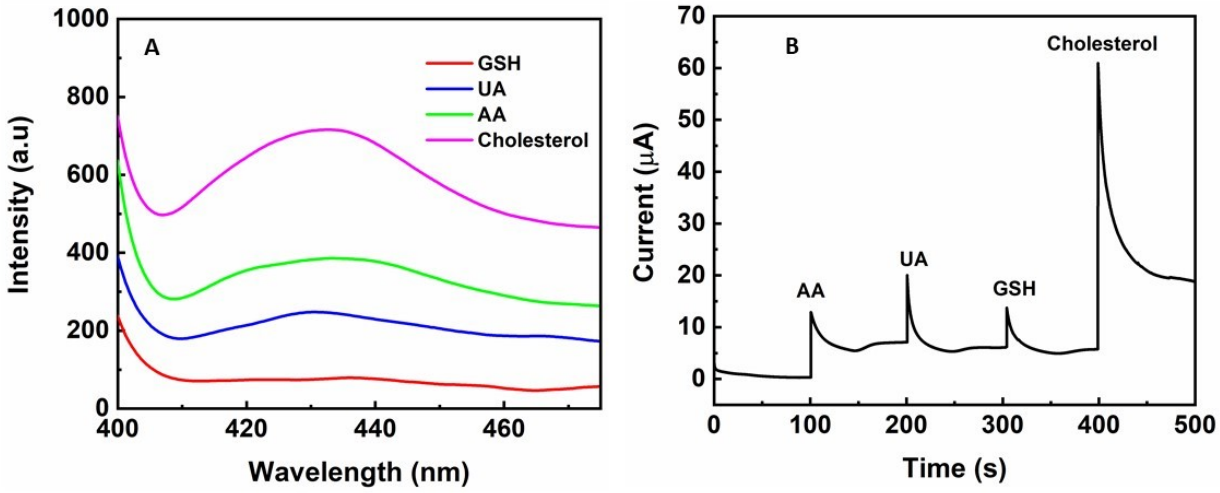


Fig.S9.(A). Fluorescence spectra of the electrolyte after Glutathione, AA, UA, and cholesterol detection (B) CA of AA, UA, Glutathione, and cholesterol with CuO@MoS_2 sensor .

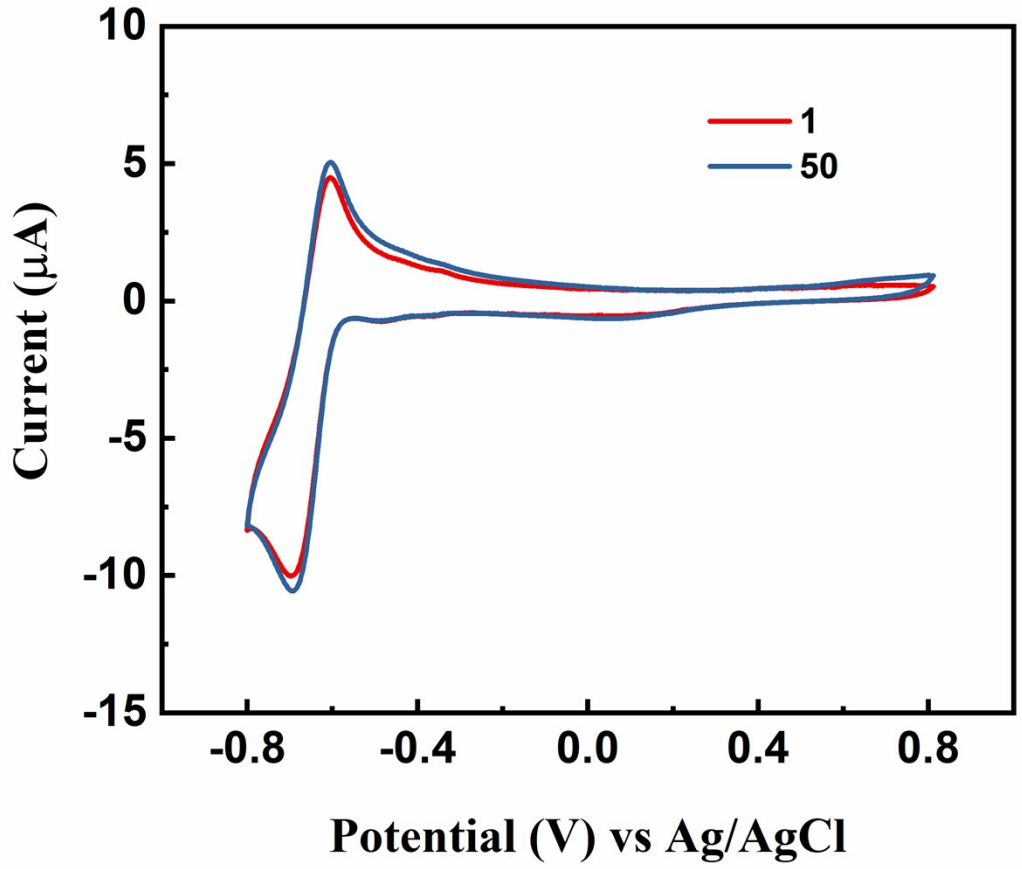


Fig. S10: CV of the first and fiftieth scans of Pt/CuO@MoS_2 in 0.1 M PBS.

Table. S1. Comparison of the CuO@MoS_2 sensor with reported cholesterol detection methods.

Sl No.	Detection Method	Material Used	Limit of Detection (LOD)	Detection Range	Reference
1	Electrochemical (Amperometric i–t method)	MoS_2-AuNPs	0.26 ± 0.0 15 µM	0.5–48 µM	[1]
2	Chemiluminescence	MoS_2 and graphene quantum dots	35 nM	0.08–300 µM	[2]
3	Electrochemical (Amperometric i–t method)	MoS_2-Cu_2O hybrid nanoparticles	0.074 µM	0.25–25 µM	[3]
4	Electrochemical (Differential Pulse Voltammetry)	Poly(methyl orange)-modified NiO/MoS_2 on screen-printed carbon electrode	0.24 mg/dL (6.2 µM)	1–15 mg/dL (25.86-387.9 µM)	[4]
5	Colorimetric	Au nanoparticles supported on MoS_2 nanoribbons	0.015 mM	0.04-1 mM	[5]
6	Fluorometric	Ch Ox in MOF and Ag nanocluster @ MoS_2 nanosheets	0.03 µM	0.06–15 µM	[6]
7	Electrochemical (Chronoamperometry)	ChOx/Pt wire based 3-D printed microneedle	0.5 µM	1 to 20 µM	[7]
8	Electrochemical (Differential Pulse Voltammetry	CuO@ MoS_2	679 nM ($26.25x10^{-4}$ mg/dL)	1.29 µM-10.34 µM (0.05-0.4 mg/dL)	This work

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