

Supporting information

Enhancing chloramphenicol sensing performance of Cu-MoS₂ nanocomposites-based electrochemical nanosensors: Roles of phase composition and copper loading amount

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S1. Supplemental Experiments

Preparation of Cu-based nanomaterials, Cu, CuO, Cu₂O, and Cu-MoS₂ nanocomposites

In all the experiments, two pure identical copper plates were used as the anode and cathode electrodes and were fixed parallel to each other at a constant distance of 40 mm. Before the experiments, the surface of both electrodes was polished with emery papers and immersed in HCl (10 wt%) solution for 5 min, and finally washed with distilled water to remove the remained HCl. In a 250 mL glass beaker, two electrodes were put into the electrolyte consisted sodium citrate

($C_6H_5Na_3O_7 \bullet 2H_2O$) and L-ascorbic acid ($C_6H_8O_6$). Finally, a direct current (DC) voltage source was supplied to the electrodes at room temperature and under magnetic stirring. The parameters of each experiment for fabrication of different phase compositions of the Cu-based nanomaterials (NMs) as listed in Table 1.

Table S1 *Synthesis conditions of copper-based nanomaterials with tunable phase composition.*

Type of Cu-based NMs	Parameters			
	Sodium citrate (g L ⁻¹)	Ascorbic acid (g L ⁻¹)	Reaction time (minutes)	Electrolysis voltage (V)
CuO	0.5	0.5	60	12
Cu ₂ O	0.75	1	60	12
Cu	0.75	2	90	15

The Cu-MoS₂ nanocomposites were prepared by the same method for fabricated Cu-GO nanocomposites according to our previous report with a slight modification. Before the electrolysis process, 10 mL of MoS₂ nanosheets suspension with a concentration of 2 mg mL⁻¹ was added into a 250 mL electrolyte solution containing $C_6H_5Na_3O_7 \bullet 2H_2O$ (0.75 g L⁻¹) and $C_6H_8O_6$ (2 g L⁻¹). The reaction time and applied voltage in this process were fixed at 90 minutes and 15 V, respectively. In this experiment, after the first 30 min, 3 mL of the obtained product was withdrawn and UV-vis spectral analysis was recorded at every 15-min interval, *i.e.*, at 30, 45, 60, 75, and 90 min.

S2. Supplemental Results

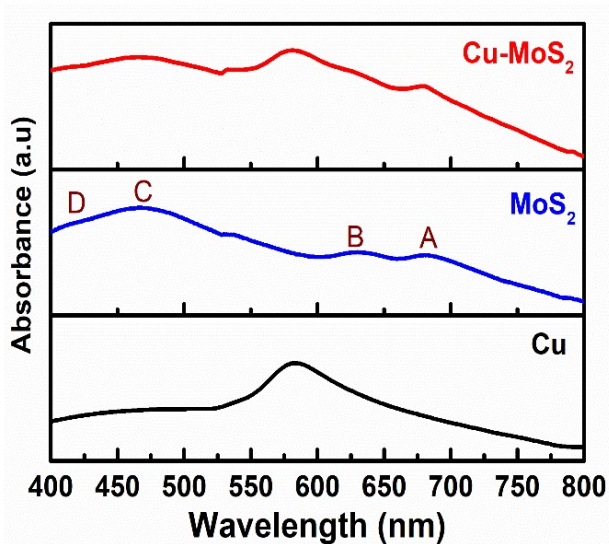


Fig. S1 UV-Vis adsorption spectra of Cu-NPs (black line), MoS₂ nanosheets (blue line), and Cu-MoS₂ nanocomposites (red line).

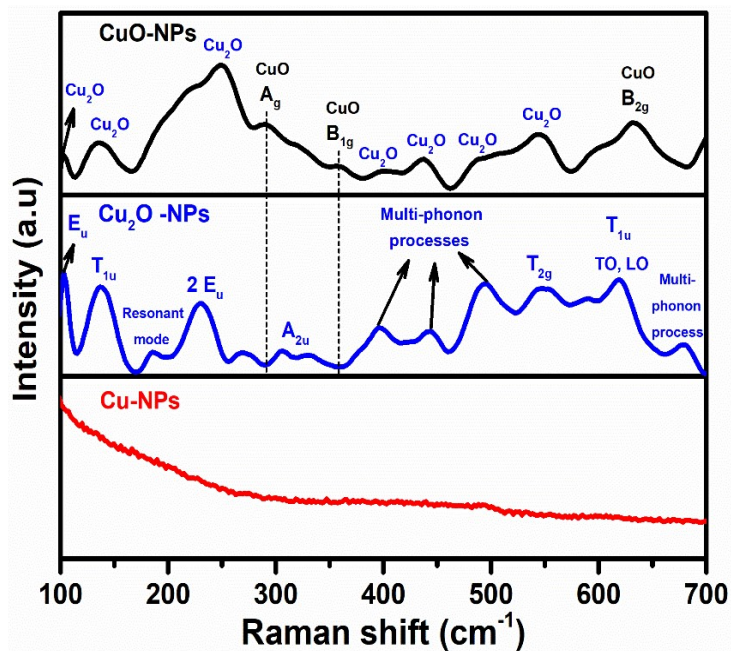


Fig. S2 Raman spectra of Cu-NPs, Cu₂O-NPs, and CuO-NPs.

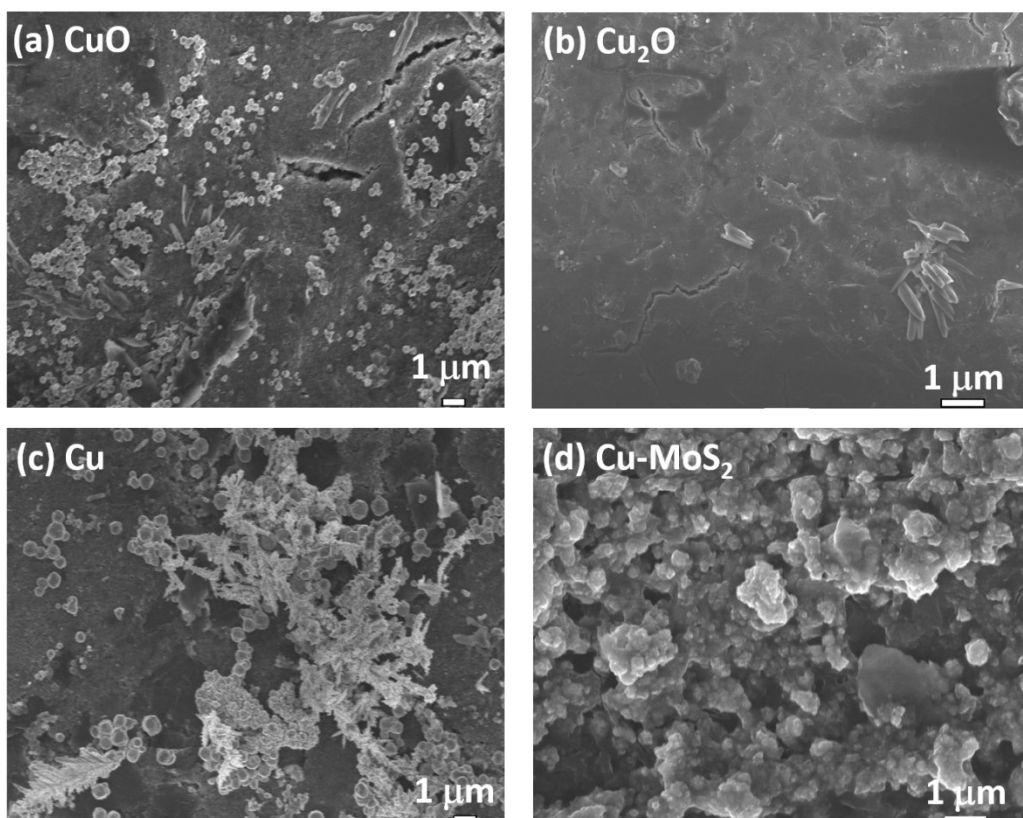


Fig. S3 SEM images of Cu-based NMs and Cu-MoS₂ nanocomposites.

Table S2 Peak current intensity and their calculated electroactive surface area (EASA) according to the Randles–Sevcik equation for various modified electrodes.

Modified Electrodes	I_{pc} (μA)	EASA (cm^2)
CuO-NPs	110.8	0.329
Cu-NPs	121.9	0.362
Cu ₂ O-NPs	126.2	0.375
Cu-MoS ₂ -30	116.3	0.346
Cu-MoS ₂ -45	119.6	0.356
Cu-MoS ₂ -60	122.5	0.364
Cu-MoS ₂ -75	135.7	0.404
Cu-MoS ₂ -90	117.9	0.351

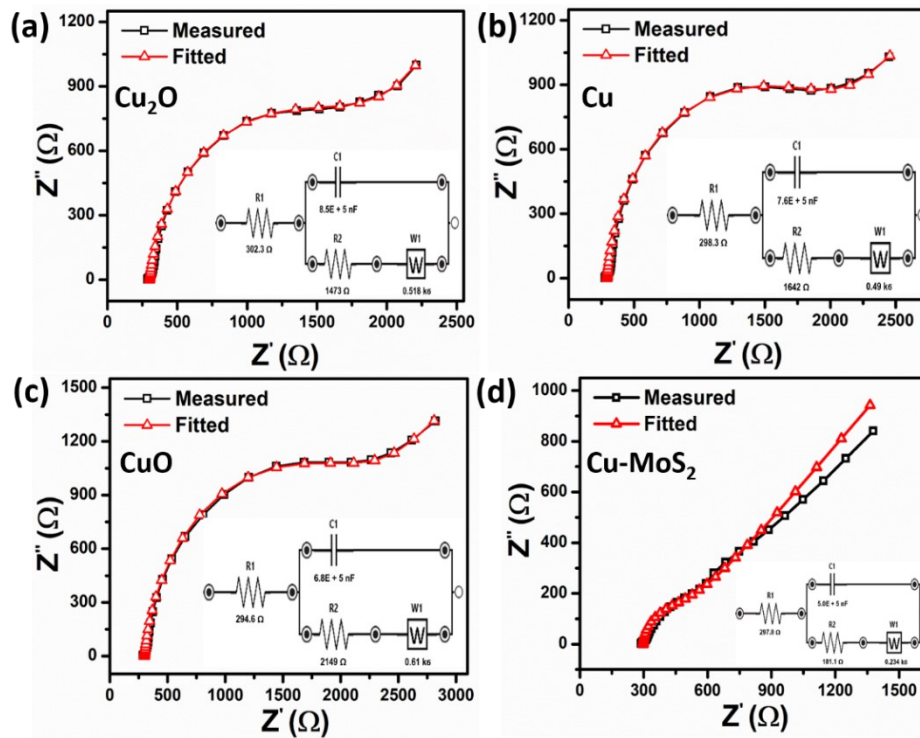


Fig. S4 Fitted and experimental Nyquist plots of impedance spectra. The red line is calculated results from model fitting, and the black line are experimental data. The inset is the Randles equivalent circuit of the electrochemical cell used in the present work.

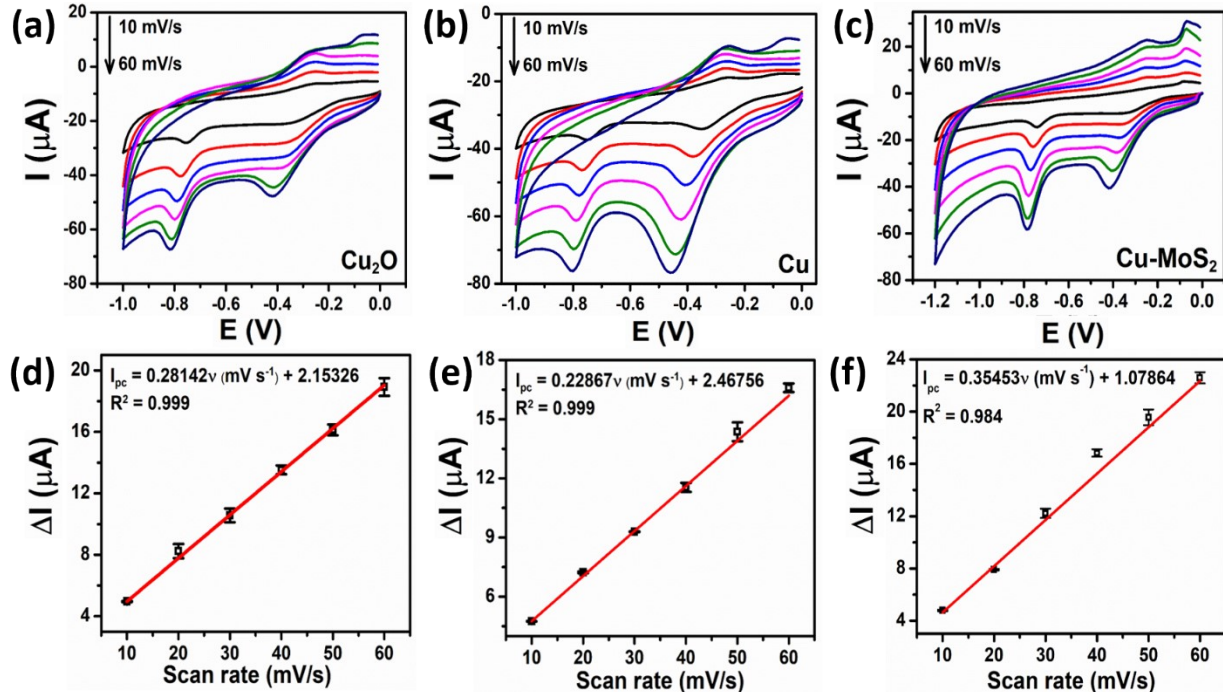


Fig. S5 CV response recorded of $50 \mu\text{M}$ CAP in 0.1 M PBS ($\text{pH } 7.2$) on $\text{Cu}_2\text{O-NPs/SPE}$ (a), Cu-NPs/SPE (b), and $\text{Cu-MoS}_2\text{-75/SPE}$ (c) with various scan rates from 10 to 60 mV s^{-1} . Insert shows the corresponding calibration plots of peak current response vs. scan rate (d, e, f) with error bars.

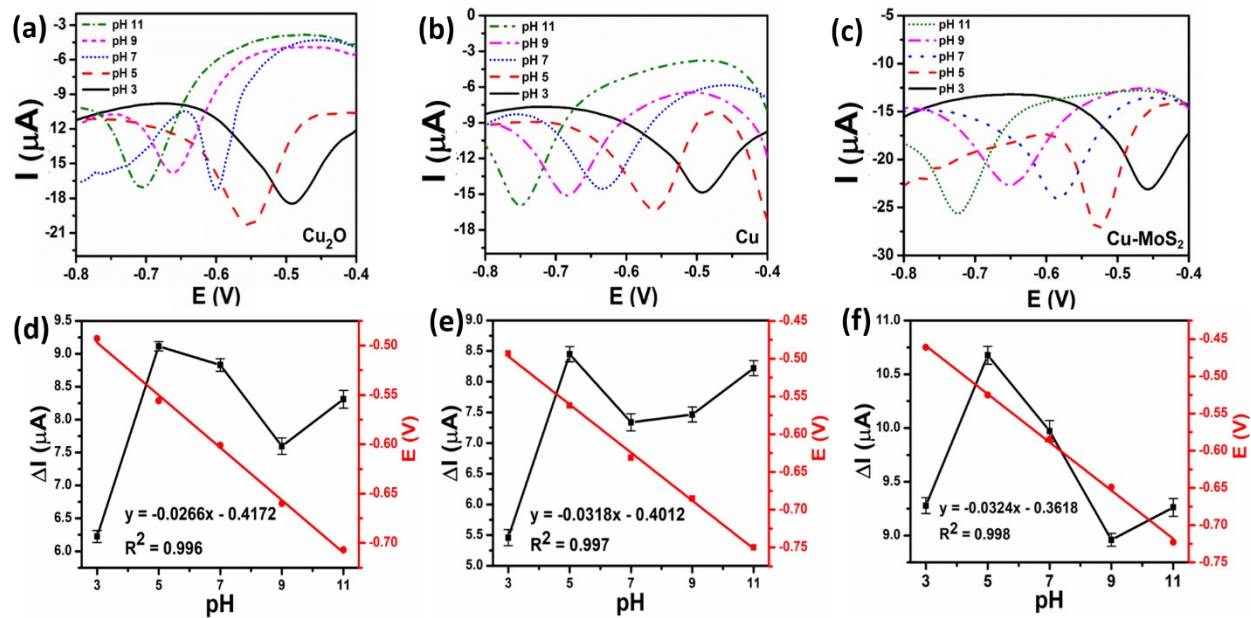


Fig. S6 DPV curves of Cu₂O-NPs/SPE (a), Cu-NPs/SPE (b), and Cu-MoS₂-75/SPE (c) in 50 μM CAP at various pH values, corresponding to the plots of peak current and peak potential vs. pH value (d, e, f) with error bars. Scan rate of 6 mV s⁻¹.

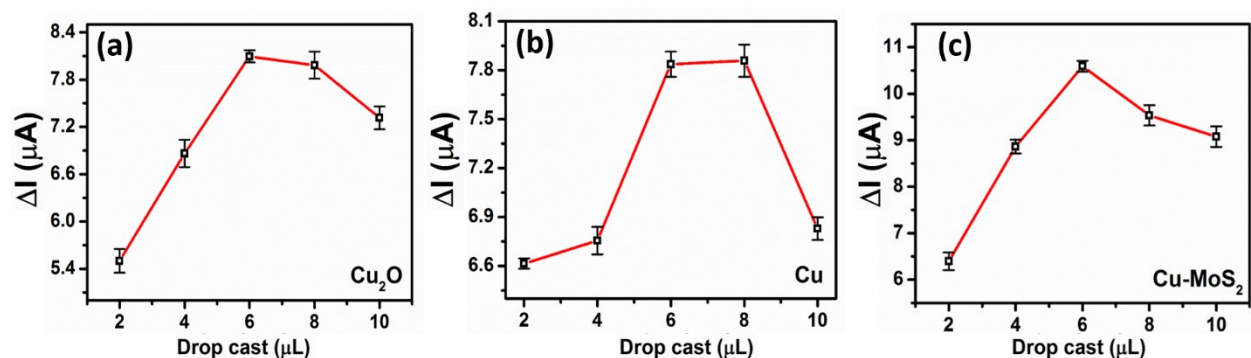


Fig. S7 Effect of modifier amount on CAP reduction of Cu₂O-NPs/SPE, Cu-NPs/SPE, and Cu-MoS₂-75/SPE.

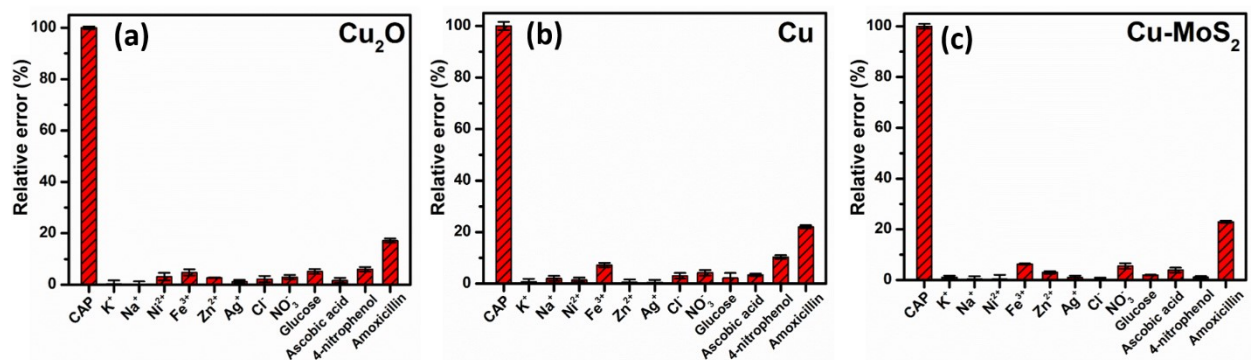


Fig. S8 Interference investigation of the Cu₂O-NPs, Cu-NPs, and Cu-MoS₂-75 modified electrodes in 0.1 M PBS (pH 5) containing 50 μM CAP with 10-fold concentration of interference substances.

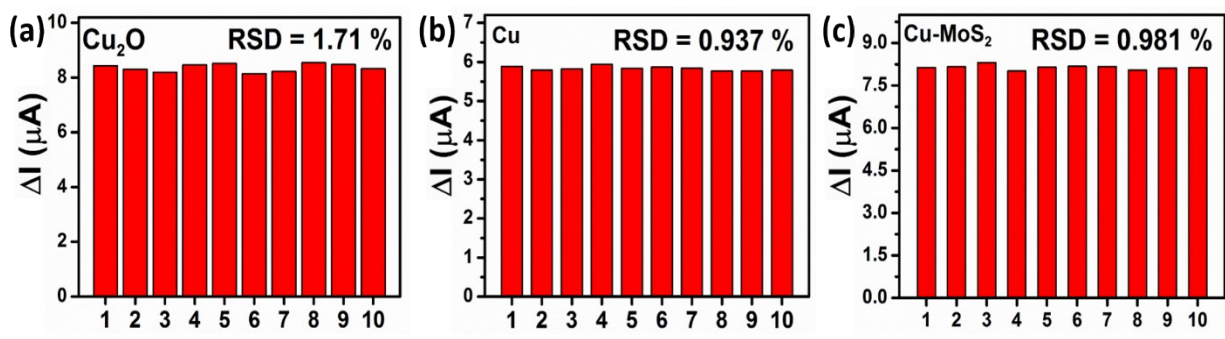


Fig. S9 Repeatability of the modified electrodes in 40 μM CAP.

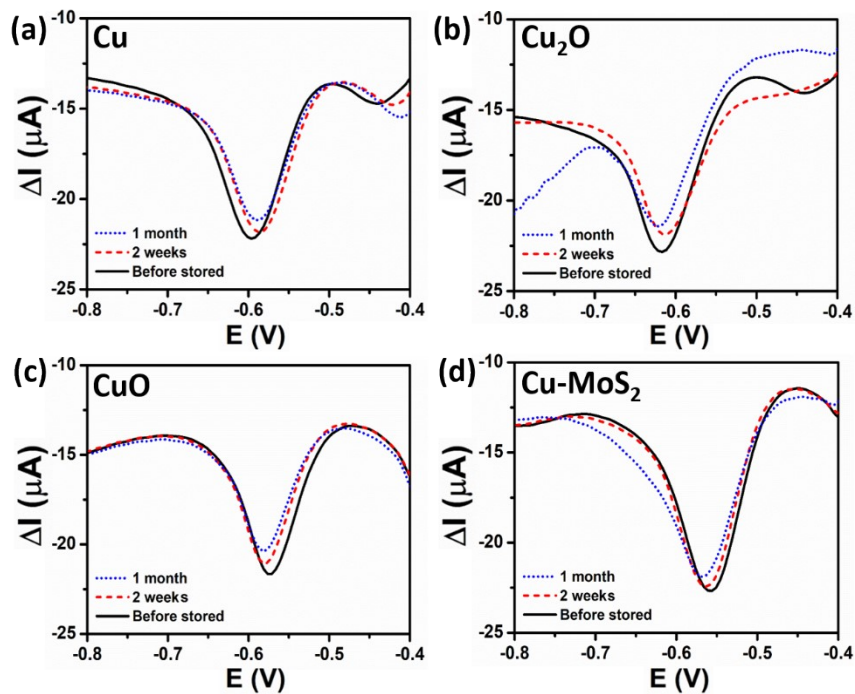


Fig. S10 Long-term stability of the modified electrodes in 50 μM CAP.