

Supplementary Information

A sensitive electrochemical sensor based on CoWO₄/multi-walled carbon nanotubes composites for the selective determination of chlorpromazine hydrochloride

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1. Experimental section

1.1. Materials and apparatus

Cobalt nitrate (Co(NO₃)₃·6H₂O), sodium tungstate (NaWO₄·2H₂O), cetyltrimethylammonium bromide (CTAB) and chlorpromazine hydrochloride were got from Aladdin Reagent (Shanghai) Co., Ltd. All chemicals were of analytical grade and used without further purification. Carbon nanotubes (CNTs) purchased from Nanjing Xianfeng Nano Materials Co., Ltd. Electrochemical analysis was done on electrochemical workstation (CHI660D, Shanghai, China). The morphology observations were performed on a scanning electron microscope (SEM, Hitachi S-4700 II). Energy dispersive spectroscopy (EDS) was used to analyze the chemical composition of the selected area. The catalysts were evaluated by X-ray diffraction (XRD), scanning from 10° to 80° at a scan rate of 2°·minute⁻¹ using quartz monochromatic Cu Kα1 radiation source (λ = 0.1541 nm). X-ray photoelectron spectroscopy ((XPS, Thermo Scientific, American) spectra were recorded by a Physical Electronics PHI 5000 Versa probe spectrometer with Al Kα radiation (1468 eV).

1.2. Synthesis of CoWO₄ and CoWO₄/MWCNTs

The CoWO₄ nanomaterial was synthesized according to the reported methods [1]. First of all, 600 mg of CTAB was dissolved in a mixture consisting of ethanol (15 mL) and ultra-pure water (25 mL). This solution was divided into 2 equal parts solution (1) and solution (2). Dropwise additions of 10 mM of Co(NO₃)₃·6H₂O and 10 mM of NaWO₄·2H₂O were added to solution (1) and solution (2), respectively. After stirring solutions (1) and (2) for 30 minutes, the solution (2) was poured into solution (1) to get a violet-colored solution. After stirring the mixture for 1 hours, the subsequent mixture was then placed in 80 mL Teflon vessel inside the stainless-steel jacket under heating conditions in the air at 180°C for 12 hours. After completion of the reaction, material was centrifuged, further repeatedly rinsed using water and ethanol to remove all traces of

CTAB. Dry the product at 70°C for 12 hours in a vacuum drying oven. MWCNTs were chemically functionalized according to the reported methods with weeny modification [2].

To obtain CoWO₄/MWCNT composite, the synthesized CoWO₄ and MWCNTs were mixed in a mass ratio of 1:3 and were sonicated in water for 30 minutes, followed by centrifugation to obtain the product.

1.3. Fabrication of CoWO₄/MWCNTs/GCE

Bare GCE was firstly carefully polished with 0.05, 0.3 and 1 μm Al₂O₃ powder to obtain a mirror-like surface. 2 mg of CoWO₄/MWCNTs were dissolved completely in 1 mL of ultra-pure water and ultrasonicated for 10 minutes to form a uniform solution. For the fabrication of CoWO₄/MWCNTs/GCE, 10 μL of CoWO₄/MWCNTs suspension dropped onto the pre-cleaned electrode surface and dried at room temperature. The preparation process of CoWO₄/GCE and MWCNTs/GCE is similar to that of CoWO₄/MWCNTs/GCE.

1.4. Electrochemical measurement of CPZ

To investigate the peak current of CPZ, the phosphate buffer solution (PBS, 0.2M, pH = 7.0) was utilized as the supporting electrolyte. In the potential range of + 0.1 to + 0.8 V, the electrochemical detection behavior of CPZ was evaluated via Cyclic Voltammetry method with a conventional three-electrode system. The bare or modified GEC services as working electrode, platinum wire as counter electrode, and saturated calomel electrode as reference electrode. All measurements were taken at room temperature.

Reference

1. V. P. Singh, G. Singh, R. Patel, U. K. Gaur and M. Sharma, *J. Environ. Chem. Eng.*, 2023, **11**(6), 111208.
2. S. Abedini, A. A. Rafati and A. Ghaffarinejad, *New J Chem.*, 2022, **46**(42), 20403-20411.