

Electronic supplementary information for New Journal of Chemistry (NJC)

A procalcitonin photoelectrochemical immunosensor: NCQDs  
and  $\text{Sb}_2\text{S}_3$  co-sensitized hydrangea-shaped  $\text{WO}_3$  as matrix  
through layer-by-layer assembly

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## 1. Materials and reagents

ITO glass (resistivity 10  $\Omega$ /sq) was obtained from Zhuhai Kaivo Electronic Components Co., Ltd. China. Bovine serum albumin (BSA) was obtained from Sigma-Aldrich (Beijing, China). Diethylenetriaminepentaacetic acid (DTPA) was obtained from Aladdin Industrial Corporation. 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC) and N-hydroxysuccinimide (NHS) were obtained from Aladdin Reagent Database Inc (Shanghai, China). Phosphate buffered saline (PBS, 1/15 mol/L  $\text{KH}_2\text{PO}_4$  and 1/15 mol/L  $\text{Na}_2\text{HPO}_4$ ) containing AA was used as an electrolyte for the PEC measurements.

## 2. Apparatus

Electrochemical impedance spectroscopy (EIS) analysis was performed on an RST5200F electrochemical workstation (Zhengzhou Shiruisi Technology Co., Ltd, China) with a three-electrode system in a 5.0 mmol/L  $[\text{Fe}(\text{CN})_6]^{3-/4-}$  solution containing 0.10 mol/L KCl. Scanning electron microscope (SEM) images and energy dispersive spectrometry (EDS) were obtained using a field emission SEM (Zeiss, Germany). X-ray diffraction (XRD) patterns were collected on a D8 advance X-ray diffractometer (Bruker AXS, Germany). UV-vis spectra were obtained on a Shimadzu UV-3101PC spectrometer (Japan). Fourier transform infrared spectra (FTIR) were obtained on Shimadzu VERTEX 70 spectrometer.

3. The SEM image of NCQDs, the EDS image of  $\text{WO}_3/\text{NCQDs}/\text{Sb}_2\text{S}_3$ , and the band gap image of  $\text{Sb}_2\text{S}_3$

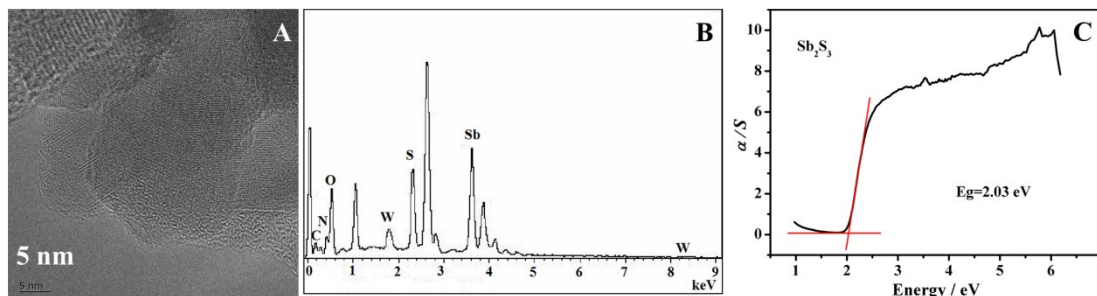


Fig. S1. (A)TEM image of NCQDs and (B) EDS image of  $\text{WO}_3/\text{NCQDs}/\text{Sb}_2\text{S}_3$ , (C) the band gap image of  $\text{Sb}_2\text{S}_3$ .

4. Optimization of experimental conditions

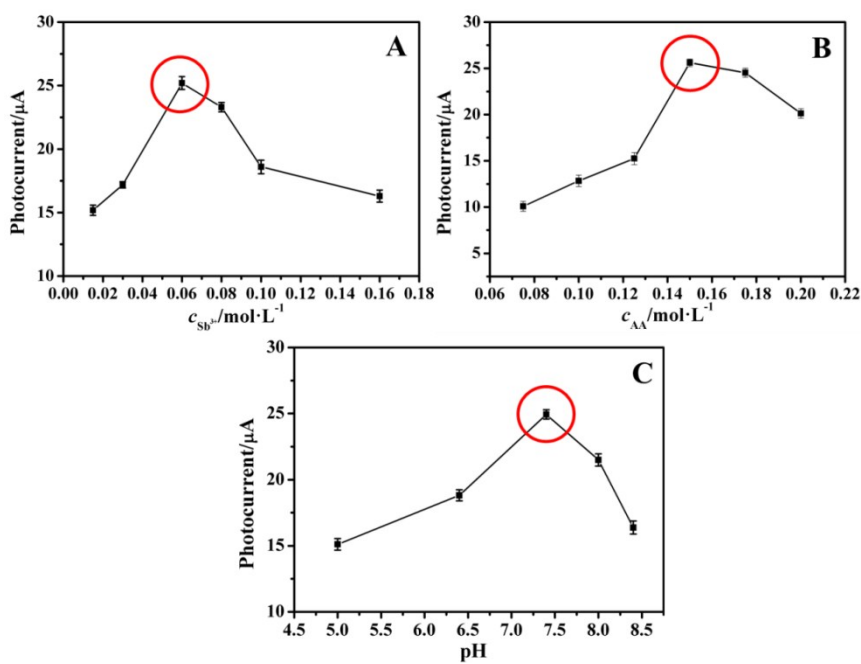


Fig. S2. Optimization of experimental conditions: (A)  $\text{SbCl}_3$  concentration, (B) AA concentration, (C) pH value, the applied potential was 0 V.

5. The specific data graph of RSD

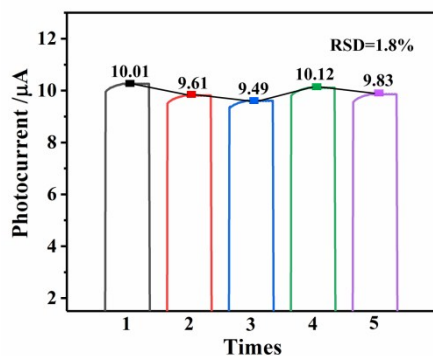


Fig. S3. The specific data graph of RSD

## 6. Simulation parameters of the equivalent circuit components

Table S1. Simulation parameters of the equivalent circuit components

Electrode	$R_s$ ( $\Omega$ )	$R_{et}$ ( $\Omega$ )	$C_{dl}$ (F)	$Z_w$
ITO	64.75	19.57	$3.944 \times 10^{-6}$	0.010460
ITO/ $\text{WO}_3$	63.33	33.82	$6.216 \times 10^{-6}$	0.012520
ITO/ $\text{WO}_3$ /NCQDs	64.79	35.64	$6.483 \times 10^{-6}$	0.011540
ITO/ $\text{WO}_3$ /NCQDs/ $\text{Sb}_2\text{S}_3$	66.34	136.2	$5.498 \times 10^{-6}$	0.005094
ITO/ $\text{WO}_3$ /NCQDs/ $\text{Sb}_2\text{S}_3$ /PDA	63.09	152.2	$9.308 \times 10^{-6}$	0.008395
ITO/ $\text{WO}_3$ /NCQDs/ $\text{Sb}_2\text{S}_3$ /PDA/anti-PCT	64.65	251.1	$5.193 \times 10^{-6}$	0.003823
ITO/ $\text{WO}_3$ /NCQDs/ $\text{Sb}_2\text{S}_3$ /PDA/anti-PCT/BSA	65.99	456.0	$8.788 \times 10^{-6}$	0.004481
ITO/ $\text{WO}_3$ /NCQDs/ $\text{Sb}_2\text{S}_3$ /PDA/anti-PCT/BSA/PCT	63.98	580.6	$9.730 \times 10^{-6}$	0.003661