Selective and sensitive visible-light-prompt photoelectrochemical sensor of paracetamol based on Bi_2WO_6 modified with Bi and copper sulfide

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1. Photocurrent responses and EIS of all materials

Fig.S1A shows the photocurrent density time (I-t) curves of all materials under visible-light irradiation 0.1 M Na_2SO_4. For Fig.S1A, CuS/Bi_2WO_6-6% has the highest photocurrent; Electrochemical impedance spectroscopy (EIS) is used tocharacterize electron transfer properties of different modified electrodes. Fig. S1B shows the EIS spectra of all materials. The results show that the impedance of CuS/Bi_2WO_6-6% is significantly smaller than that of CuS/Bi_2WO_6-3% and CuS/Bi_2WO_6-9%. This shows that CuS/Bi_2WO_6-6% has good electrical conductivity, which is consistent with i-t test results in Fig. S1A. Therefore, CuS/Bi_2WO_6-6% was selected for the next compound study.

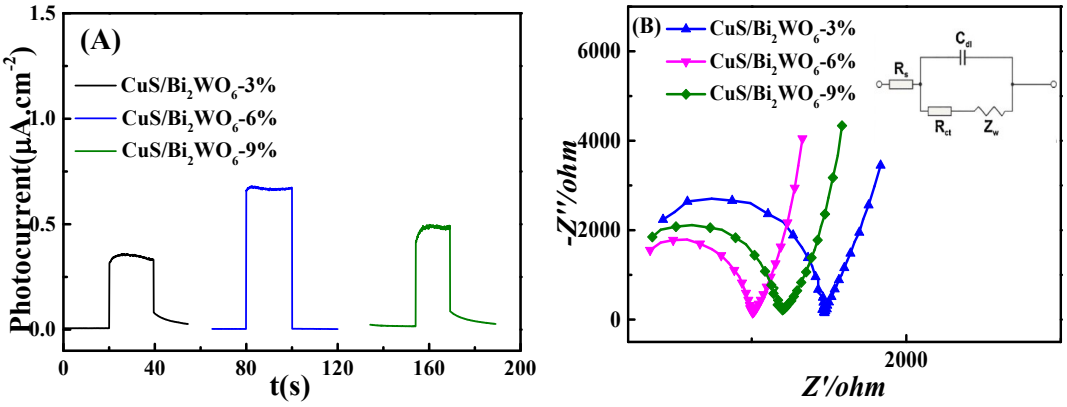

Fig. S1 (A) Photocurrent responses and (B) EIS of CuS/Bi_2WO_6-X%.

2. Optical test of the Bi_2MoO_6 and CuS composites.

The band gap energies of the as-prepared samples could be calculated by the following formula:

$$\alpha hv = A(vh - E_g)^{n/2} \qquad (1)$$

In the equation, α, h, v, A, and n, denote the absorption coefficient, the Planck's constant, the incident light frequency, the constant, and the optical transition type, respectively. As shown in Fig. S3A-B, CuS and Bi_2WO_6 are all direct band gap semiconductors, so their n values are all 1. Therefore, the band gap widths of CuS and Bi_2WO_6 are 2.18 eV and 2.82 eV, respectively.

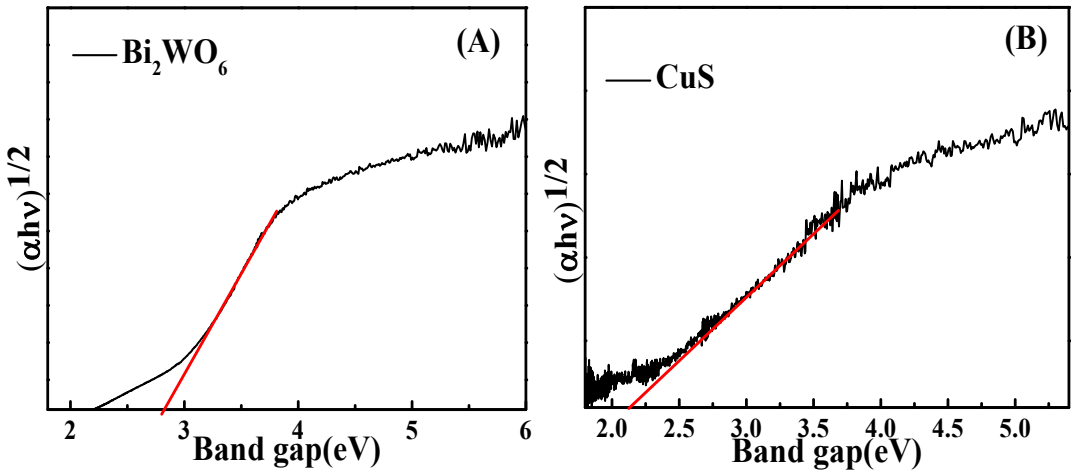

Fig. S2 Plots of (αhv) n/2 vs. photon energy (hv) for Bi_2WO_6 (A) and CuS (B).

3. Stability tests of PEC sensor base on Bi-CuS/Bi_2WO_6-6% towards PA

In order to further study the long-term stability of PA detection based on Bi-CuS/Bi_2WO_6-6%, we compared the current changes of the sensors within 14 days, as shown in Fig. S3A, using the same every two days PA was measured by Bi-CuS/Bi_2WO_6-6%. The response photocurrent of the Bi-CuS/Bi_2WO_6-6% to PA was retained after 14 days. These results show that the sensor based on Bi-CuS/Bi_2WO_6-6% has excellent stability. The reproducibility of Bi-CuS/Bi_2WO_6-6% was tested by detecting the variation of PA photocurrent with five parallel electrodes (Fig. S3B). The photocurrent of the five parallel electrodes did not show any significant change, indicating that it has good reproducibility.

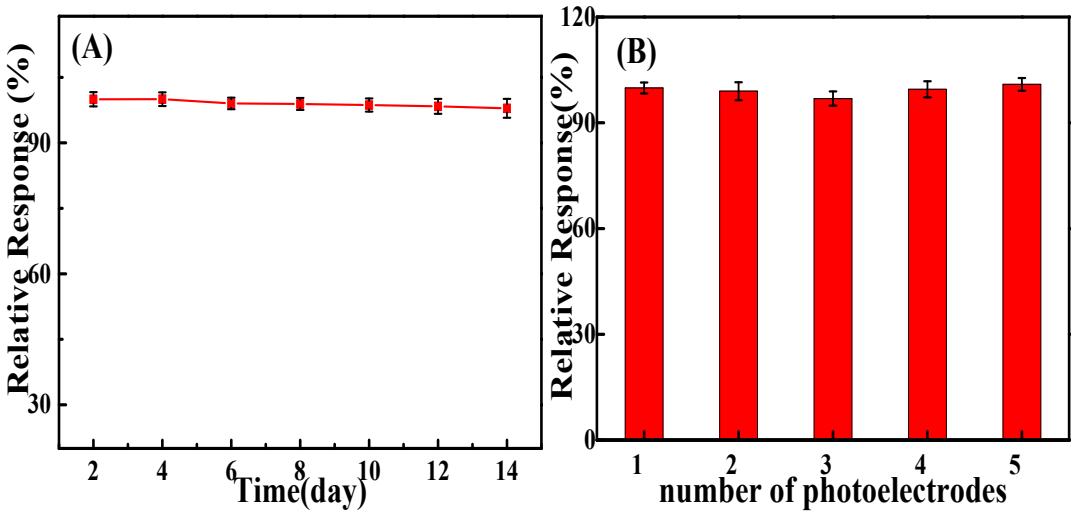

Fig. S3 (A) Stability test of PEC sensor; (B) The current responses of five parallel Bi-CuS/Bi_2WO_6-6% photoelectrodes towards PA

Table S1 Comparison of the major characteristics of several reported methods used in detecting PA.

Method	Materials	Linear Range	LOD	Ref.
Differential Pulse Voltammetry	Pd/GO/GCE	0.005-0.5 μM 0.5-80.0 μM	2.2 nM	1
Electrochemical	MWCNT/Bi_2O_3	0.02-28 μM	0.0052 μM	2
Electrochemical	Solanum melongena polyphenol oxidase	20-200 μM	5 μM	3
PEC	FeNGQDs/BiOBr	0.01-2 μM	3.33 nM	4
PEC	Bi-CuS/Bi_2WO_6-6%	0.01-60 μM	2.12 nM	This Work

References

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