Photocatalytic Self-Cleaning Electrochemical Sensor for 4-Nitrophenol detection

Jiabing Chen^{1,2}, Youluan Lu¹, Leshu Huang¹, Zhen Shi², Yin Zheng^{1,2,*}, Xinjian Song^{2,*},
Chenyi Wu², Zaikun Wu³

¹ Hubei Key Laboratory of Biological Resources Protection and Utilization, Hubei, 445000, China

² Department of Chemistry, Hubei Minzu University, Enshi, Hubei 445000, China

³ School of Chemical Engineering & Pharmacy, Wuhan Institute of Technology, Wuhan, Hubei 430073, China

*E-mail: zhengyin0617@163.com ; whxjsong@163.com

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Electrode fouling and passivation are the main reasons for attenuated the electrochemistry signals. In this work, a renewable electrode for determination of 4-nitrophenol (4-NP) which not only has excellent detection signals but also can be photo-catalytically refreshed to remain the selectivity and sensitivity was been created. The GO/TiO₂-CuTCPP composite material was characterized by Transmission electron microscopy (TEM), X-ray diffraction (XRD), electrochemical impedance spectroscopy (EIS), X-ray photoelectron spectroscopy (XPS), Fourier transform infrared spectra (FT-IR). The electrochemical behavior of 4-NP on GO/TiO₂-CuTCPP/GCE was investigated by cyclic voltammetry (CV) and square wave voltammetry (SWV) in 0.2 mol/L acetic acid buffer at pH 5.5. The result showed that the GO/TiO₂-CuTCPP/GCE exhibits the higher peak current and photo-catalytic activity to prone the self-cleaning ability. Under the optimal conditions, the oxidation current peak values linearly with the concentration of 4-NP ranging from 0.5 to 100 µmol/L, and the detection limit was 0.16 µmol/L (S/N = 3). Moreover, the sensors showed excellent renewable ability under visible light without damaging the electrode microstructure and attenuating electrochemical signals.

Keywords: graphene oxide, titanium dioxide, electrochemical sensor

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