Supplementary Information

Wireless Single-electrode Electrochemiluminescence Device Based on Wireless Reverse Charging or On-The-Go USB Transmission for Multiplex Analysis

Chengda Meng^{a, b}, Dmytro Viktorovych Snizhko^{a, c}, Yuriy Tymofiiovych Zholudov^{a, c}, Wei Zhang^{a, b}, Yiran Guan^{a,b}, Yu Tian ^{a, b, *}, Guobao Xu^{a, b, *}

 ^a State Key Laboratory of Electroanalytical Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street, Changchun 130022, China
^b School of Applied Chemistry and Engineering, University of Science and Technology of China, Hefei 230026, China
^c Laboratory of Analytical Optochemotronics, Kharkiv National University of Radio Electronics, Kharkiv 61166, Ukraine
* Corresponding author.
E-mail addresses: guobaoxu@ciac.ac.cn (G. Xu); tianyu@ciac.ac.cn (Y. Tian)

1. Experimental Section

1.1. Materials and Reagents. Luminol is provided by Beijing Chemical Reagent Company (Beijing, China). Hydrogen peroxide (H_2O_2) is provided by Beijing Chemical Works (Beijing, China). Uric acid was bought from Sangon Biotech Co., Ltd. (Shanghai, China). Uricase was obtained from J&K Scientific Ltd. (Beijing, China). The fresh solution of 10 mM luminol was prepared by dissolving a certain amount of luminol in 0.1 M NaOH solution. The H_2O_2 solution (wt% = 30%) was diluted with double distilled water to different concentrations before use. UA and uricase (10 units/mg) were dissolved in 0.1 M carbonate buffer solution (CBS). All chemicals and reagents were of analytical grade and used as received.

1.2. Apparatus. The detection of H_2O_2 and UA was done in a self-made small lightlight box. As shown in Figure 1, ECL images are taken in the professional mode of Huawei P20 smartphone. The wireless transmission module is customized by Zhongshan Honglan Electronics Co., Ltd. The working voltage of the device is 5 V and the rated power is 2 W. The spot photos are analyzed by using the self-developed mobile application for intensity analysis, and the relative light unit (RLU) measurements. A cutting plotter (Shangke H1380) from Jinan Shangke Trade and Business Co., Ltd. was used to make patterns on a plastic sticker. An automatic 96-well plate washer (Rayto-3100) was used in the procedure of washing the electrode.

1.3. Assay Procedure of ECL Detection of Hydrogen Peroxide. 10 μ L of ECL solution was added into each cell, including 70% 0.1 M carbonate buffer (pH=10), 10% 2 mM luminol, 10% 1 mM H₂O₂ and 10% (v/v) Triton X-100. Using Huawei P20 smartphone to capture ECL images in professional mode, the exposure time is 15 s and the delay time is set to 5 s.

2. Supporting figures



Fig. S1 Oscilloscope image of receiver voltage output applied to the SEES.



Fig. S2 (A) Fabrication procedure, (B) principle of potential distribution in SEES (orange line)* and (C) equivalent electrical circuit of the carbon ink SEES. The voltage between each reaction cell can be estimated by the following equation: $E_c = E_{tot} \times L_c / L_{tot}$. L_c and L_{tot} are the length of a single reaction cell and the length of a whole electrode, respectively. Linearity of potential distribution in SEES is linear if conductivity of solution significantly smaller than conductivity of electrode zone corresponded to the cell, so $I_e >> I_s$. In general case, the potential distribution curve will be a combination of linear fragments corresponded to zones. Since the diameter of all the individual reaction cells are the same, the potential difference between the two ends of all the single reaction cells is also the same, and thus the electrochemical reaction are essentially the same for all the single reaction cells.



Fig. S3 Effect of luminol concentration on relative ECL intensity. Experimental conditions: different concentrations of luminol in CBS buffer (pH 10), and 100 μ M H₂O₂. Effect of luminol concentration on relative ECL intensity. Experimental conditions: different concentrations of luminol in CBS buffer (pH 10), and 100 μ M H₂O₂.



Fig. S4 Optimization of condition for H_2O_2 detection. (A) Effect of pH, (B) effect of voltage. Experimental condition: 200 μ M luminol and 100 μ M H_2O_2 in CBS (pH=10).



Fig. S5 Selectivity of this method for H_2O_2 detection. Concentrations of interferences are all 100 μ M, 200 μ M luminol and 100 μ M H_2O_2 in each group.



Fig. S6 Schematic demonstration of UA detection.



Fig. S7 Optimization of condition for UA detection. (A) Effect of pH of catalytic reaction, (B) effect of reaction time. Experimental condition: 200 μ M luminol, 100 μ M UA and in CBS.



Fig. S8 Calibration curve of ECL intensity vs concentration of UA. Experimental conditions: different concentration of UA (5-100 μ M) and 200 μ g·mL⁻¹ uricase are mixed in PBS buffer (pH=10) for 10 minutes. And then the mixed solution was added into 200 μ M luminol in CBS buffer (pH=10).



Fig. S9 Selectivity of UA detection. The concentration of interferents is 100 μ M. And one group has no interferences (CBS only). Experimental conditions: different kinds of interferences and UA (100 μ M) and 100 μ g/mL uricase are mixed in PBS buffer (pH=10) for 10 minutes, and then the mixed solution was added into 200 μ M luminol in CBS buffer (pH=10).

Materials	Methods	Linear ranges (µM)	LOD (µM)	Ref.
FeMoOv	Electrochemistry	1-100	0.81	1
Fe ₂ (MoO ₄) ₃ -F	Colorimetry	1-30	0.70	2
ABEI/AuNPs/CoS ₂ NWs	Chemiluminescence	1-100	0.30	3
MSN/TPE-CS@AgNPs	Fluorescence	1-300	0.64	4
L012 Modified Electrodes	Electrochemiluminescence	10-5000	4.3	5
Luminol	WPT-ECL	1-100	0.73	Present work

Table S1. Comparison of different methods for H_2O_2 detection

Table S2.	Comparison	of different	methods	for UA	detection
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Materials	Methods	Linear ranges (µM)	LOD (µM)	Ref.
Ni/RGO/CCF	Electrochemisty	10-60	5.08	6
CCA-YH	Colorimetry	5-800	0.58	7
CuCo PBA	Chemiluminescence	0.3-5	0.16	8
Tb ^{III} -dtpa-bis(2,6-diaminopurine)	Fluorescence	10-50	5.80	9
MWCBP	Electrochemiluminescence	10-100 25-1000	4.9	10
Luminol	WPT-ECL	5-100	1.32	Present work

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