Supporting information

A nucleic acid dye-enhanced electrochemical biosensor for the label-free detection of Hg^{2+} based on gold nanoparticle modified disposable screen-printed electrode

Wei Liu,[a] Yunqi Wang,[a] Fangfang Sheng,[a] Bing Wan,[a] Gangxu Tang,[b] Shuxia Xu [a c]*

a College of Environment and Ecology, Chengdu University of Technology, Chengdu 610059, P. R. China

b College of Material and Chemistry & Chemical Engineering, Chengdu University of Technology, Chengdu 610059, P. R. China

c State Environmental Protection Key Laboratory of Synergetic Control and Joint Remediation for Soil & Water Pollution, Chengdu University of Technology, Chengdu 610059, P. R. China

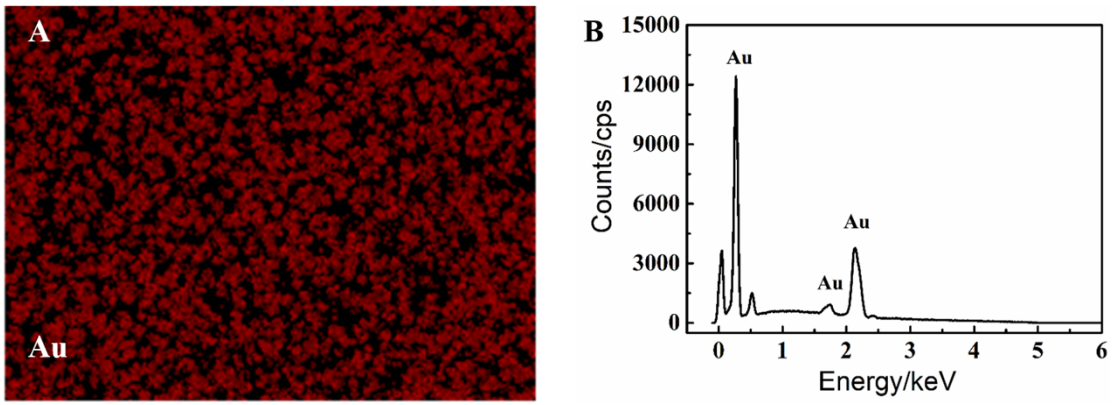


Fig S1 (A) The elemental mapping images of the AuNPs modified SPCE surface. (B) EDS pattern of the AuNPs modified SPCE surface.

Table S1 Variation of CV and EIS values of electrode surface under different modification steps.

Steps	CV (μA)	EIS (Ω)
AuNPs/ SPCE	63.24	339.6
DNA-c/ AuNPs/ SPCE	42.74	895.9
MCH/ DNA-c/ AuNPs/ SPCE	33.53	2472
Hg^{2+}/ MCH/ DNA-c/ AuNPs/ SPCE	35.60	2015
GelRed/ Hg^{2+}/ MCH/ DNA-c/ AuNPs/ SPCE	57.25	610.2

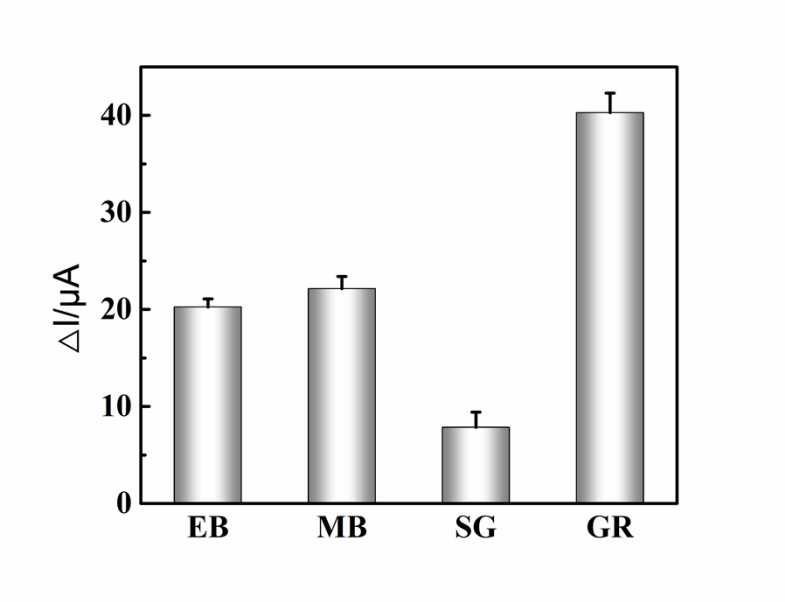


Fig S2 DPV signal responses of the electrochemical sensor with different dyes, EB (ethidium bromide), 2μM; MB (methylene blue), 2 μM; SG (SYBR Green I), 2×; GelRed, 2×. Error bars represented the standard deviation of three parallel experiments.

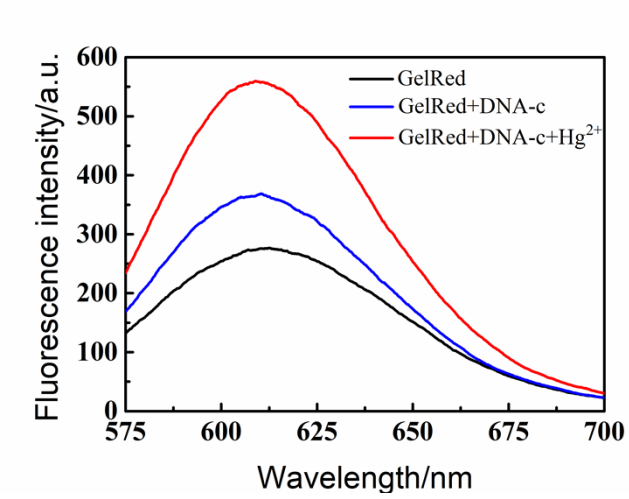


Fig S3 Fluorescence spectra of GelRed, GelRed+DNA-c and GelRed + DNA-c + Hg^{2+}. (Concentration of Hg^{2+} =500 nM, DNA-c=100 nM, GelRed=2×, excitation wavelength was 530 nm)

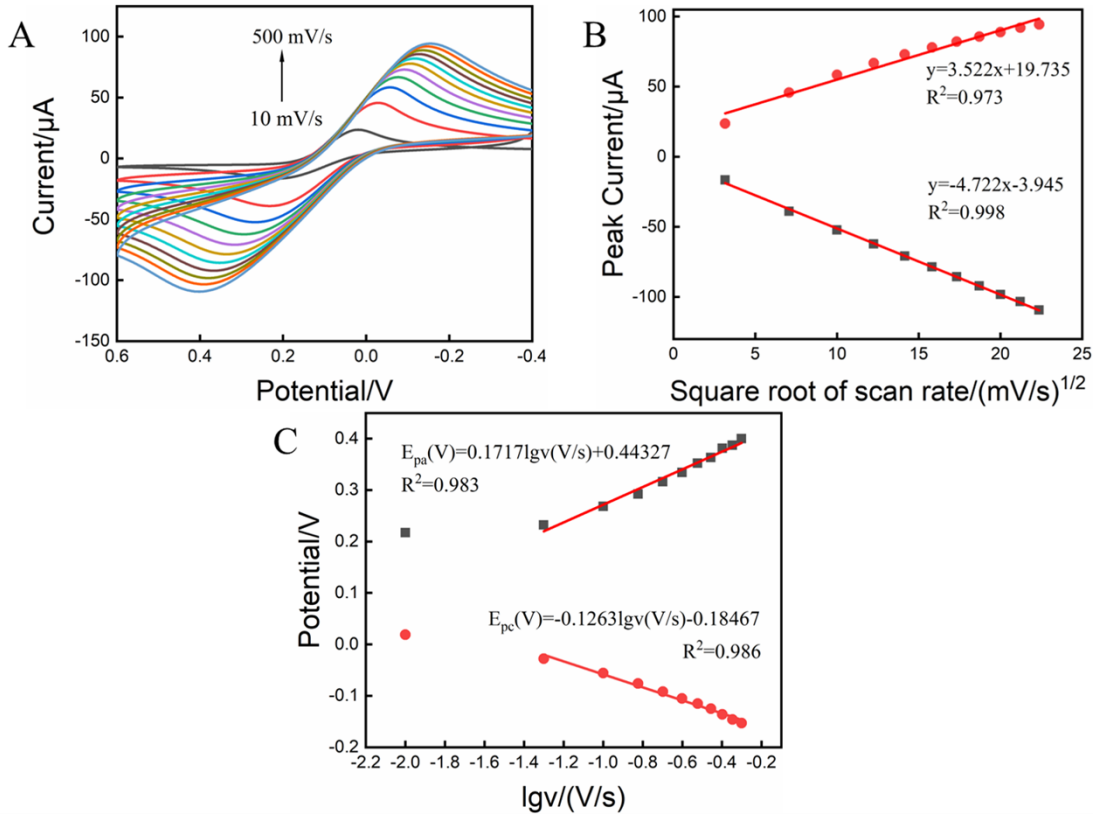


Fig S4 (A) CVs of electrochemical sensors at different scan rates; (B) the linear relationship between peak current and the square root of scanning speed； (C) the linear relationship between the anodic and cathodic peak potentials versus logarithm of scan rate.

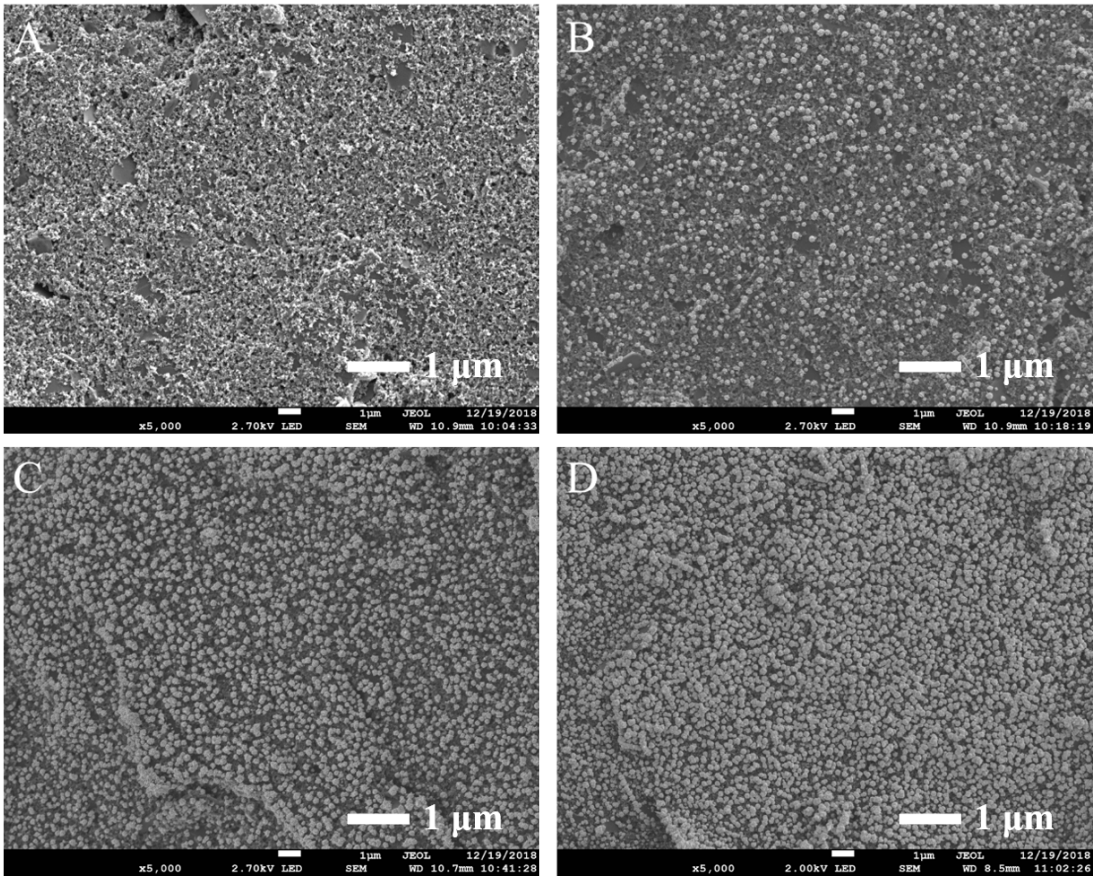


Fig S5 The SEM images of the electrode surfaces with different electrodeposition times, (A) unmodified SPCE;(B)50 s; (C) 150 s; (D) 300 s.

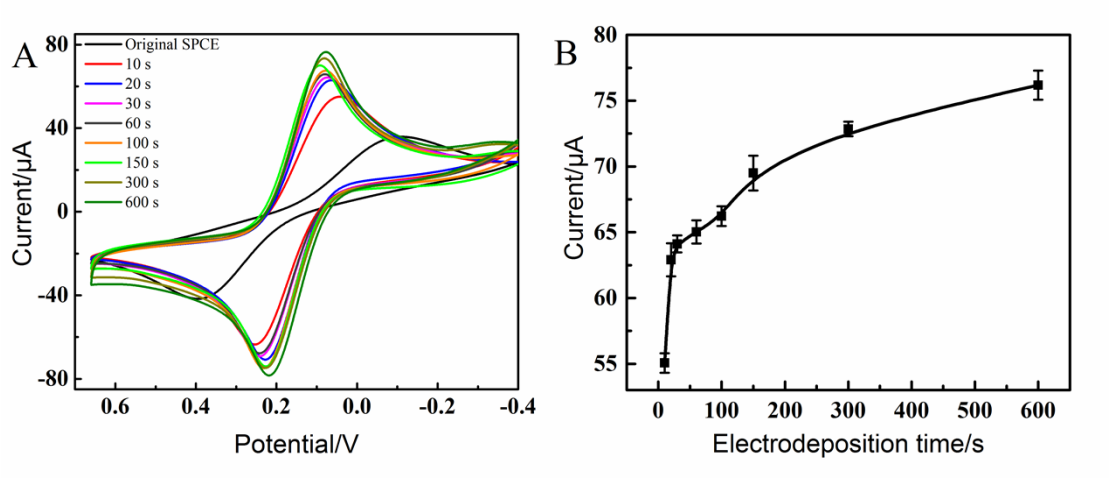
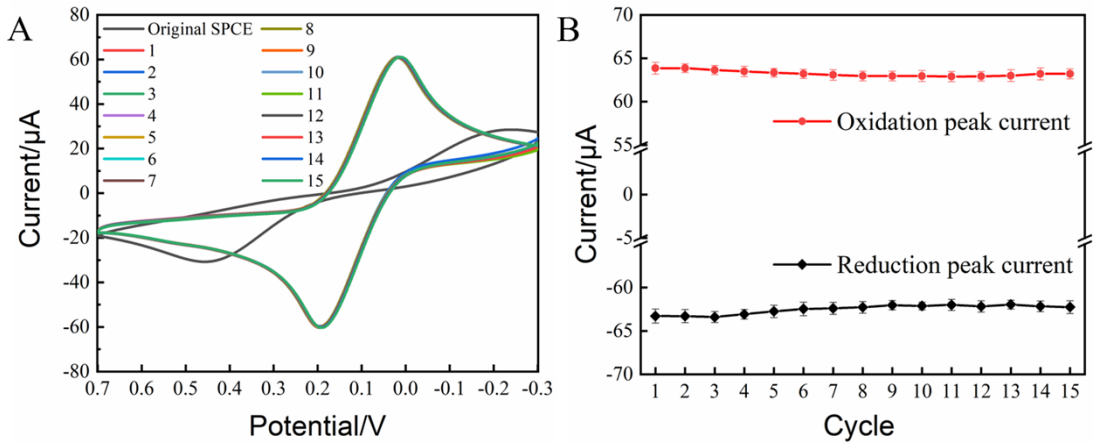


Fig S6 The (A) CVs and (B) electrochemical response of electrodes in $[Fe(CN)_6]^{3-/4-}$ (evaluated through the DPVs)with different electrodeposition times. Error bars represented the standard deviation of three parallel experiments.



57

58

59 **Fig S7** (A) CVs and (B) redox peak current of the AuNPs modified SPCE after succsive

60 fifiteen cycles.

61

62

63 **Table S2** Comparison of different Hg^{2+}detection methods

Method	Liner range	Limit of detection	Ref.
fluorescence	5–250 nM	1.95 nM	1
fluorescence	0.1-50 μM	19.0 nM	2
fluorescence	50- 1200 nM	20.0 nM	3
colorimetry	2-100 nM	14.23 nM	4
colorimetriy	2-28 nM	0.032 nM	5
SERS	0.1-1000 nM	0.1 nM	6
SERS	0.1-10000 nM	0.1 nM	7
Electrochemistry	0.1- 10 nM	0.028 nM	8
Electrochemistry	0.1-130 nM	0.03 nM	9
Electrochemitry	0.05-100 nM	0.024 nM	10
Electrochemitry	0.1-500 nM	0.04 nM	This work

64

References

1 J. Wang, F. Song, Y. Ai, S. Hu, Z. Huang and W. Zhong, *J. Lumin.*, 2019, **34**, 205-211.

2 S. Liao, X. Li, H. Yang and X. Chen, *Talanta*, 2019, **194**, 554-562.

3 P. E. Hande, A. B. Samui and P. S. Kulkarni, *Actuators B Chem.*, 2017, **246**, 597-605.

4 P. Borthakur, G. Darabdhara, M. R. Das, R. Boukherroub and S. Szunerits, *Sens. Actuators B Chem.*,2017, **244**, 684-692.

5 J. Hai, F. Chen, J. Su, F. Xu and B. Wang, *Anal. Chem.*, 2018, **90**, 4909-4915.

6 L. Qi, M. Xiao, F. Wang, L. Wang, W. Ji, T. Man, A. Aldalbahi, M. Naziruddin Khan, G. Periyasami, M. Rahaman, A. Alrohaili, X. Qu, H. Pei, C. Wang and L Li, *Nanoscale*, 2017, **9**, 14184-14191.

7 Q. Zou, X. Li, T. Xue, J. Zheng and Q. Su, *Talanta*, 2019, **195**, 497-505.

8 A. L. Suherman, K. Ngamchuea, E. E. L. Tanner, S. V. Sokolov, J. Holter, N. P. Young and R. G. Compton RG, *Anal. Chem.*, 2017, **89**, 7166-7173.

9 H. Wang, Y. Zhang, H. Ma, X. Ren, Y. Wang, Y. Zhang and Q. Wei, *Biosens. Bioelectron.*, 2016, **86**, 907-912.

10 C. Mei, D. Lin, C. Fan, A. Liu, S. Wang and J. Wang, *Biosens. Bioelectron.*, 2016, **80**, 105-110.