

Supporting information

Label-free electrochemical Immunosensor Based on One-Step Electrochemical Deposition of AuNP-RGO nanocomposites for Detection of Endometriosis marker CA 125

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1. EXPERIMENTAL SECTION

1.1. Characterization

Morphology and elemental analysis of prepared composites were studied by Field Emission-Scanning Electron Microscopy (FE-SEM, JEOL JSM-7610F). All samples were deposited onto the indium tin oxide (ITO) glass with the optimal procedure. The crystalline structure of composite was studied by X-ray diffraction (XRD) using PANalytical X'Pert PRO diffractometer with the Cu K α 1 radiation ($\lambda = 1.540598$ nm). Raman spectra were monitored Dongwoo 500i model spectrometer analyzed by as-prepared composite (acquired at a resolution of 1.0 cm^{-1} , acquisition time of 30 s). X-ray Photoelectron Spectroscopy (XPS) study were analyzed with an ESCA chemical analysis electron spectrometer (JEOL Ltd., Japan, JPS-9030). SP150 Bio-Logic Science Instrument (electrochemical workstation, France) was used for electrochemical analysis. The electrochemical cell involved in a three-electrode system. The platinum (Pt) wire as a counter electrode, glassy carbon electrode (GCE) was a working electrode, and saturated Ag/AgCl electrode, and Cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and square wave voltammetry (SWV) techniques were performed in the presence of 0.1 M KCl/5 mM $[\text{Fe}(\text{CN})_6]^{3-/4-}$ (pH 7.4, 0.1 PBS) mixture as a redox probe.

1.2. Graphene oxide synthesis. Graphene oxide (GO) prepared by modified Hummer's method.^{S1} Typically, 2.0 g GR, 2.0 g NaNO_3 , and 50 mL concentrated H_2SO_4 were successively added into a beaker and stirred for 30 min in an ice bath. Then, 6.0 g KMnO_4 was added into the above mixture was stirred for 5h. The reaction mixture was stirred for 30 min at 35°C after which is diluted with 60 mL of MP- H_2O is added and stirred below 100°C and kept for 30 min. Then the reaction mixture terminated by 300 mL of MP- H_2O and 20 mL of H_2O_2 . After vigorous stirring for 60 min, the final product was centrifuged by repeated washing with MP- H_2O until the pH 7.0.

Figure caption

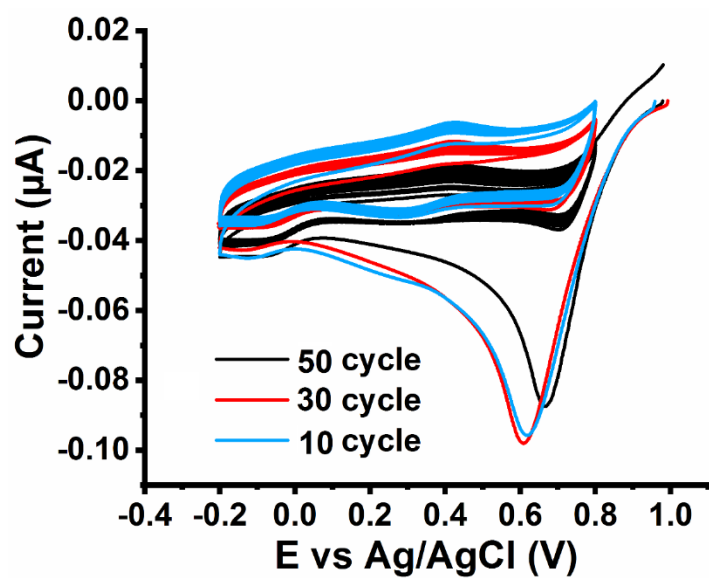


Figure S1. 10, 30, and 50 cycles electrochemical deposition of AuNP/RGO.

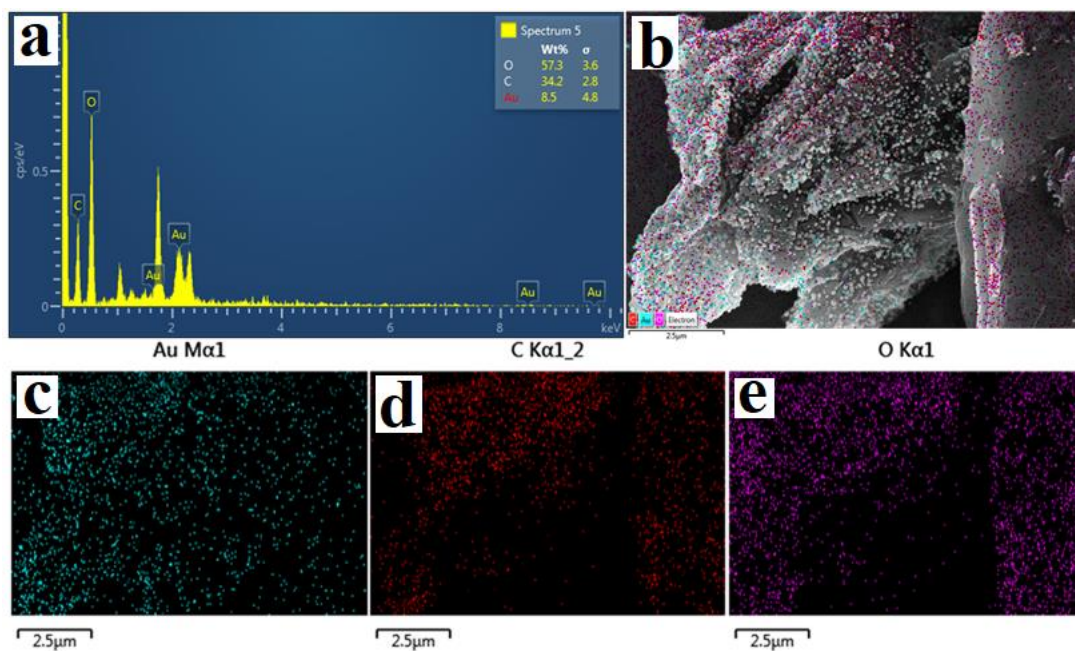


Figure S2. (a) SEM-EDX analysis (insert; weight percentages), (b-e) mapping analysis of Au, C, and O elements, respectively.

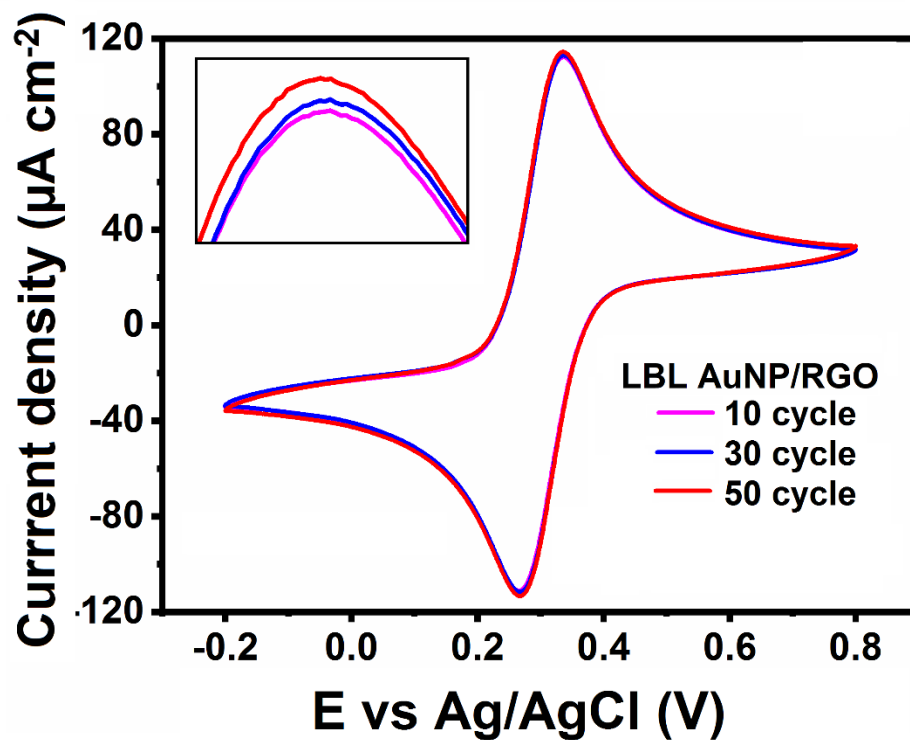


Figure S3. CV response of different cycles 10, 30, and 50 cycles of 50-AuNP/RGO (insert: extended view). All experiment was examined by 0.1 M KCl/5 mM $[\text{Fe}(\text{CN})_6]^{3-/4-}$ (pH 7.4, 0.1 M PBS).

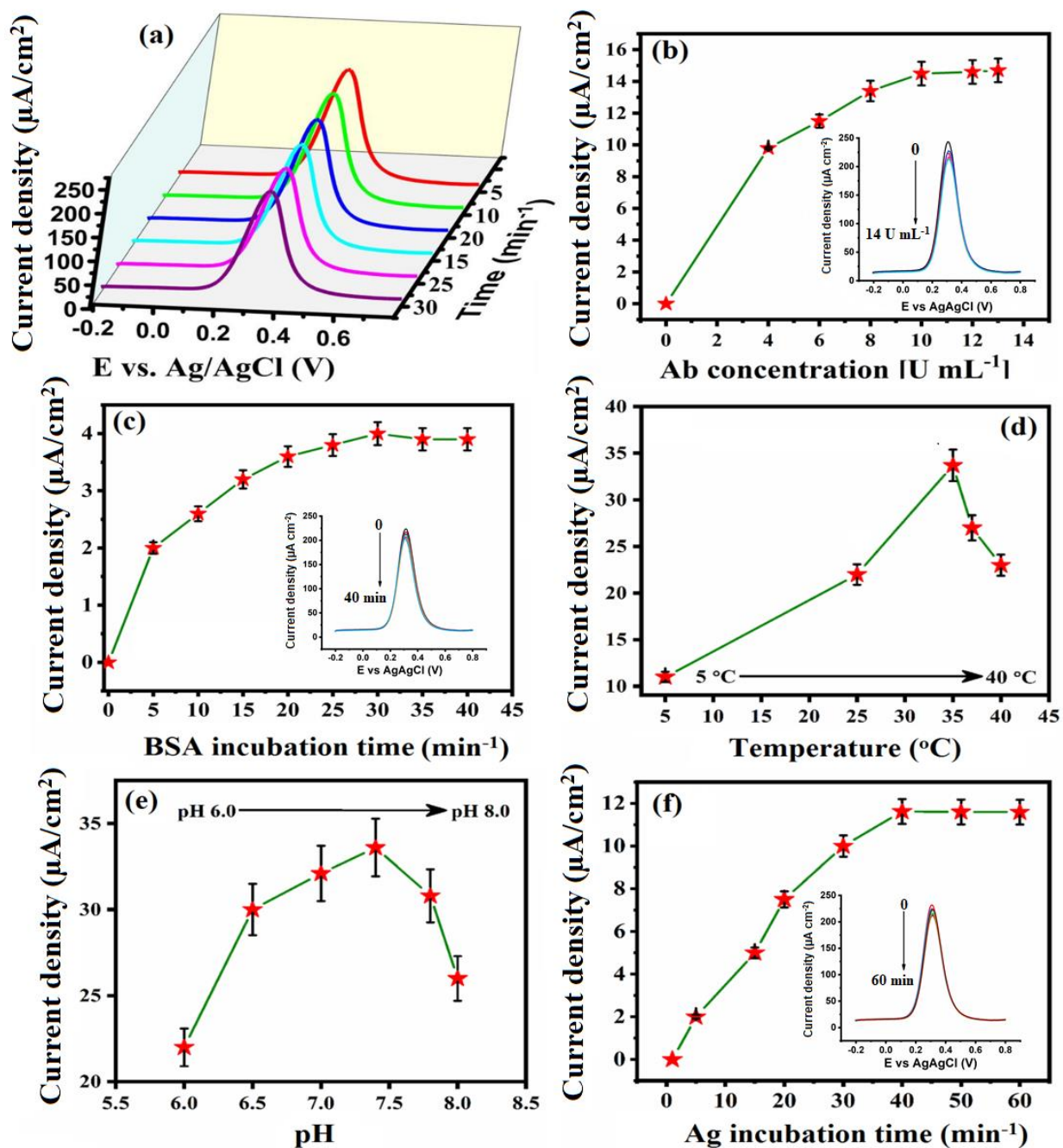


Figure S4. (a) Effect of incubation time, (b) Effect of the immobilization Ab concentration, (c) effect of BSA incubation time in the presence of 10 U mL^{-1} , (d) Incubation temperature, (e) effect of pH, and (f) incubation time of Ag. Inset corresponding SWV curve. All immunosensor signals respond to 10 U mL^{-1} CA125 in 0.05 MPBS containing $5 \text{ mm} [\text{Fe}(\text{CN})_6]^{3-/4-}/0.1 \text{ M KCl}$. Error bar = RSD ($n=3$).

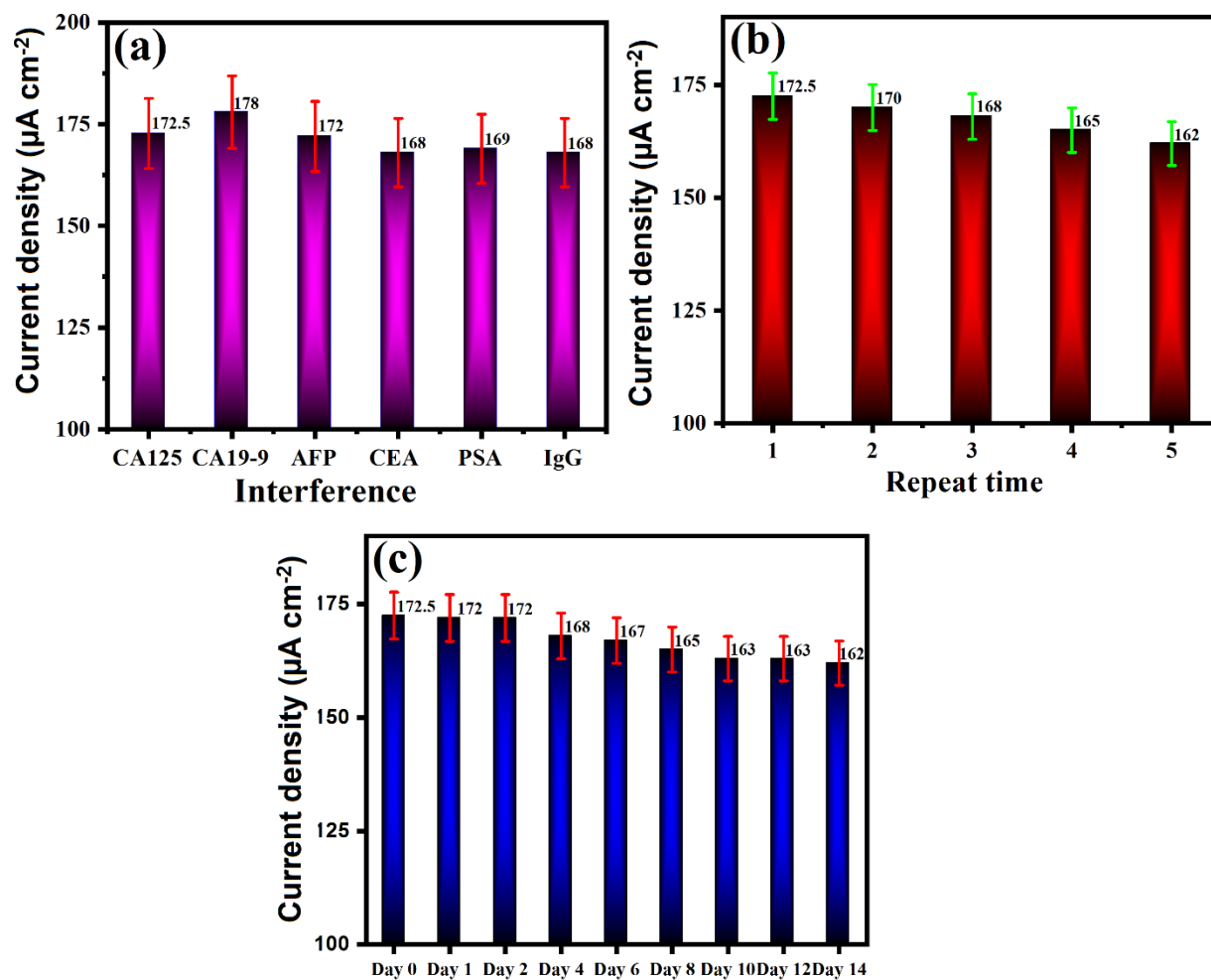


Figure S5. (a) Effect of interference, (b) effect of repeatability, (c) effect of storage stability, signal response of the immunosensor to 10 U mL⁻¹ CA125 in 0.1 PBS M (pH 7.4) solution containing in 5 mm [Fe(CN)₆]^{3-/4-}/0.1 M KCl. Error bar = RSD (n=3).

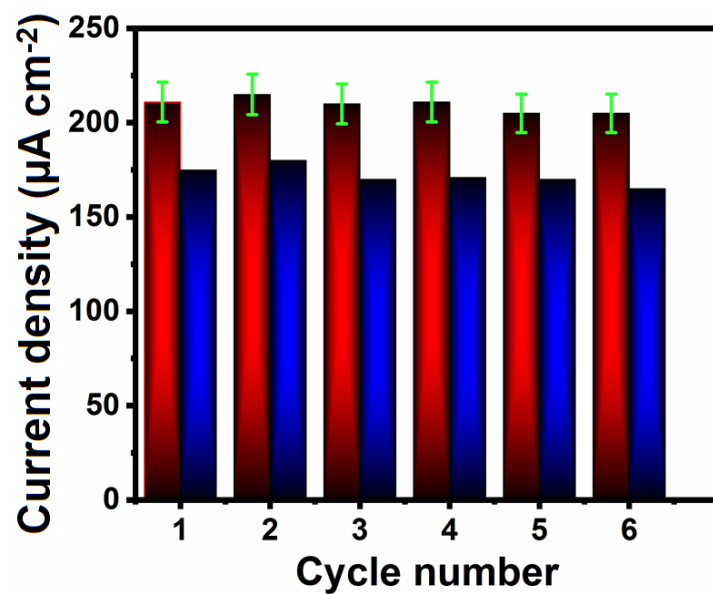


Figure S6. Effect of regeneration, signal response of the immunosensor to 10 U mL^{-1} CA125 in $0.1 \text{ M PBS (pH 7.4)}$ solution is containing in $5 \text{ mm } [\text{Fe}(\text{CN})_6]^{3-/4-}/0.1 \text{ M KCl}$. Error bar = RSD ($n=3$).

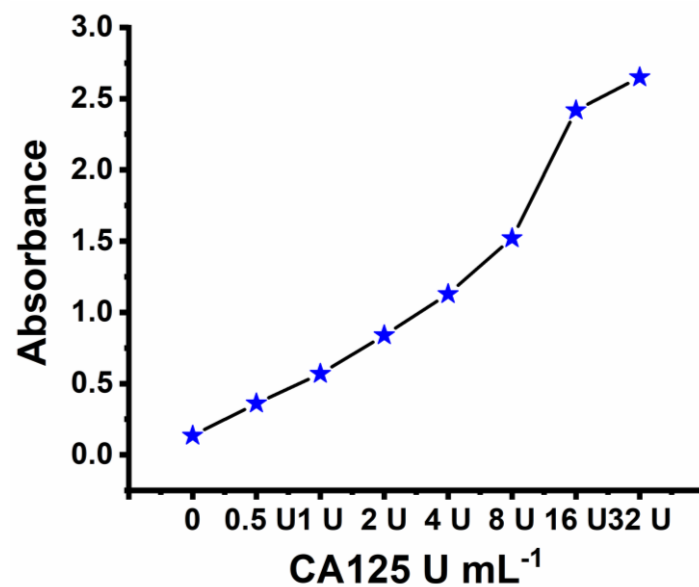


Figure S7. Standard inhibition curve for the indirect ELISA. Serum sample was 2-fold dilution

References

S1. Li, Y.; Cui, R.; Huang, H.; Dong, J.; Liu, B.; Zhao, D.; Wang, J.; Wang, D.; Yuan, H.; Guo, X. High Performance Determination of Pb^{2+} in Water by 2, 4-Dithiobiuret-Reduced Graphene Oxide Composite with Wide Linear Range and Low Detection Limit. *Anal. Chim. Acta* **2020**.