

Supplementary Materials

An electrochemical aptasensor for detection of lead ions using a screen-printed carbon electrode modified with gold/polypyrrole nanocomposite and toluidine blue as a redox probe

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S1 Synthesis of AuNPs

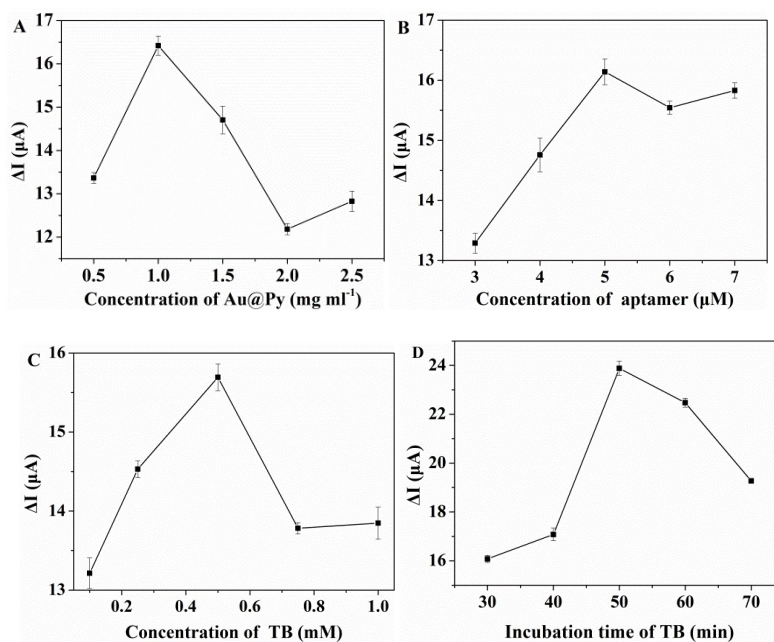
100 ml of 1 % (w/w) HAuCl₄ solutions was heated until boiling. After, 3.5 mL of 1 % sodium citrate solution was added quickly into the boiling aqueous solution with vigorous stirring and heating. The solution was kept boiling with continuous stirring until the solution color from pale to bright red and then the heating stopped. The solutions were stirred continuously until it cooled down to room temperature, centrifuged and washed three times with ultrapure water. Finally, the solution was diluted with 100 mL of water and filtered by 0.22 um of microporous membrane. The last solution was stored in the refrigerator at 4 °C.

S2 The synthesis of oligomer polypyrrole

Briefly, 1 mL of pyrrole monomer was added to 35 mL HCl solution (0.1 M) and stirred for 30 min. Then 3.51 g of ammonium persulphate (APS, (NH₄)₂S₂O₈) was resolved in 0.1 M HCl solution (20 mL), then the solution was added dropwise to the pyrroles monmer solution continuous stirring 12 hours at room temperature to completely polymerize the pyrrole. Finally, the precipitated solution was centrifuged and washed three times with ultrapure water, and then dried under vacuum at 60 °C for 24 h.

S3 Optimization of experimental conditions

As shown in Fig. 1A, with the increase of the concentration of Au@Py from 0.5 to 2.5 mg·mL⁻¹, the ΔI increased and reached the maximum at 1.0 mg·mL⁻¹, suggesting that 1 mg·mL⁻¹ of conduction material was sufficient for the reaction. Thus, 1 mg·mL⁻¹ was selected as the suitable concentration of Au@Py material. The aptamer with different concentrations was optimized (Fig. 1B), and the ΔI kept invariable (about 16 μ A) above the concentration of 5 μ M aptamer. Therefore, 5 μ M was selected as the suitable aptamer concentration. As shown in Fig. 1C, the concentration of TB was optimized. With the increased the concentration of TB, the current signal increased and reached the maximum at 0.5mM, indicating that 0.5 mM of TB was the most suitable concentration of TB in the below experiments. Since the incubation time of TB with cs-DNA can influence the current signal, it is necessary to investigate the optimal TB's incubation time values of working solutions. As shown in Fig. 1D, the ΔI reached the maximum value when the incubation time of TB was 50 mins, thus 50 mins was chosen as the most appropriate the incubation time of TB. The influence of the incubation time of the biosensor with Pb²⁺ was also investigated. As shown in Fig. 1E, above 25 mins, the ΔI signal almost kept a constant, suggesting that 25 mins was suitable as the incubating time of biosensor and Pb²⁺. Hence, the incubating of 25 mins was adopted in the following work.



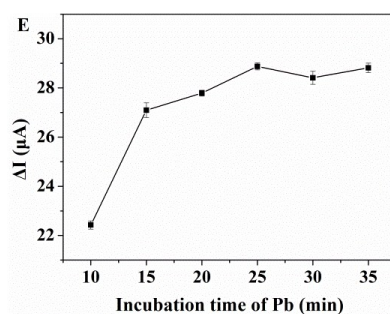


Fig.S1 (A) Concentration of Au@Py, (B) Concentration of aptamer, (C) Concentration of TB, (D) Different incubation times on aptasensor with TB, (E) Different incubation times on aptasensor with Pb^{2+} .

S4

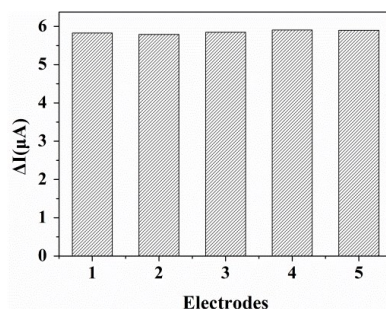


Fig.S2 The concentrations were 10 ppb respectively. The electrochemical DPV response of same fabricated biosensors for five times

S6 The recycle of the biosensor

To verify the reutilization of the methods, two groups experiments were done. Firstly, Firstly, the current of all electrodes with 25 ppb Pb^{2+} were detected (a). Then, one group electrode was modified again by 3 μ L of 2.0 μ M Pb^{2+} aptamer, TB (3 μ L, 1.0 mM) solution was thereafter evenly added onto the surface of the SPCE, and 25 ppb Pb^{2+} was incubated with the probe for 1h to detecting the current (b). Another group, after (a) operation, the electrodes were stored in the 4 $^{\circ}$ C for 24 h and do the same with b (c).

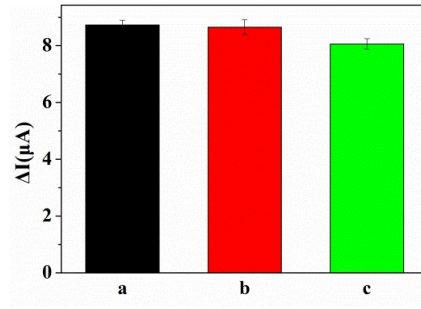


Fig.S3 (a) the ΔI of first time detecting the Pb^{2+} , (b) the ΔI of reused the sensor to detecting the Pb^{2+} , (c) the ΔI of reused the sensor to detecting the Pb^{2+} after 24 h.