Supplemental Information to

Monitoring of bovine serum albumin using ultrasensitive electrochemiluminescence biosensors based on multilayer CdTe QDs modified ITO electrodes

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1 Characterization of TGA–capped CdTe QDs

1.1 Absorption and PL spectra of CdTe QDs

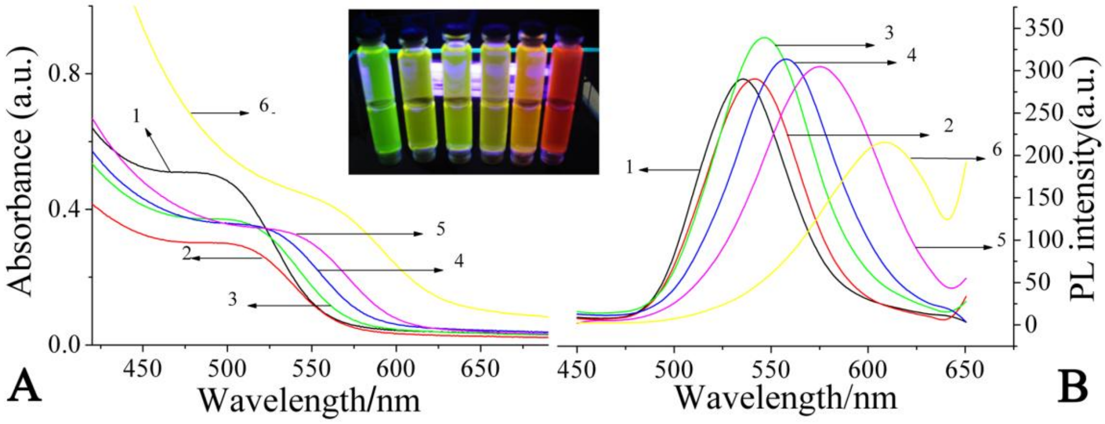

Figure S.1.1 (A) UV-VIS sbsorption and (B) Fluorescence spectrum

The absorption peaks 1 – 6 for the refluxing time were 4 min, 20 min, 30 min, 50 min, 60 min and 120 min, respectively. The inset showed fluorescent photographs of as-prepared CdTe QDs under UV irradiation

The UV–vis spectra showed a sufficiently narrow partical size distribution of the QDs (Figure S.1.1 A). The inset shows a photograph of the photoluminescence emitting color change of the CdTe QDs (under the UV lamp, λ_{ex}=365nm) during the synthesis. The PL spectra and UV–spectra both turn up red–shifts, which indicated that the size of the QDs could be tuned simply through different refluxing time (Figure S.1.1 B).

1.2 The photoluminescence quantum yield (QY)

Rhodamine 6G was used as the reference material. The QY is defined as

$$Y_u = Y_s \cdot \frac{F_u}{F_s} \cdot \frac{A_s}{A_u}$$

Where Y_u and Y_s are the QY of CdTe QDs and rhodamine 6G, F_u and F_s are the integral area of fluorescence of CdTe QDs and rhodamine 6G, A_u and A_s are the absorption of CdTe QDs and rhodamine 6G, respectively.

One proof of their good quality is the high PL QY which up to 38.9—74.6 % upon the refluxing from 1 min to 120 min. When refluxing for 1 h, the prepared CdTe QDs nanoparticles was very high (74.6 %), which had a better dispersion characteristic and centralized distribution.

1.3 XRD pattern of CdTe

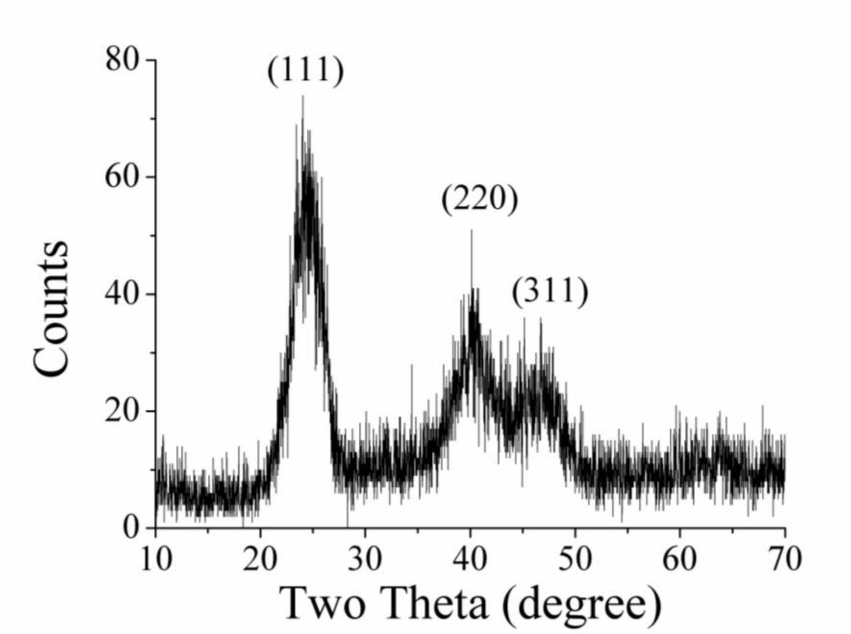

Figure S.1.3 XRD pattern of CdTe

The X-ray diffraction (XRD) pattern of CdTe nanocrystals consists of the characteristic peaks of cubic zinc blende CdTe. The diffraction peaks are broadened due to the finite particle size.

2 Layers of CdTe QD films

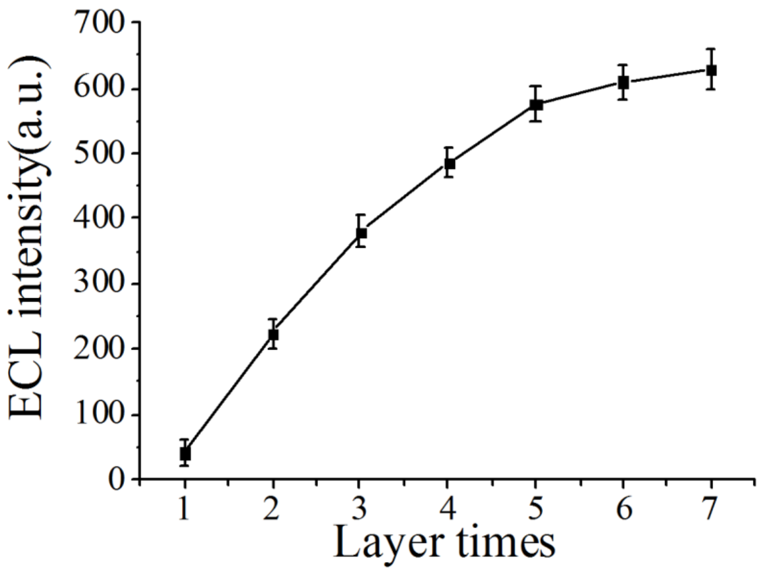

Figure S.2 Effect of layer times on ECL intensity

The experiment condition was performed in 1.0×10^{-6} g mL^{-1} BSA solution, 0.1 M carbonate bicarbonate buffer solution (pH was 9.32), the flow rate of pump 1 and pump 2 was 1.8 mL min^{-1} and 1.5 mL min^{-1}, respectively.

The layers of CdTe QD films on ITO glass was examined over 1–7 ranges, and the ECL intensity reached up to maximum value when the ITO glass was modified by 4 layers. Therefore, these multilayer QD films with 4 layers were adopted in the experiment (Figure S.2).

3 Optimum pH

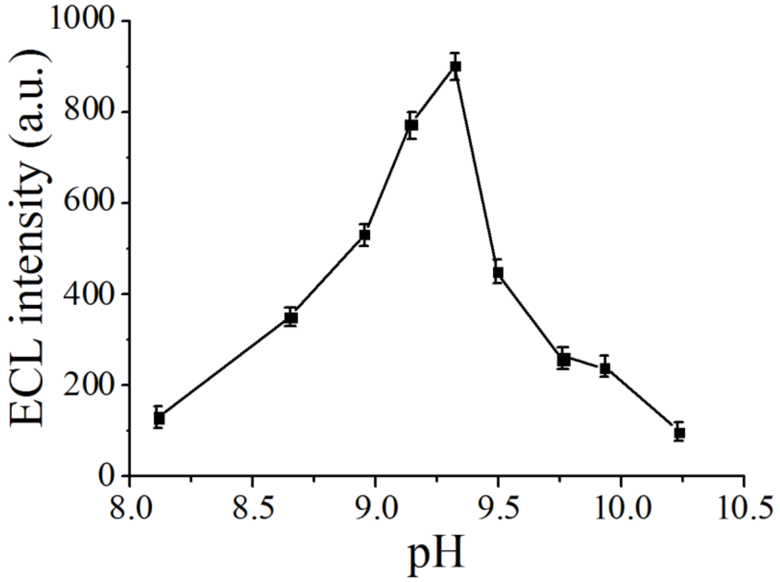

Figure S.3 Effect of pH on ECL intensity

The experiment condition was performed in 1.0×10^{-6} g mL^{-1} BSA solution, the multilayer QD films with 4 layers, the flow rate of pump 1 and pump 2 was 1.8 mL min^{-1} and 1.5 mL min^{-1}, respectively.

The effect of pH on the ECL reaction was examined in the range from 8.11 to 10.23. The results showed that the optimum pH of carbonate bicarbonate buffer solution was 9.32 since a maximal ECL signal could be obtained under this alkalinity (Figure S.3).

4 Flow rate of pump 1

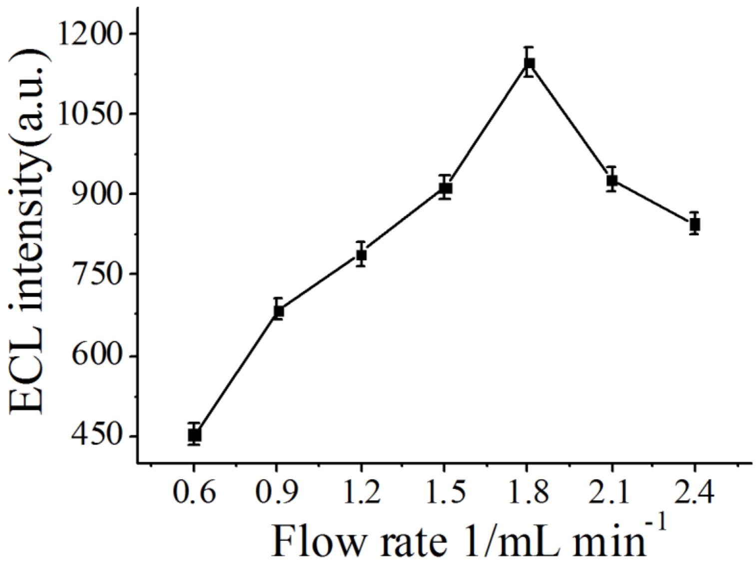

Figure S.4 Effect of pump 1 on |ECL intensity

The experiment condition was performed in 1.0×10^{-6} g mL^{-1} BSA solution, 0.1 M carbonate bicarbonate buffer solution (pH was 9.32), the multilayer QD films with 4 layers, the flow rate of pump 2 was 1.5 mL min^{-1}.

The flow rate of pump 1 represents the volume of carbonate bicarbonate buffer solution, The effect of the flow rate of pump 1 was examined in the range of 0.6–2.4 mL min^{-1}. The results showed that, when flow rate of pump 1 was less than 1.8 mL min^{-1}, the ECL signal increased with the increasing of flow rate, and when flow rate of pump 1 was greater than 1.8 mL min^{-1}, the ECL signal decreased with the increasing of flow rate. Therefore, the optimal flow rate of pump 1 was 1.8 mL min^{-1} (Figure S.4).

5 Flow rate of pump 2

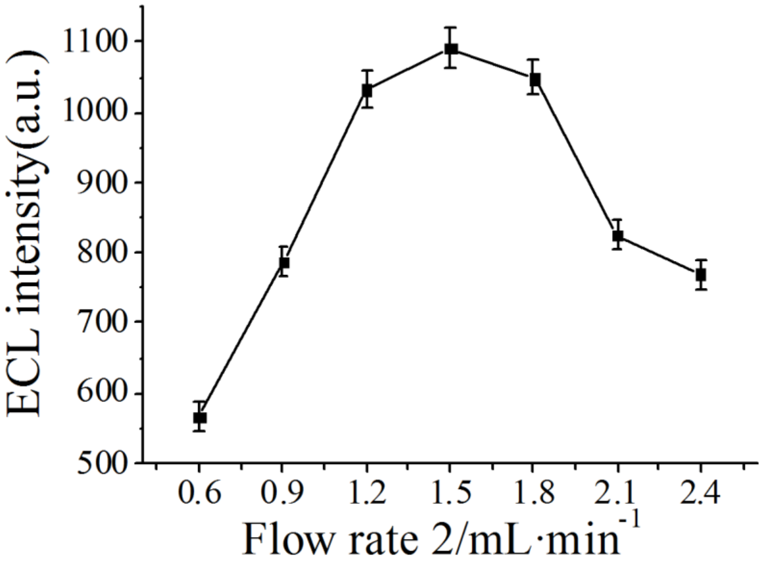

Figure S.5 Effect of pump 2 on ECL intensity

The experiment condition was performed in 1.0×10^{-6} g mL^{-1} BSA solution, 0.1 M carbonate bicarbonate buffer solution (pH was 9.32), the multilayer QD films with 4 layers, the flow rate of pump 1 was 1.8 mL min^{-1}.

The flow rate of pump 2 represents the volume of BSA solution. The effect of the flow rate of pump 2 was examined in the range of 0.6–2.4 mL min^{-1}. The results showed that, when flow rate of pump 2 was less than 1.5 mL min^{-1}, the ECL signal increased with the increasing of flow rate, and when flow rate of pump 2 was greater than 1.5 mL min^{-1}, the ECL signal decreased with the increasing of flow rate. Therefore, the optimal flow rate of pump 2 was 1.5 mL min^{-1} (Figure S.5).