Electronic supplementary information for

Electrochemical aptasensor for zeatin detection based on MoS_2 nanosheets and enzymatic signal amplification

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Buffers

Probe DNA immobilization buffer, 10 mM Tris–HCl, 1.0 mM EDTA, 1.0 M NaCl and 1.0 mM TCEP, pH 7.4. DNA hybridization buffer, 10 mM Tris–HCl, 1.0 mM EDTA, and 1.0 M NaCl, pH 7.4. Washing buffer, 10 mM Tris-HCl containing 100 mM NaCl, pH 7.4. Zeatin buffer, 10 mM Tris-HCl containing 50 mM NaCl, pH 7.4. Avidin-ALP buffer, 10 mM Tris-HCl containing 50 mM KCl, pH 7.4. Detection buffer, 10 mM Tris-HCl containing 0.6 M PNPP and 0.1 M KCl, pH 9.5.

Electrode effective surface area

The function of MoS_2 and AuNPs in increasing electrode effective area was also investigated using chronocoulometry technique in 0.1 mM $K_3[Fe(CN)_6]$. The electrochemical effective surface area can be counted from equation (1), where A is the effective surface area, c is the $K_3[Fe(CN)_6]$ concentration, D is the diffusion coefficient of $K_3[Fe(CN)_6]$(the diffusion coefficient D of $K_3[Fe(CN)_6]$ is $7.6\times10^{-6}cm^2\cdot s^{-1}$) [1], n is electron transfer number, Q_{dl} is double layer charge which could be eliminated by background subtraction, Q_{ads} is Faradic charge. Other symbols have their usual meanings. According to the slope of the curves of Q versus $t^{1/2}$ (Fig. 2B), A was calculated to be 0.089, 0.22 and 0.95 cm^2 for GCE, MoS_2/GCE and AuNPs/MoS_2/GCE, respectively. These results indicated that MoS_2 and AuNPs can effective improve the electrode effective area.

$$Q(t) = \frac{2nFAcD^{1/2}t^{1/2}}{\pi^{1/2}} + Q_{dl} + Q_{ads} \quad (1)$$

Optimization of experiment conditions

To achieve high detection sensitivity, several experiment parameters were

optimized, such as hybridization time, biotin and avidin binding time, ALP concentration and zeatin binding time. For optimization, the electrode was prepared according to the process described in section 2.3 and 2.4 except changing the optimized experiment condition.

Fig. S1A was the effect of hybridization time on the electrochemical oxidation signal of PNP. With extending hybridization time from 0 to 120 min, the oxidation peak current increased gradually. When the hybridization time further increased, the oxidation peak current tended to level off. Thus 120 min was employed as optimal hybridization time. Fig. S1B illustrated the effect of biotin and avidin binding time on the electrochemical reduction signal of PNP. The oxidation peak current increased with prolonging binding time from 0 to 75 min. Then, The electrochemical oxidation peak current increased slowly. So 75 min was used in this work. The effect of Avidin-ALP on the electrochemical response of the biosensor was also investigated. As seen in Fig. S1C, the electrochemical oxidation signal increased with improving avidin-ALP concentration from 0 to 0.9 mg/mL. However, the rate of the increase of electrochemical oxidation peak current slowed down when further enhancing Avidin-ALP concentration. Therefore, 0.9 mg/mL was used as the optimal concentration of Avidin-ALP. Zeatin and aptamer binding time can greatly influence the detection of zeatin. Thus it was also optimized. With increasing binding time from 0 to 80 min, the oxidation peak current decreased gradually (Fig. S1D). Then the current decreased slowly with further extending binding time. Thus 80 min was selected as optimal binding time for zeatin and aptamer DNA.

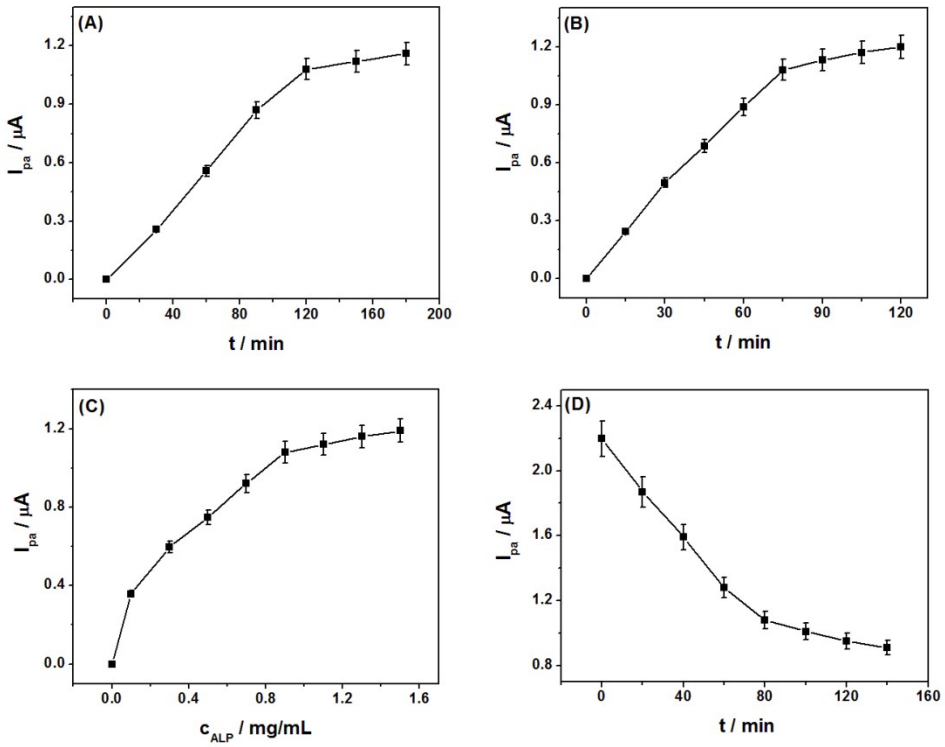

Fig. S1. Effect of hybridization time (A), biotin and avidin binding time (B), ALP concentration (C) and zeatin binding time (D) on the electrochemical response. Zeatin concentration is 1 nM.

Reference

1. R. Adams, *Electrochemistry at solid electrodes*, Marcel Dekker, New York, 1969.