Electronic Supplementary Information (ESI) for:

# Novel reduced graphene oxide/molybdenum disulfide/polyaniline nanocomposites based electrochemical aptasensor for detection of aflatoxin $B_1$

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**Contents (Additional)**

## 1. Additional Experimental Section

### 1.1 Preparation of $MoS_2$/RGO/PANI precursor

The $MoS_2$/RGO/PANI Composite was prepared based on the previously reported methods with slightly modification.[1] In brief, GO (40 mg) was added to 40 mL deionized water and ultrasonicated for 1 h to form a GO suspension. $(NH_4)_6Mo_7O_{24}\cdot 4H_2O$) (0.211 g) and thiourea (0.182 g) was dispersed in 20 mL deionized water and stirred for 1 h. Then, the solution was well mixed and agitated ultrasonically for 30 min. Subsequently, the mixture was poured into a 100 mL enclosed stainless steel high pressure reactor, and kept at 200 °C for 24 h. After cooling to room temperature, the $MoS_2$/RGO precursor was collected by centrifugation at 8000 rpm for 10 min, rinsed with water and vacuum dried at 60 °C for 24 h.

The $MoS_2$/RGO precursor (125 mg) was ultrasonicated in 40 mL deionized water for 1 h to form a suspension of $MoS_2$/RGO. Aniline (1.14 mL) and HCl (12.5 mL, 1 M) was blended in 30 mL deionized water and stirred for 30 min. The mixture of aniline and HCl was added dropwisely to the $MoS_2$/RGO suspension and ultrasonicated for 1 h to make sure the aniline well dispersed on the $MoS_2$/RGO nanosheets. Then, a solution of APS (1.2 M, 13 mL) was quickly poured into the aniline-$MoS_2$/RGO reaction system and continually agitated at 10 °C for 4 h. After the reaction completing, the $MoS_2$/RGO/PANI composite suspension was collected from the solution by filteration and rinsed with 50 mL ethanol (3 times) and 50 mL deionized water (3 times) to remove unreacted agents, and vacuum dried at 60 ˚C for 9h.

## 2. Additional Figures

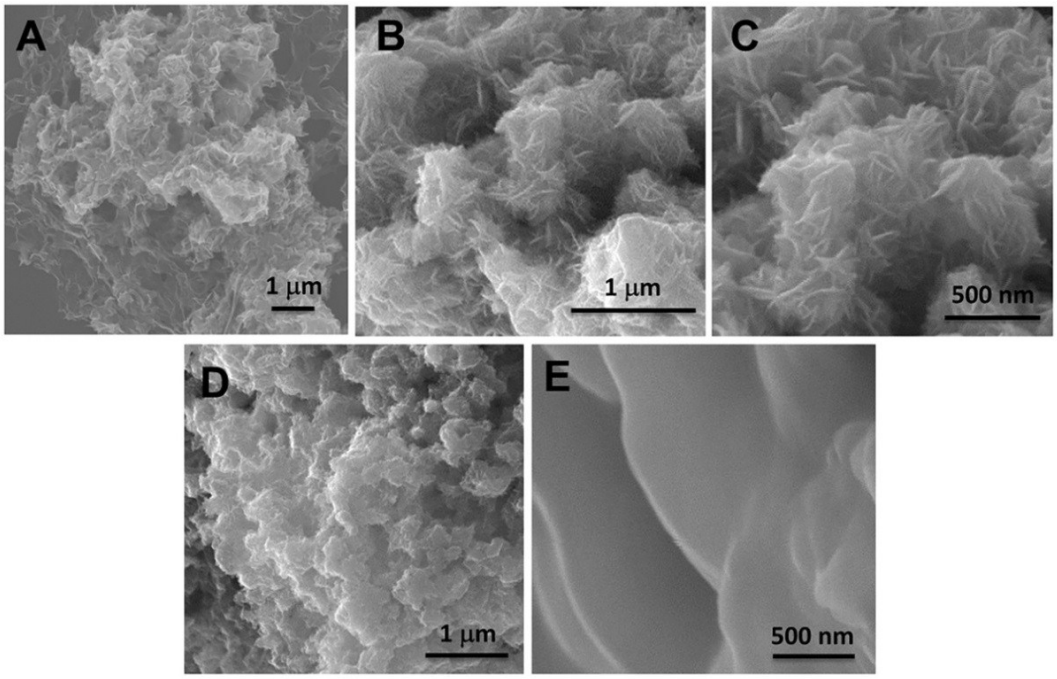



**Fig. S1**. SEM micrographs of GO (A), RGO/$MoS_2$ (B, C) and RGO/$MoS_2$/PANI composite (D, E).

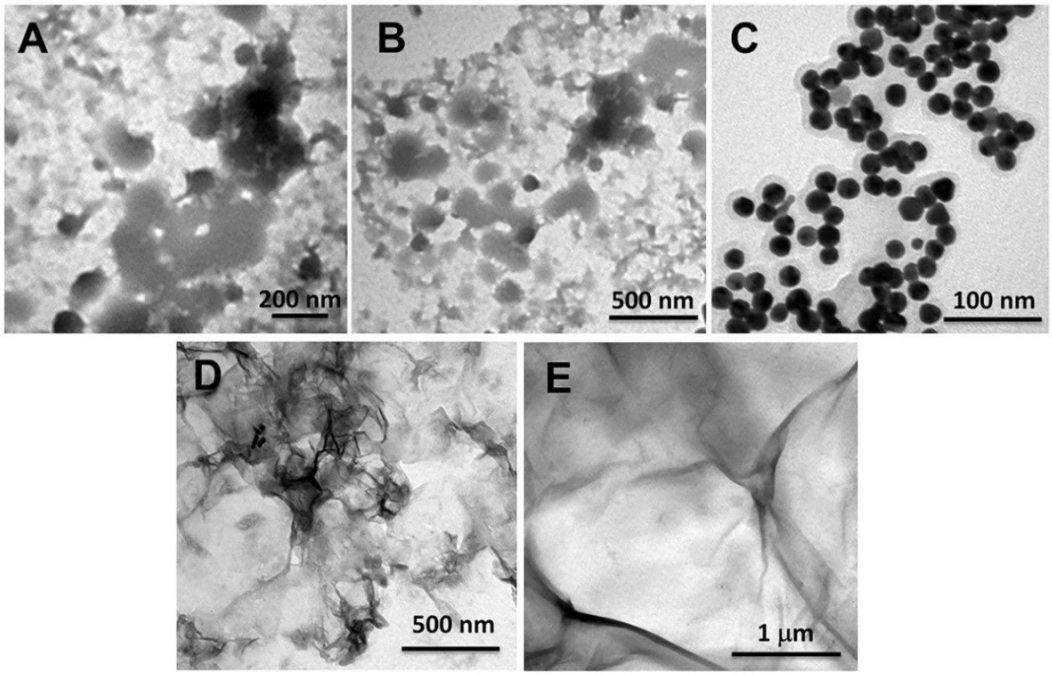
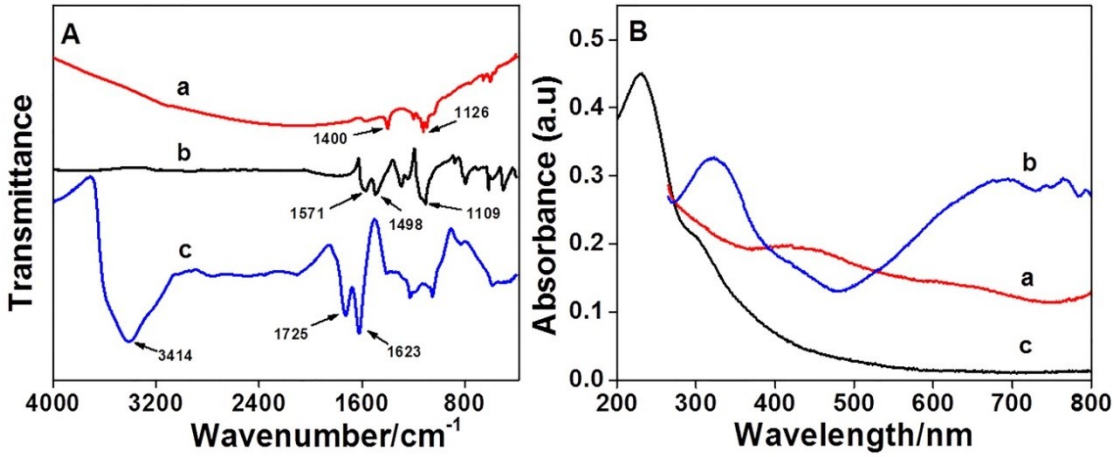



**Fig. S2.** TEM micrographs of RGO/$MoS_2$/PANI composite (A, B), AuNPs (C), RGO/$MoS_2$ (D) and GO (E).

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48 **Fig. S3** (A) FTIR spectra of (a) RGO/$MoS_2$, (b) RGO/$MoS_2$/PANI composite, and (c)
49 GO; (B) UV-visible spectra of (a) RGO/$MoS_2$ composite, (b) RGO/$MoS_2$/PANI and (c)
50 GO.

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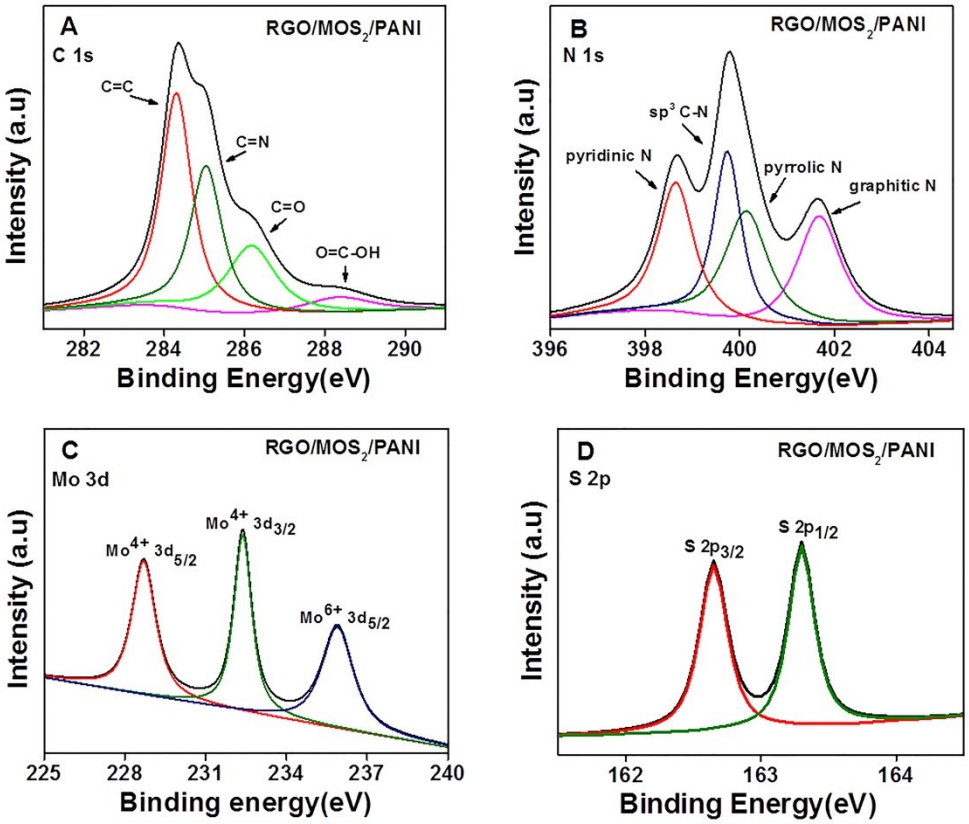


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53 **Fig. S4**. The high-resolution XPS spectra of the (A) C 1s for RGO/$MoS_2$/PANI; (B) N
54 1s for RGO/$MoS_2$/PANI; (C) Mo 3d for RGO/$MoS_2$/PANI; (D) S 2p for
55 RGO/$MoS_2$/PANI

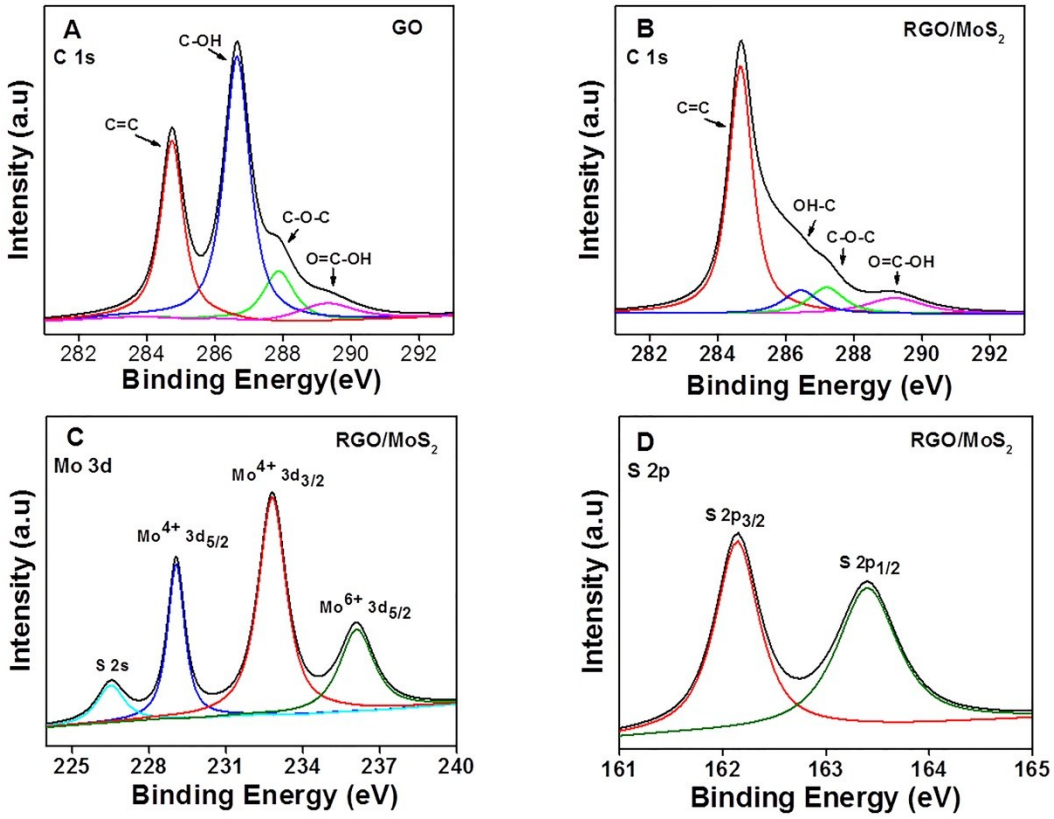


**Fig. S5**. The high-resolution XPS spectra of the (A) C 1s for GO; (B) C 1s for RGO/$MoS_2$; (C)Mo 3d for RGO/$MoS_2$; (D) S 2p for RGO/$MoS_2$

The chemical compositions of RGO/$MoS_2$/PANI nanocomposites were investigated by XPS spectroscopy measurements as shown in Fig. S4. The C1s spectra of RGO/$MoS_2$/PANI composites resolved into four main peaks located respectively at 284.3 (the graphitic carbon), 285.0 (C-N), 286.2 (C-O), and 288.4 eV (C=O) which are consistent with the reported data for chemically synthesized RGO/$MoS_2$/PANI nanocomposites.[1] As indicated in Fig. S4 (B), the XPS spectrum of N 1s has also four peaks namely pyridinic N (398.7 eV, N in 6-member ring), $sp^3$-C and N bonds (399.7 eV), pyrrolic N (400.1 eV, N in 5-member ring), and graphitic N (401.7 eV, N in graphene basal plane), indicating that most of nitrogen atoms have been substituted for carbon atoms in $sp^2$ frameworks.[2,3] The Mo 3d spectrum show strong peaks at

228.7 ($Mo^{4+}$ ,$3d_{5/2}$), 232.4 ($Mo^{4+}$ $3d_{3/2}$), and 235.9 eV ($Mo^{6+}$ $3d_{5/2}$), respectively as indicated in Fig. S4 (C) which agree with value of other RGO/$MoS_2$/PANI based composites previously reported.[3] The peak at 235.9 eV ($Mo^{6+}$ $3d_{5/2}$), may be attributed to the slow oxidation process from $MoS_2$ (IV) to $MoO_3$ (VI) or trace $MoO_4^{2-}$ (VI) from unreacted precursor which stated in previously reported study.[4] Additionally, the S 2p spectrum depicts strong signals at 162.6 and 163.3 eV on behalf of S $2p_{3/2}$ and S $2p_{1/2}$ as shown in Fig. S4 (D). For comparison, the chemical compositions of GO and RGO/$MoS_2$ nanocomposites were also investigated as shown in Fig. S5.

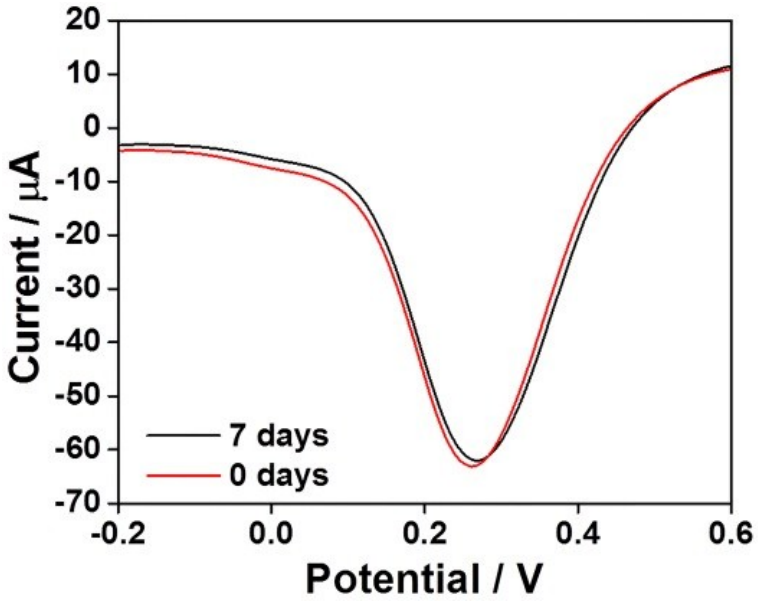


**Fig. S6.** DPVs responses of electrochemical aptasensor before and after storage.

## 3. Additional References


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