Electronic Supplementary Information

3D nitrogen-doped graphene/β-cyclodextrin: host-guest interaction for electrochemical sensing

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1. The preparation of 3D−NG/CD biosensor

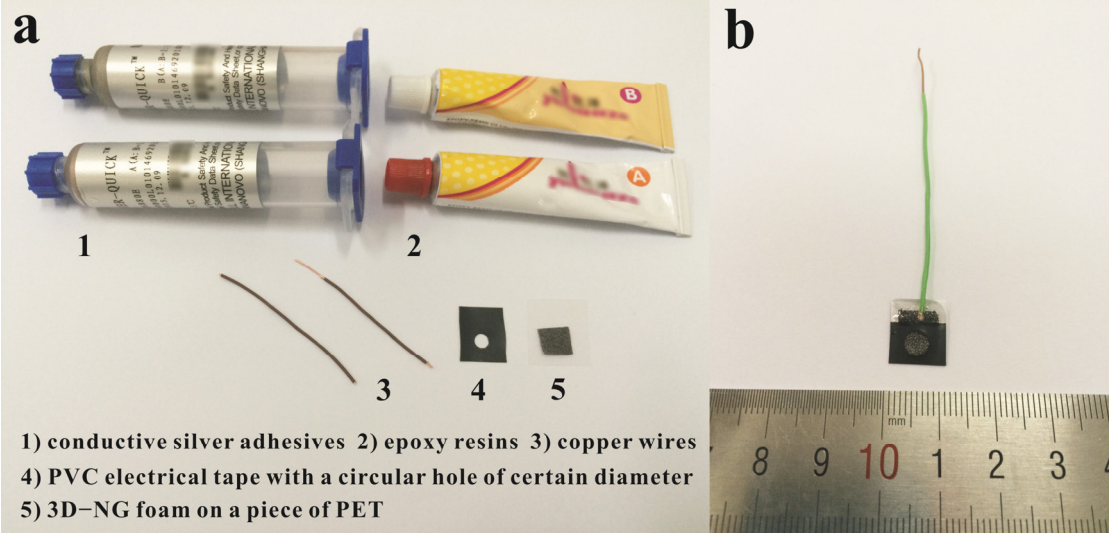

Fig. S1. (a) The conponents of 3D-NG/ CD biosensor (b) a fabricated 3D-NG/ CD biosensor. The effective surface area of the electrode is calculated on $S=1/4\ \pi d^2$, where d (typical value is 4~4.5 mm) stands for the diameter of the circular hole on PVC tape.

2. The characterizations of XPS spectra of 3D-G and 3D-NG.

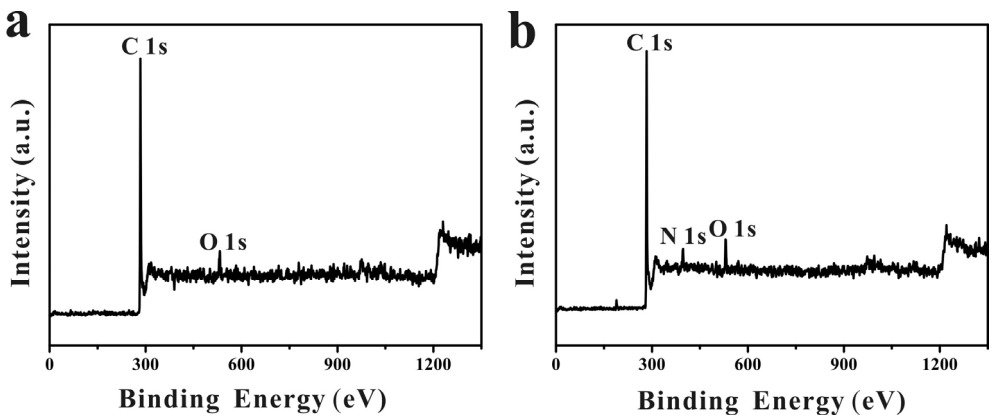

Fig. S2. The wide survey XPS spectra of (a) 3D-G and (b) 3D-NG. C 1s peak and O 1s peak can be found in both two spectra while C 1s peaks are the most prominent ones. N 1s peak only shows up in the spectrum of 3D-NG.

3. The characterizations of XRD of 3D−G and 3D−NG.

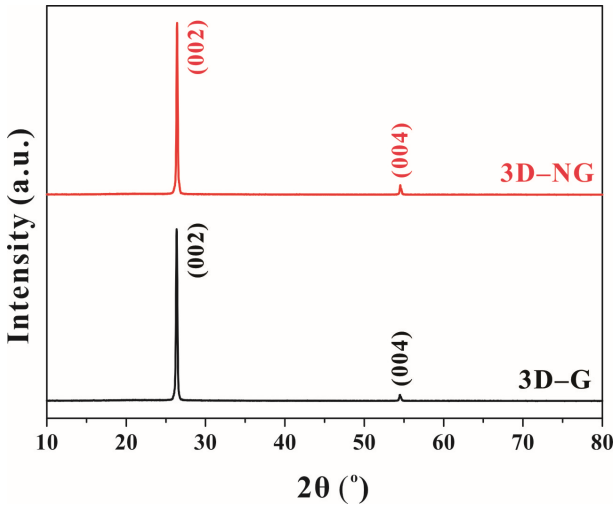

Fig. S3. XRD profiles of 3D-G and 3D-NG. For both 3D-G and 3D-NG, two typical diffraction peaks at 26.5° and 54.6° are attributed to the (002) and (004) reflections of graphitic carbon, respectively (JCPDS card 75-1621). The results indicate a high crystalline degree for 3D-G and 3D-NG.

4. The effect of scan rate.

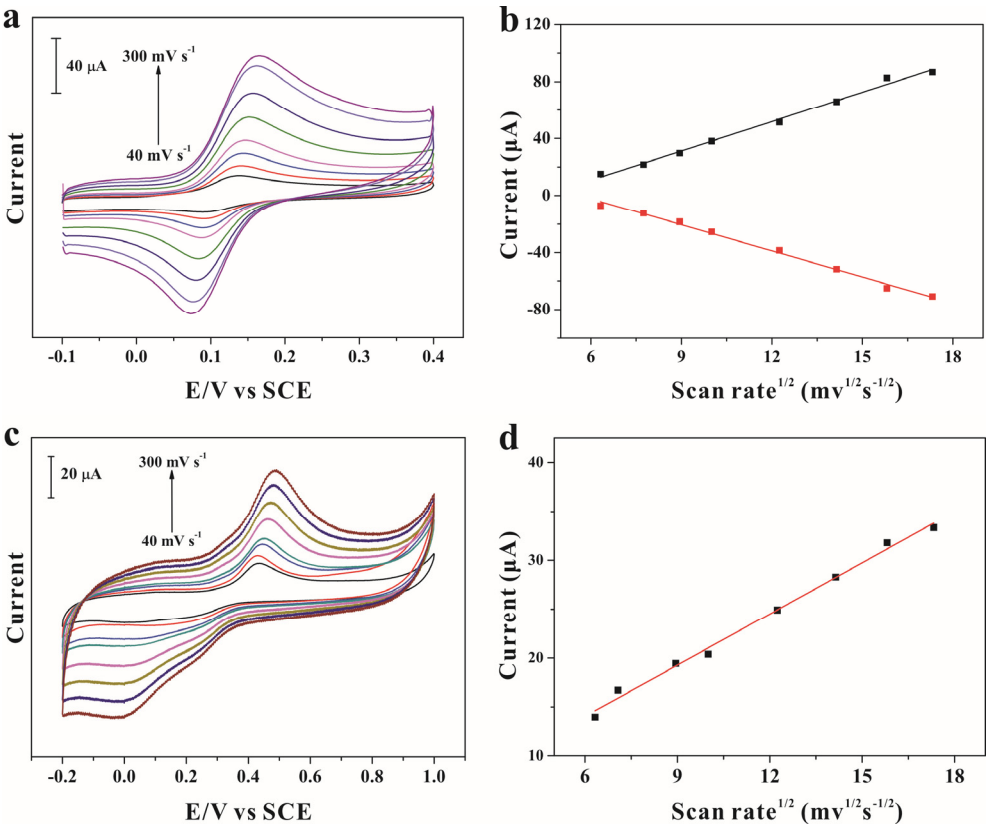

Fig. S4. (a) Cyclic voltammograms of 3D-NG/CD in 0.1 M PBS and 100 μM DA (pH = 7.40) at increasing scan rates: 40, 50, 80, 100,150, 200, 250 and 300 $mV \cdot s^{-1}$. (b) Linear dependence of I_{pa} (the black line) and I_{pc} (the red line) with scan rate. (c) CV of 3D-NG 3D-NG/CD in 0.2 M PBS and 100 μM APAP (pH = 7.20) when the scan rate is the same with those of DA. (b) Linear dependence of I_{pa} with scan rate.

5. The stability of 3D-NG/CD sensor.

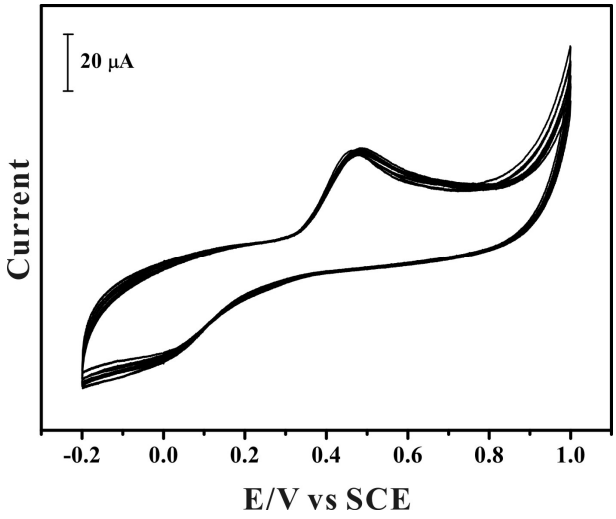

Fig. S5. Cyclic voltammograms of 3D-NG/CD in 0.1 M PBS and 100 μM APAP (pH = 7.40) with 8 cycles. The scan rate was 0.1 $V \cdot s^{-1}$.

6. The selectivity of 3D-NG/CD biosensor.

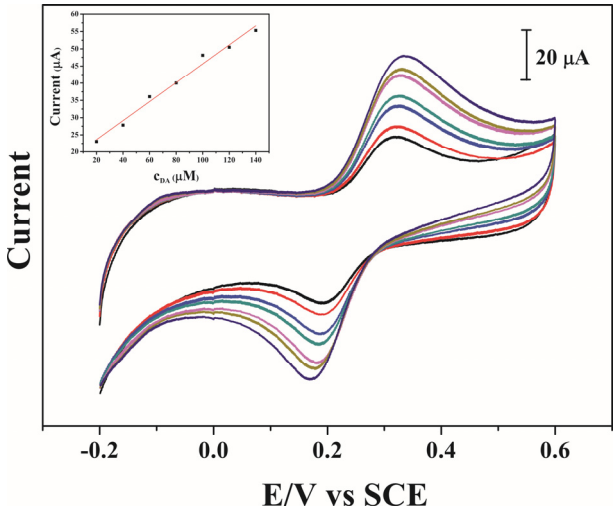

Fig. S6. Cyclic voltammograms of 3D-NG/CD in 0.1 M PBS and 100 μM AA (pH = 6.00). The concentration of DA are 20, 40, 60, 80, 100, 120, 140 μM, respectively. The scan rate was 0.1 $V \cdot s^{-1}$.

7. The potential of 3D-NG/CD sensor based on host-guest interaction.

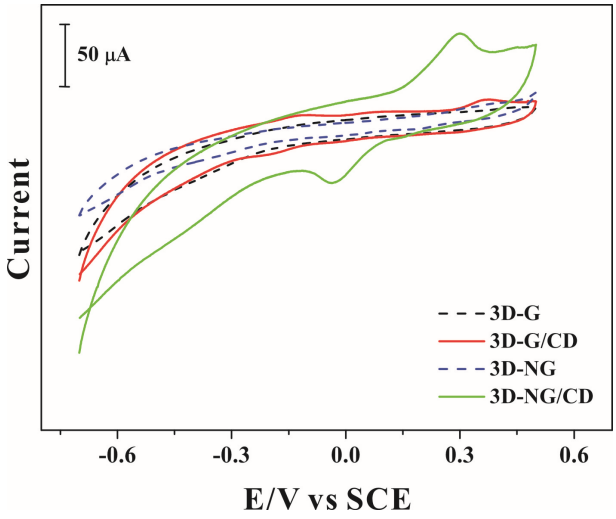

Fig. S7. CV curves of different electrodes in 100 μM *o*-nitrophenol. As is shown above, 3D-NG/CD sensor can be expended to detect more guest molecules. Host-guest interaction between β-CD and guests mainly calls for guest molecules of proper size, which means there are more potential guests.

Table S1. The comparison among our work and previous studies.

DA:

Electrode materials	Sensitivity	Methods[+]	Ref.
3D-NG/β-CD	5468.6 μA/(mM·cm^2)	CV	This work
3D-G foam	619.6 μA/(mM·cm^2)	LSV	1
MWCNT/GO/GCE	1530 μA/(mM·cm^2)	DPV	2
Screen printed electrode using graphene ink	86.7μA/mM	CV	3
Nafion/AgNP/RGO/GCE	390 μA/mM	LSV	4
GNs paste electrode	975.7 μA/mM	DPV	5
(PSS-functionalized RGO/PAMAM stabilized AuNP)n/PDDA/GCE	361.8 μA/mM	DPV	6
NG/GCE	204.9 μA/mM	DPV	7
Pd_3Pt_3/PDDA-RGO/GCE	45.2 μA/mM	DPV	8

APAP:

Electrode materials	Sensitivity	Methods[+]	Ref.
3D-NG/β-CD	2419.2 μA/(mM·cm^2)	CV	This work
MWCNT/GO/GCE	938 μA/(mM·cm^2)	DPV	2
MWCNT-GNs/GCE	90.8 μA/mM	DPV	9
G-chitosan/GCE	79 μA/mM	DPV	10

[+]DPV stands for differential pulse polarography and LSV for linear sweep voltammetry. These three kinds of methods are comparable because the differences of them influence little to the results mentioned above.

References

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