Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Supporting Information

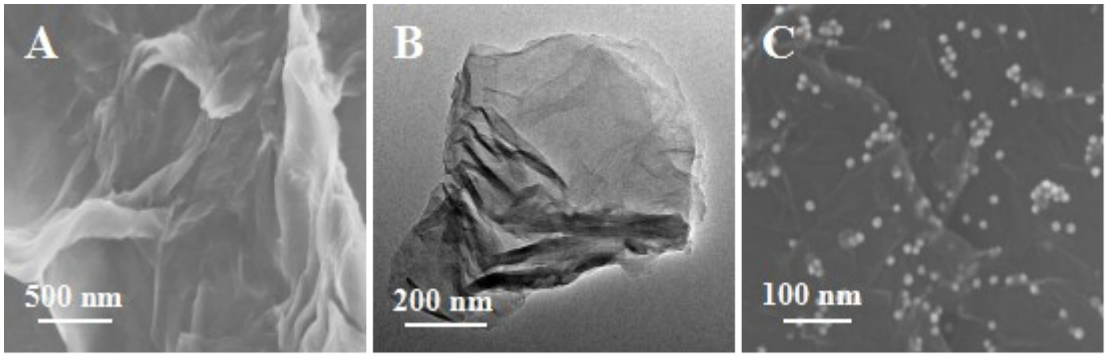

Figure S1. (A) SEM, (B) TEM images of the original GO. (C) SEM image of NG-AuNPs.

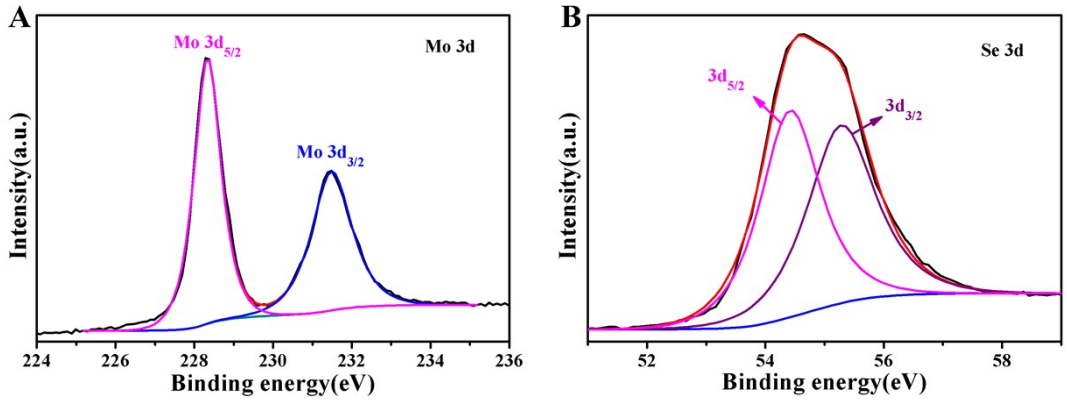

Figure S2. (A) Mo 3d and (B) Se 3d spectra of $MoSe_2$.

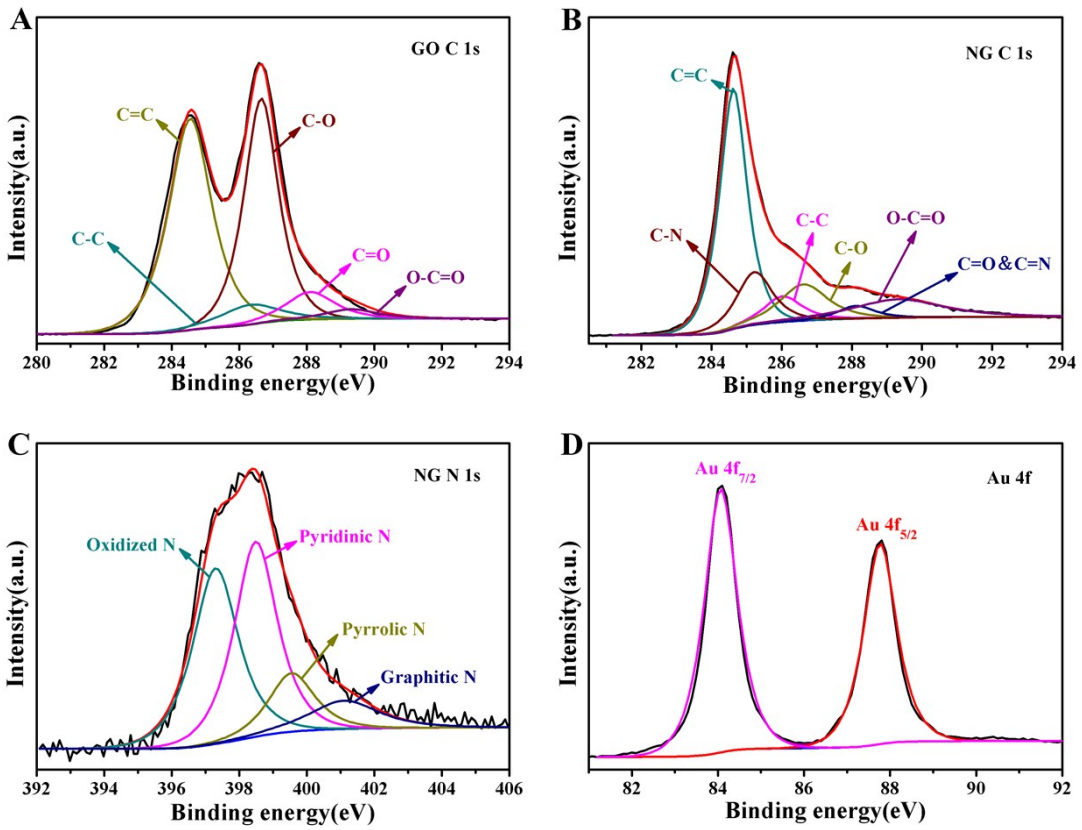

Figure S3. (A) C 1s spectra of GO, (B) C 1s and (C) N 1s spectra of NG, (D) Au 4f spectra of NG-AuNPs.

In order to calculate the effective surface areas, the chronocoulometry (CC) was performed in 0.1 mM $[Fe(CN)_6]^{3-}$ and 1.0 M KCl solution.[1] According to the equation as follows:

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

where Q (C), n, F (C mol^{-1}), A (cm^2), c (mol cm^{-3}), D (cm^2 s^{-1}), t (s), Qdl (C) and Qads (C) are charge, charge transfer number, Faraday constant, effective surface areas, substrate concentration, diffusion coefficient, electrolysis times, double layer charge and adsorption charge, respectively. According to Fig. S4A and B shown that the A calculation values of bare GCE and AuNPs/$MoSe_2$/GCE were 0.015 cm^2 and 0.047 cm^2, respectively. It was shown that $MoSe_2$ could apparently increase the effective surface area of electrode and the active sites. Nevertheless, as displayed in Fig. S4C, after $MoSe_2$ was immobilized onto electrode surface,

the DPV response dramatically increased by 227.4% owing to the signal amplification effect of the material. It was helpful to improve the sensitivity of the sensor.

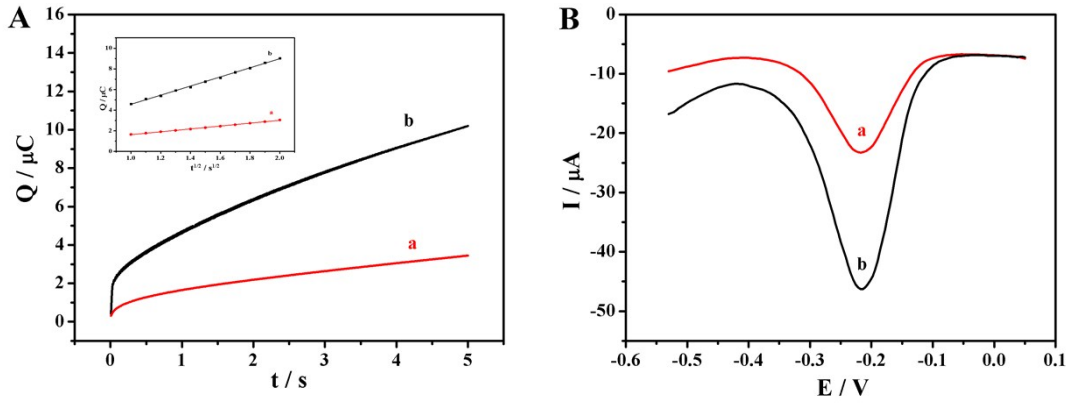

Figure S4. (A) Q-t curve of bare GCE (a) and AuNPs/$MoSe_2$/GCE (b) in 0.1 mM $[Fe(CN)_6]^{3-}$ and 1.0 M KCl solution. The inset was the Q-$t^{1/2}$ curve. (B) The DPV responses of hemin/assistance DNA/DNA-linked NG-AuNPs hybrids/miRNA/MCH/ capture probe/AuNPs/GCE (a) and hemin/ assistance DNA/DNA-linked NG-AuNPs hybrids /miRNA/MCH/capture probe/AuNPs/$MoSe_2$/GCE (b), which were measured in a certain volume of 10 mM PBS buffer (pH 8.0) containing 50 mM NaCl, 10 mM $MgCl_2$.

Table S1. Different methods for miRNA-21 detection.

DPV: differential pulse voltammetry; ECL: electrochemiluminescence.

Amplification strategy	Methods	LOD	References
Target-guide assembly of AuNPs	ECL	20 fM	2
Polymerase chain reaction amplification	DPV	1.0 pM	3
Gold nanoparticle loaded split-DNAzyme-probe amplification	Fluorescence	10 pM	4
Mismatched catalytic hairpin assembly	DPV	0.6 pM	5
AuNPs-decorated MoS_2 nanosheet amplification	DPV	0.78 fM	6

Duplex-specific nuclease signal amplification	Fluorescence	1 pM	7
Hairpin assembly target recycling amplification	DPV	0.35 fM	8
Hybrid antibody and enzymatic amplification	DPV	0.4 fM	9
NG-AuNPs hybrids and supersandwich amplification	DPV	0.17 fM	This work

Table S2. Detection of miRNA-21 in serum samples (*n*=3).

Samples	qRT-PCR [a] (fM)	Proposed biosensor (fM)
1	32.7 ± 2.8	33.1 ± 3.8
2	35.6 ± 3.4	34.8 ± 4.1
3	36.7 ± 2.5	37.8 ± 2.4
4	38.9 ± 2.9	38.1 ± 4.2

References

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