Supporting Information

A novel label-free strategy for pathogenic DNA detection based on metal ions binding-induced fluorescence quenching of graphitic carbon nitride nanosheets

Yan Xiao, Yuhao, Sheng, Jie Zhou, Miaomiao Chen, Wei Wen, Xiuhua Zhang*, Shengfu Wang

Hubei Collaborative Innovation Center for Advanced Organic Chemical Materials, Ministry of Education Key Laboratory for the Synthesis and Application of Organic Functional Molecules & College of Chemistry and Chemical Engineering, Hubei University, Wuhan 430062, PR China

***Corresponding Authors:**

E-mail: zhangxh@hubu.edu.cn

Tel.: +86-27-50865309. Fax: +86-27-88663043

Supplementary Tables and Figures

Table S1. Sequences of the oligonucleotides used in the experiments.

Names		Sequence (5'-3')
Probe for HBV gene	Probe 1	CCCCCCTACCACATCATCCATATAACTGAA AGCCAACCCCCC
	Probe 2	CCCCCCTACCACATCATCCATATAACTGAA ACCCCCC
	Probe 3	CCCCCCTACCACATCATCCATATAACCCCC CC
	Probe 4	TTTTTTTACCACATCATCCATATAACTGAA AGCCAATTTTTT
HBV gene		TTGGCTTTCAGTTATATGGATGATGTGGTA
The single-base mismatched (SBM) strand*		TTGGCTTTCAGTTATATTGATGATGTGGTA
The non-complementary (NC) strand		ACTAAGGACTACAAGTACATTTCGAATTCT

*The mismatched base is underlined.

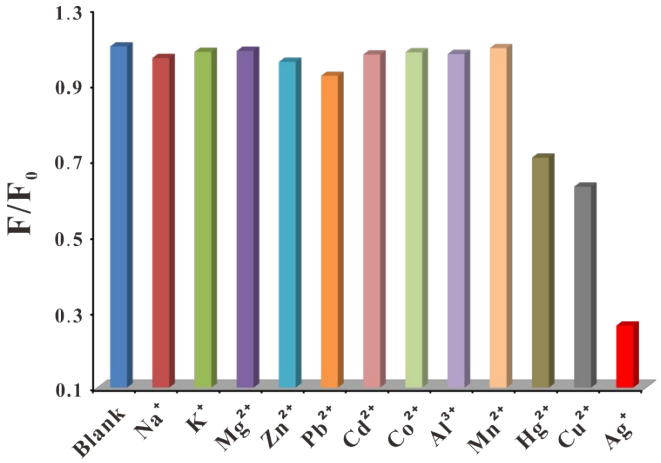

Fig. S1. Relative fluorescence intensity (F/F_0, where F and F_0 represent the emission intensity of g-C_3N_4 nanosheets in the presence and in the absence of the tested species, respectively) of the g-C_3N_4 nanosheets in the presence of different metal ions. The concentrations of all tested species were 5 μM.

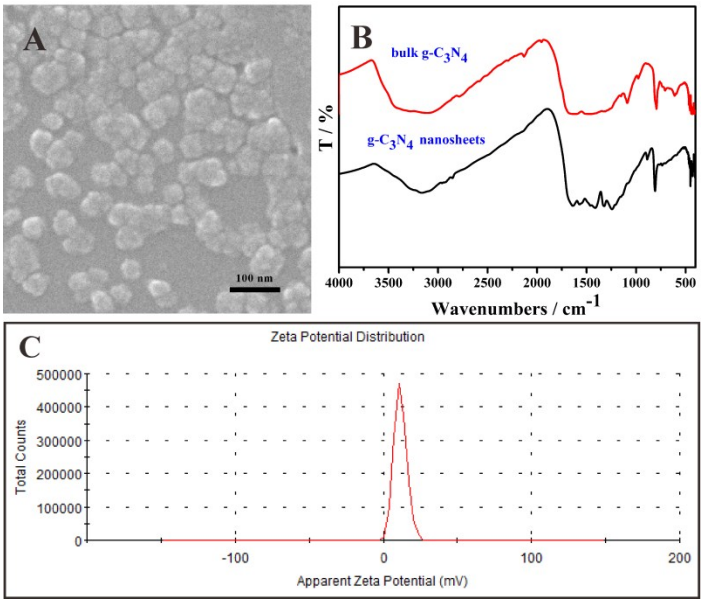

Fig. S2. (A) SEM image of g-C_3N_4 nanosheets. (B) FT-IR spectra of bulk g-C_3N_4 (red line) and g-C_3N_4 nanosheets (black line). (C) Zeta potential of the prepared g-C_3N_4 nanosheets.

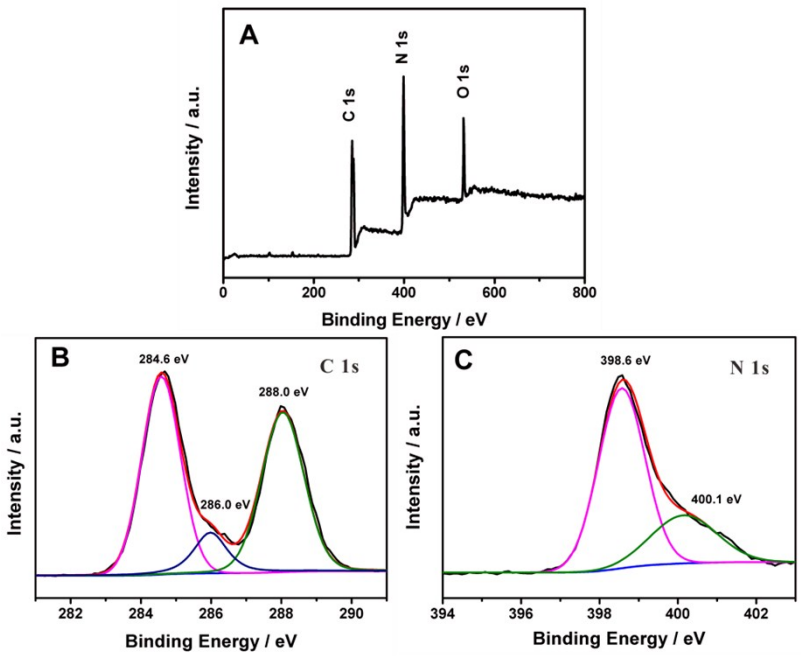

Fig. S3. (A) X-ray photoelectron spectroscopy (XPS) survey spectrum of g-C_3N_4 nanosheets. (B, C) Expanded spectrum in the C 1s (b) and N 1s (c) region.

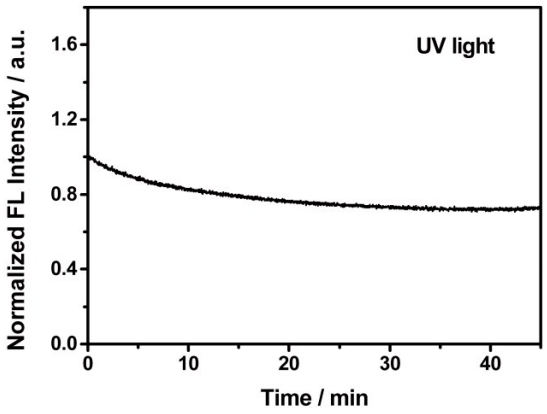

Fig. S4. Photostability of g-C_3N_4 nanosheets under continuous illumination by UV light.

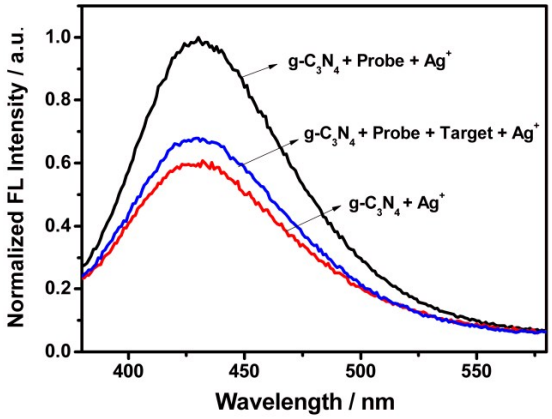

Fig. S5. Fluorescence spectra of g-C_3N_4 nanosheets in the presence of different substances (black line: probe and Ag^+; blue line: probe, target and Ag^+; red line: Ag^+).

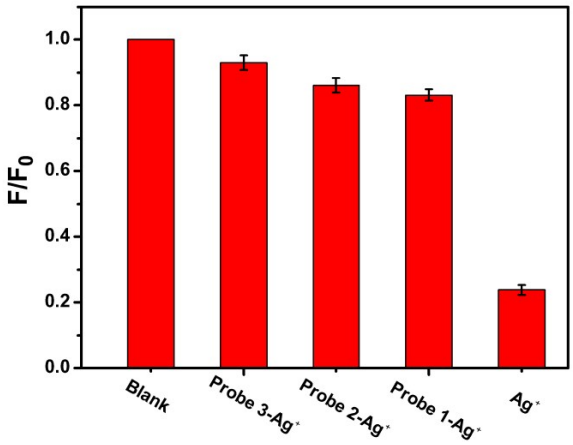

Fig. S6. Relative fluorescence intensity (F/F_0, where F and F_0 represent the emission intensity of g-C_3N_4 nanosheets in the presence and in the absence of the tested species, respectively) of the g-C_3N_4 nanosheets after reaction with different C-Ag^+-C probe DNAs and free Ag^+ in the absence of target. The Ag^+ concentrations of all tested species were 1 μM.

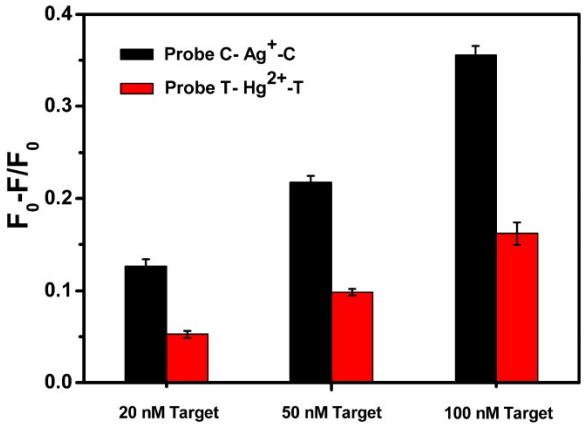

Fig. S7. Assay of the target DNAs using different probe system (black: Probe 1 C-Ag^{+}-C, red: Probe 4 T-Hg^{2+}-T). $(F_0\text{-}F)/F_0$, where F and F_0 represent the emission intensity of g-C_3N_4 nanosheets in the presence and in the absence of HBV gene, respectively.

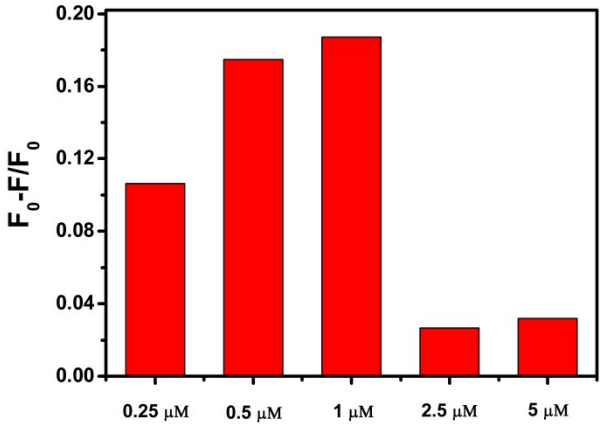

Fig. S8. Optimization of experimental conditions of the concentration of silver ions ($(F_0\text{-}F)/F_0$, where F and F_0 represent the emission intensity of g-C_3N_4 nanosheets in the presence and in the absence of HBV gene, respectively). The concentration of the probe was 0.1 μM.

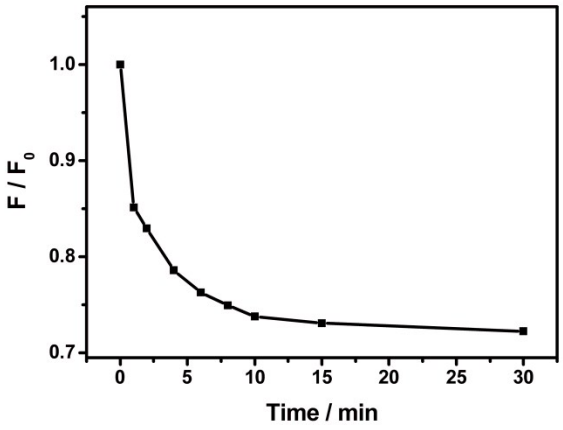

Fig. S9. Time dependence of the fluorescence quenching of 0.5 μg/mL g-C_3N_4 nanosheets by 1 μM silver ions.

Table S2. Comparison of different fluorescence methods for DNA detection.

Detection method	Strategy	Liner range	Detection limit	ref
Fluorescence	G-quadruplex/NMM	0-200 nM	5 nM	1
Fluorescence	QDs/BHQ	12-300 nM	4.03 nM	2
Fluorescence	FAM-DNA/CoOOH	1-50 nM	0.5 nM	3
Fluorescence	UCNPs/Au NPs	0-50 nM	0.25 nM	4
Fluorescence	DNA/Ag NCs	10-100 nM	3 nM	5
Fluorescence	Ag NCs/GO	10-100 nM	1.18 nM	6
Fluorescence	g-C_3N_4/Ag^+	2-100 nM	1.0 nM	this work

References

[1] J. T. Ren, J. H. Wang, J. Wang, N. W. Luedtke and E. K. Wang, *Biosens. Bioelectron.*, 2012, 31, 316-322.

[2] J. Z. Lv, Y. M. Miao, J. J. Yang, J. Qin, D. X. Li and G. Q. Yan, *Biosens. Bioelectron.*, 2017, 91, 560-565.

[3] A. H. Loo, Z. Sofer, D. Bouša, P. Ulbrich, A. Bonanni and M. Pumera, *ACS Appl. Mater. Interfaces.*, 2016, 8, 1951-1957.

[4] H. Zhu, F. Lu, X. C. Wu and J. J. Zhu, *Analyst*, 2015, 140, 7622-7628.

[5] Y. Xiao, Z. J. Wu, K. -Y. Wong and Z. H. Liu, *Chem. Commun.*, 2014, 50, 4849-4852.

[6] S. Q. Zhang, K. Wang, K. -B. Lia, W. Shi, W. -P. Jia, X. Y. Chen, T. Sun and D. -M. Hana, *Biosens. Bioelectron.*, 2017, 91, 374-379.