Electronic Supplementary Material (ESI) for RSC Advances.

Au Nanoparticles Fluorescence Switch-mediated Target Recycling Amplification Strategy for Sensitive Nucleic Acid Detection

Haiping Wei [a], Yan Wang [b,*], Hong Zhang [a], Haiyan Zhao [a], Wei Jiang [a,*]

[a] *Key Laboratory for Colloid and Interface Chemistry of Education Ministry, School of Chemistry and Chemical Engineering, Shandong University, 250100 Jinan, P.R. China*

[b] *The 88th Hospital of PLA, 270100 Tai'an, P.R. China*

Corresponding author[a]: Tel: 86-531-88363888; fax: 86-531-88564464.

E-mail: wjiang@sdu.edu.cn

Corresponding author[b]: E-mail: wy6766@sohu.com

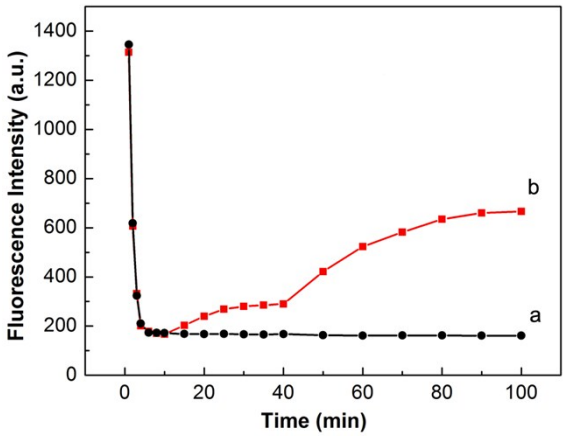

Fig. S1. The change in fluorescence during the detection procedure. Condition: pH: 8.0, Temperature: 37 °C, F-DNA: 5.0×10^{-8} mol L^{-1}, T-DNA: 5.0×10^{-9} mol L^{-1}, Exo III: 1.3×10^{6} U L^{-1}.

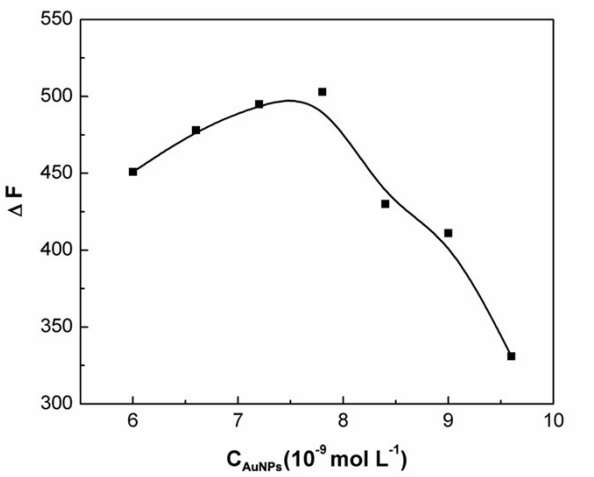

Fig. S2. Effects of the concentration of AuNPs. Condition: pH: 8.0, Temperature: 37 °C, F-DNA: 5.0×10^{-8} mol L^{-1}, T-DNA: 5.0×10^{-9} mol L^{-1}, Exo III: 1.3×10^{6} U L^{-1}. 10 min incubation time of F-DNA and AuNPs, 30 min hybridization time of F-DNA on AuNPs surface and T-DNA, 60 min incubation time of Exo III.

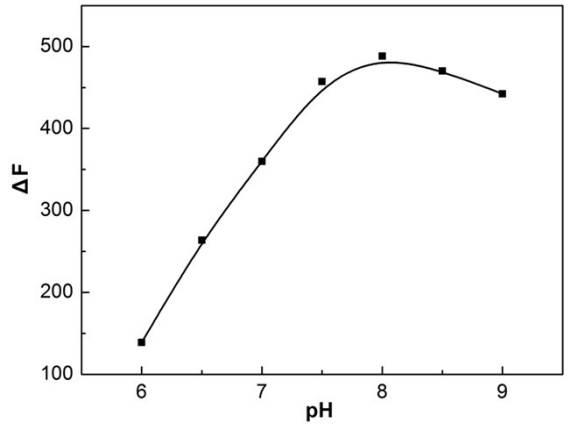

Fig. S3. Effects of the pH. Condition: Temperature: 37 °C, F-DNA: 5.0×10^{-8} mol L^{-1}, T-DNA: 5.0×10^{-9} mol L^{-1}, Exo III: 1.3×10^{6} U L^{-1}. 10 min incubation time of F-DNA and AuNPs, 30 min hybridization time of F-DNA on AuNPs surface and T-DNA, 60 min incubation time of Exo III.

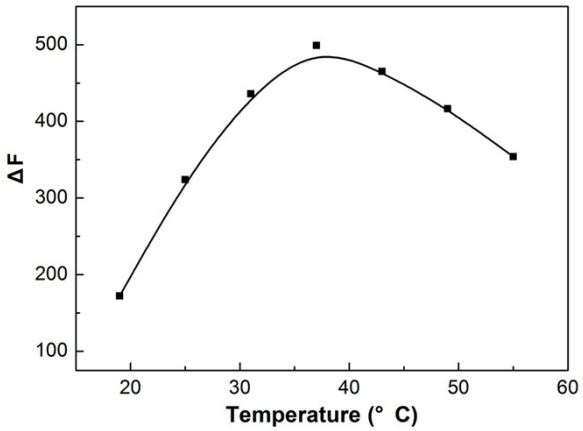

Fig. S4. Effects of the reaction temperature. Condition: pH: 8.0, F-DNA: 5.0×10^{-8} mol L^{-1}, T-DNA: 5.0×10^{-9} mol L^{-1}, Exo III: 1.3×10^{6} U L^{-1}. 10 min incubation time of F-DNA and AuNPs, 30 min hybridization time of F-DNA on AuNPs surface and T-DNA, 60 min incubation time of Exo III.

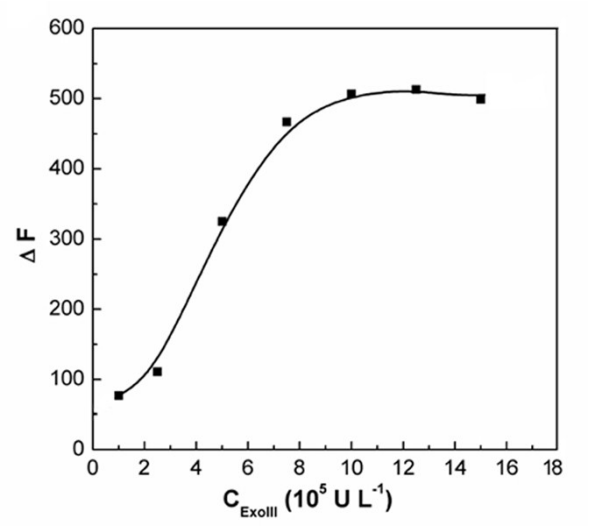

Fig. S5. Effects of concentrations of Exo III. Condition: pH: 8.0, Temperature: 37 °C, F-DNA: 5.0 × 10^{-8} mol L^{-1}, AuNPs: 7.8 × 10^{-9} mol L^{-1}, T-DNA: 5.0 × 10^{-9} mol L^{-1}.10 min incubation time of F-DNA and AuNPs, 30 min hybridization time of F-DNA on AuNPs surface and T-DNA, 60 min incubation time of Exo III.

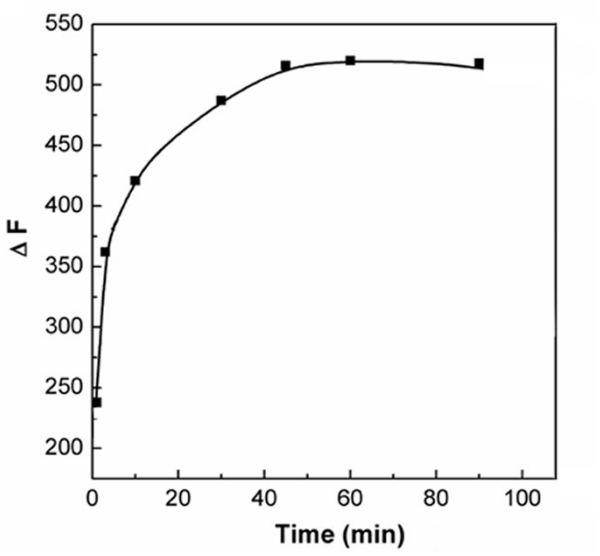

Fig. S6. Effects of incubation time of Exo III. Condition: pH: 8.0, Temperature: 37 °C, F-DNA: 5.0 × 10^{-8} mol L^{-1}, AuNPs: 7.8 × 10^{-9} mol L^{-1}, T-DNA: 5.0 × 10^{-9} mol L^{-1}, , Exo III: 1.3 × 10^{6} U L^{-1}. 10 min incubation time of F-DNA and AuNPs, 30 min hybridization time of F-DNA on AuNPs surface and T-DNA.

Table S1 Comparison of the nanomaterial-based fluorescent methods for DNA detection

Strategy	Nanomaterial	Synthesis procedure of the nanomaterial	Detection limit ($mol \cdot L^{-1}$)	Ref.
The fluorescent oligonucleotide with carbon nanotubes and target DNA	single walled carbon nanotubes	The purchased single walled carbon nanotubes were sonicatied in DMF for 5 h.	4.0×10^{-9}	1
The carbon nanotube-based nanobeacon for detection of DNA	single walled carbon nanotubes	The purchased nanotubes were refluxed in HNO_3 for 2 days, and the precipitates were oxidized by HNO_3/H_2SO_4 for 4 h, and then the products were kept in an oven at 50 ℃ for 5 h.	4.2×10^{-11}	2
A graphene platform for sensing biomolecules	graphene oxide	The graphene oxide were synthesized from natural graphite powder by a modified Hummers method.	1.0×10^{-9}	3
Graphene and HpaII-based fluorescent strategy for DNA detection	graphene oxide	The graphene oxide were synthesized by the Hummers method.	4.3×10^{-11}	4
A conjugation polymer nanobelts platform for nucleic acid detection	conjugation polymer nanobelts	The conjugation polymer nanobelts were synthesized with chemical oxidation polymerization of p-phenediamine monomers.	3.0×10^{-8}	5
Fluorescence-enhanced nucleic acid detection with Pd nanowires	Pd nanowires	Te nanowires were synthesized with hydrothermal method, and Te nanowires mixed with H_2PdCl_4 solution was stirred, and then centrifuged and washed for Pd nanowires.	3.0×10^{-10}	6
The different interaction between ss-DNA or ds-DNA and MoS_2 nanosheets	MoS_2 nanosheets	MoS_2 nanosheets were synthesized by exfoliating bulk MoS_2 using electrochemical lithium-intercalation method.	5.0×10^{-10}	7
The affinity change of carbon nitride nanosheets to DNA probes upon their recognition to targets	carbon nitride nanosheets	Carbon nitride nanosheets were prepared by sonicating bulk graphitic-phase carbon nitride, which was first synthesized by polymerization of melamine.	8.1×10^{-11}	8
Au nanoparticles fluorescence switch-mediated target recycling strategy	Au nanoparticles	The mixture of chloroauric acid and sodium citrate were maintained at 100 °C for 20 min with stirring.	1.0×10^{-11}	this method

References

1 R. H. Yang, J. Y. Jin, Y. Chen, N. Shao, H. Z. Kang, Z. Y. Xiao, Z. W. Tang, Y. R. Wu, Z. Zhu, W. H. Tan, *J. Am. Chem. Soc.*, 2008, **130**, 8351-8358.

2 J. Chen, Y. Huang, M. Shi, S. L. Zhao, Y. C. Zhao, *Talanta*, 2013, **109**, 160-166.

3 C. H. Lu, H. H. Yang, C. L. Zhu, X. Chen, G. N. Che, *Angew. Chem. Int. Ed.*, 2009, **48**, 4785-4787.

4 W. Wei, C. Y. Gao, Y. X. Xiong, Y. J. Zhang, S. Q. Liu, Y. P. Pu, *Talanta*, 2015, **131**, 342-347.

5 L. Wang, Y. W. Zhang, J. Q. Tain, H. L. Li, X. P. Sun, *Nucleic Acids Res.*, 2011, **39**, e37.

6 L. B. Zhang, S.J. Guo, S. J. Dong, E. K. Wang, *Anal. Chem.*, 2012, **84**, 3568-3573.

7 C. F. Zhu, Z. Y. Zeng, H. Li, F. Li, C. H. Fan, H. Zhang, *J. Am. Chem. Soc.*, 2013, **135**, 5998-6001.

8 Q. B. Wang, W. Wang, J. P. Lei, N. Xu, F. L. Gao, H. X. Ju, *Anal. Chem.*, 2013, **85**, 12182-12188.