Supporting Information

Ultrasensitive and turn-on homogeneous Hg^{2+} sensing based on target-triggered isothermal cycling reaction and dsDNA-templated copper nanoparticles

Qingli Chai[a], Yuqi Wan[a], Yanyun Zou[a], Ting Zhu[a], Ningxing Li[b], Jinyang Chen[a]*, Guosong Lai[a]

[a]*Hubei Key Laboratory of Pollutant Analysis & Reuse Technology, Department of Chemistry, Hubei Normal University, Huangshi 435002, PR China*

[b]*College of Chemistry and Chemical Engineering, Hunan University, Changsha 410082, PR China*

**Corresponding author. E-mail: chenjy@hbnu.edu.cn*

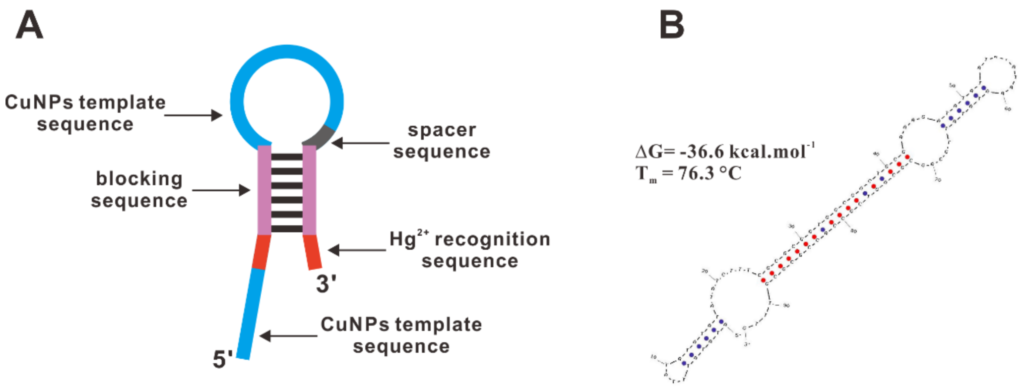

Fig. S1. (A) Design of hairpin DNA structure. (B) Simulation diagram of hairpin structure of hairpin DNA probe with OligoAnalyzer Tool. Oligo concentration: 1.0 μM, Na^{+} concentration: 100 mM, Mg^{2+} concentration: 2 mM.

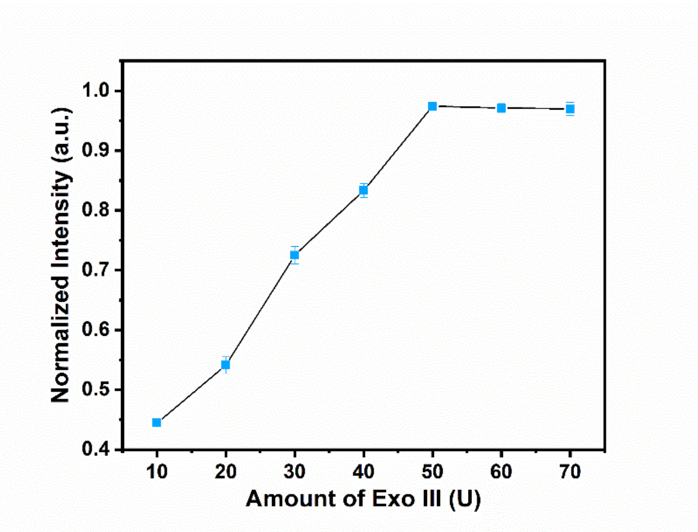

Fig. S2. Effects of the amount of Exo III on the fluorescence signal of the sensor for Hg^{2+} detection. Hg^{2+} concentration: 100 nM.

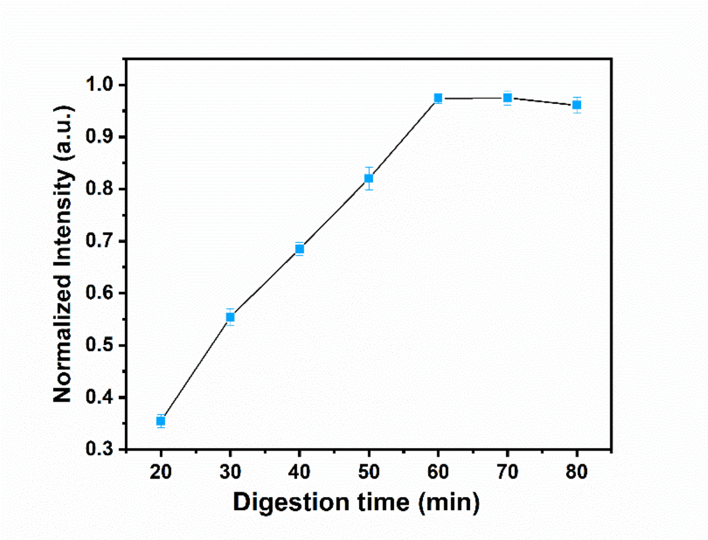

Fig. S3. Effects of the digestion time on the fluorescence signal of the sensor for Hg^{2+} detection. Hg^{2+} concentration: 100 nM.

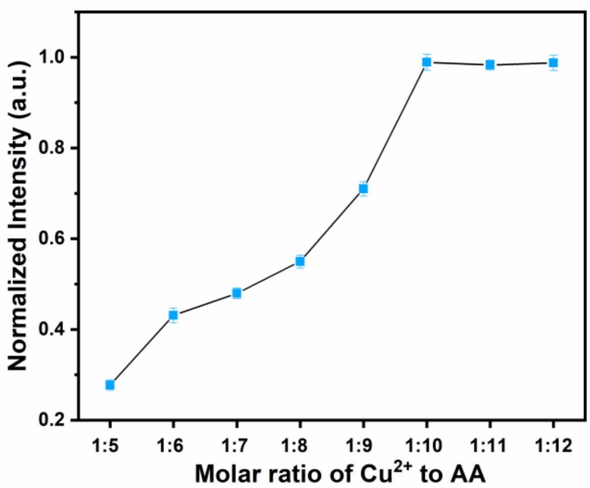

Fig. S4. Effects of the molar ratio of Cu^{2+} to AA on the fluorescence signal of the sensor for Hg^{2+} detection. Hg^{2+} concentration: 100 nM.

Table S1. Comparison of the method for Hg^{2+} detection in this work with some previously reported strategies.

Method	Linear range	LOD	Reference
Fluorescence	1.0 nM ~ 60 nM	0.39 nM	[1]
Fluorescence	0 ~ 6 μM	42 nM	[2]
Fluorescence	0.10 nM ~ 1.0 μM	0.03 nM	[3]
Fluorescence	0 ~ 4.5 μM	7.0 nM	[4]
Fluorescence	0.5 μM ~ 64 μM	7.4 nM	[5]
Phosphorescence	20 nM ~ 0.8 μM	4.8 nM	[6]
Colorimetric	1.9 nM ~ 62.5 nM	0.13 nM	[7]
Colorimetric	1.0 nM ~ 28 nM	32 pM	[8]
Rayleigh Scattering	50 pM ~ 500 nM	20 pM	[9]
Electrochemical	0 ~ 10 μM	227 pM	[10]
Electrochemical	10 pM ~ 100 μM	2.9 pM	[11]
Fluorescence	**10 pM ~ 1.0 μM**	**3.9 pM**	**This work**

References

[1] W. Gu, X. Pei, Y. Cheng, C. Zhang, J. Zhang, Y. Yan, C. Ding, Y. Xian, Black Phosphorus Quantum Dots as the Ratiometric Fluorescence Probe for Trace Mercury Ion Detection Based on Inner Filter Effect, ACS Sens., 2 (2017) 576-582.

[2] M. Lan, J. Zhang, Y.S. Chui, P. Wang, X. Chen, C.S. Lee, H.L. Kwong, W. Zhang, Carbon nanoparticle-based ratiometric fluorescent sensor for detecting mercury ions in aqueous media and living cells, ACS Appl. Mater. Interfaces, 6 (2014) 21270-21278.

[3] Y. Cai, F. Wang, Y. Hua, H. Liu, M. Yin, C. Zhang, Y. Zhang, H. Wang, A fluorimetric testing strip for the visual evaluation of mercury in blood using copper nanoclusters with DMSO-enhanced fluorescence and stability, Nanoscale, 12 (2020) 24079-24084.

[4] Z. Q. Zhou, R. Yan, J. Zhao, L. Y. Yang, J. L. Chen, Y. J. Hu, F. L. Jiang, Y. Liu, Highly

selective and sensitive detection of Hg^{2+} based on fluorescence enhancement of Mn-doped ZnSe QDs by Hg^{2+}-Mn^{2+} replacement, Sens. Actuator B-Chem., 254 (2018) 8-15.

[5] S.M. Tawfik, A.A. Abd-Elaal, Y.I. Lee, Selective dual detection of Hg^{2+} and TATP based on amphiphilic conjugated polythiophene-quantum dot hybrid materials, Analyst, 146 (2021) 2894-2901.

[6] Y. Miao, X. Sun, J. Lv, G. Yan, Preparation of Single-Stranded DNA-Templated Room-Temperature Phosphorescent Quantum Dots and Their Application for Mercury(II) Detection in Environmental and Biological Fluids, Anal. Chem., 91 (2019) 5036-5042.

[7] Z. Deng, W. Jin, Q. Yin, J. Huang, Z. Huang, H. Fu, Y. Yuan, J. Zou, J. Nie, Y. Zhang, Ultrasensitive visual detection of Hg^{2+} ions via the Tyndall effect of gold nanoparticles, Chem. Commun., 57 (2021) 2613-2616.

[8] J. Hai, F. Chen, J. Su, F. Xu, B. Wang, Porous Wood Members-Based Amplified Colorimetric Sensor for Hg^{2+} Detection through Hg^{2+}-Triggered Methylene Blue Reduction Reactions, Anal. Chem., 90 (2018) 4909-4915.

[9] W. Ren, Y. Zhang, H.G. Chen, Z.F. Gao, N.B. Li, H.Q. Luo, Ultrasensitive Label-Free Resonance Rayleigh Scattering Aptasensor for Hg^{2+} Using Hg^{2+}-Triggered Exonuclease III-Assisted Target Recycling and Growth of G-Wires for Signal Amplification, Anal. Chem., 88 (2016) 1385-1390.

[10] X. Song, Y. Wang, S. Liu, X. Zhang, H. Wang, J. Wang, J. Huang, Ultrasensitive electrochemical detection of Hg^{2+} based on an Hg^{2+}-triggered exonuclease III-assisted target recycling strategy, Analyst, 143 (2018) 5771-5778.

[11] N. Ma, X. Ren, H. Wang, X. Kuang, D. Fan, D. Wu, Q. Wei, Ultrasensitive Controlled Release Aptasensor Using Thymine-Hg^{2+}-Thymine Mismatch as a Molecular Switch for Hg^{2+} Detection, Anal. Chem., 92 (2020) 14069-14075.