Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting Information

Nitrogen doped carbon dots for detection of mercury ions in living cells and visualization of latent fingerprints

Guojuan Ren,[a] Yuxi Meng,[a] Qi Zhang,[b] Mingyu Tang,[a] Baoya Zhu,[a] Fang Chai,*[a] Chungang Wang, *[b] Zhongmin Su*[b]

a) Key Laboratory of Photochemical Biomaterials and Energy Storage Materials, Colleges of Heilongjiang Province, College of Chemistry and Chemical Engineering, Harbin Normal University, Harbin 150025, P. R. China
E-mail: fangchai@gmail.com

b) Faculty of Chemistry, Northeast Normal University, Changchun 130024, P. R. China E-mail: wangcg925@nenu.edu.cn; zmsu@nenu.edu.cn

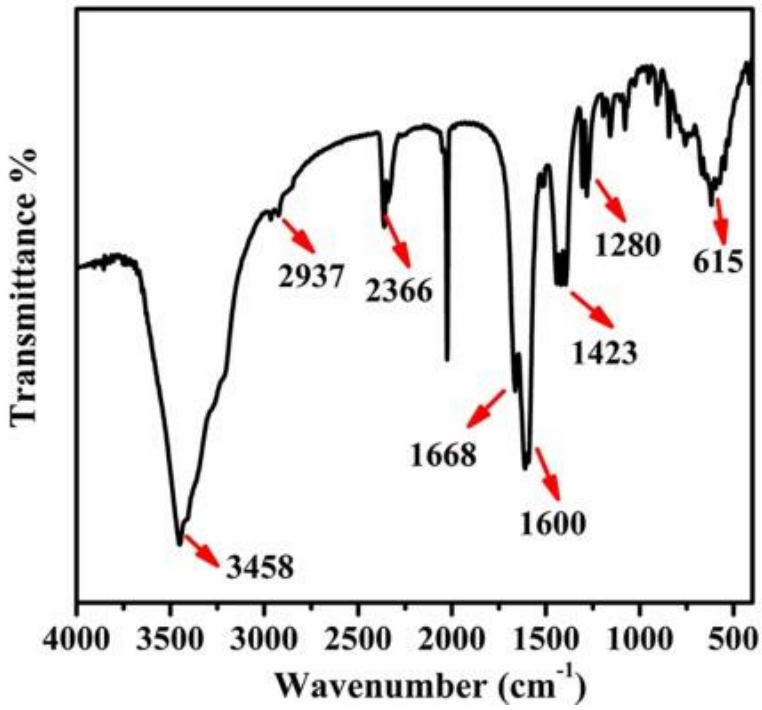

Fig. S1. FTIR spectrum of NCDs in the dry state.

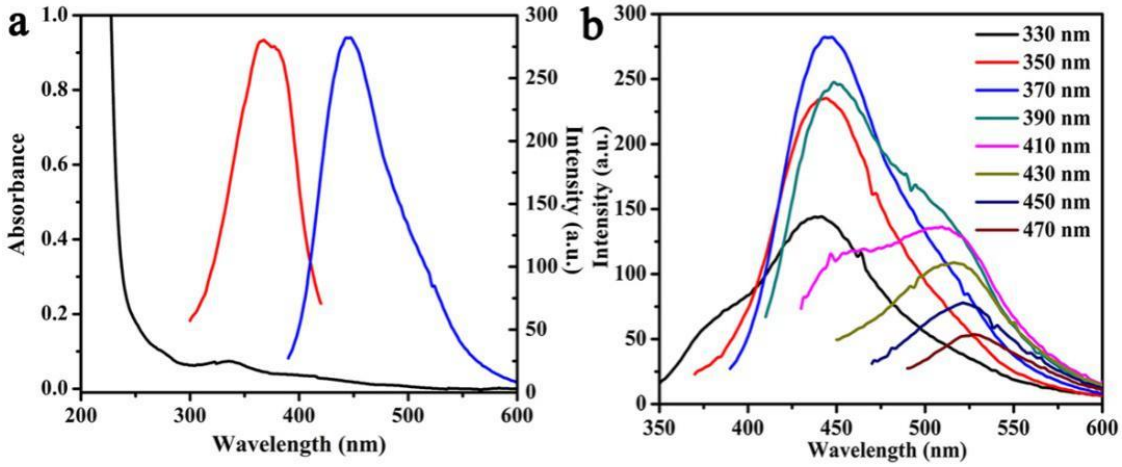

Fig. S2. a) UV–vis absorption spectra (black line), excitation (red color) and emission (blue color) spectra of NCDs. b) Fluorescence spectra of NCDs at different excitation wavelengths.

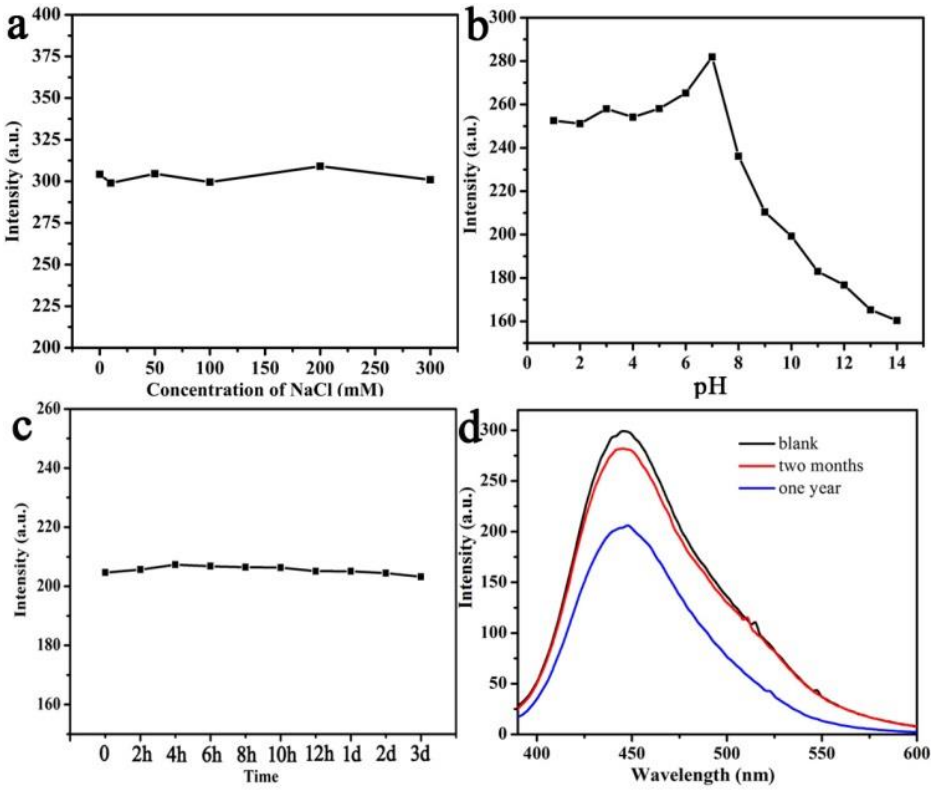

Fig. S3. a) The fluorescence intensity of NCDs at different ionic strengths regulated by concentrations of NaCl from 0 to 300 mM. b) The effect of pH value on fluorescence intensity of NCDs. c) The fluorescence intensity of NCDs at different storage time (0-3d). d) The fluorescence spectra of NCDs after two months and one year.

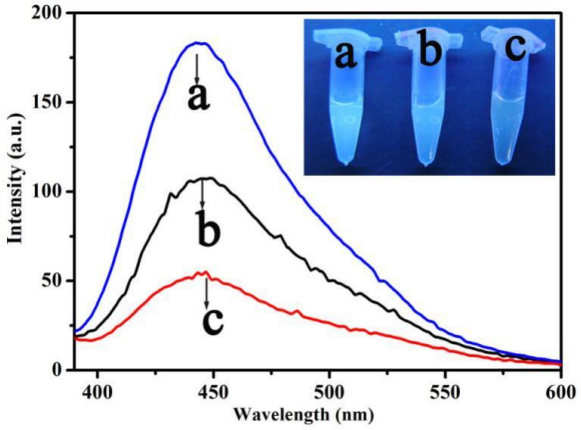

Fig. S4. a) Fluorescent intensity of alone NCDs. b) and c) showed fluorescent intensity of the mixture of all the metal ions in the absence and presence of Hg^{2+}, respectively. Corresponding to pictures (inset).

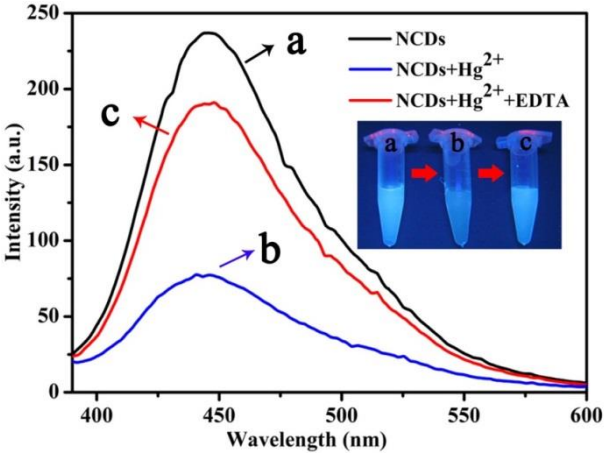

Fig. S5. Fluorescence spectra for the NCDs (a), the quenching of NCDs fluorescence by Hg^{2+} (b), fluorescence recovery as result of EDTA addition (c).

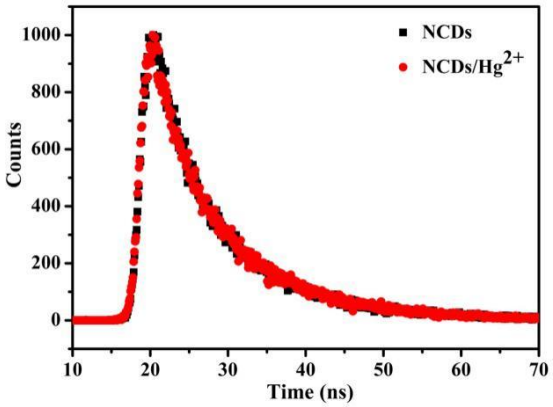

Fig. S6. Time-resolved fluorescence decays of NCDs (black), NCDs/Hg^{2+} complex (red).

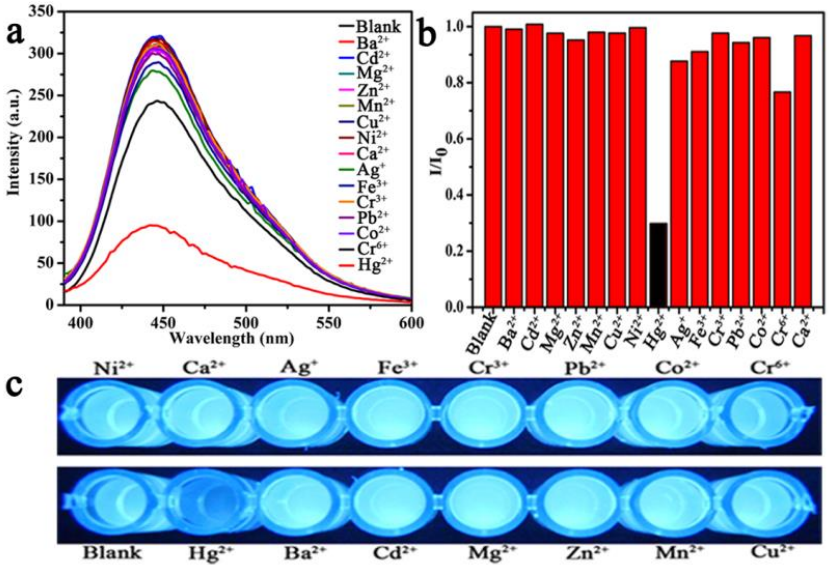

Fig. S7. Selectivity of detection for lake water samples: a) Fluorescence spectra of NCDs containing 100 μM Hg^{2+} compared with 100 μM other ions in lake water. b) Relative fluorescence intensity (λ_{ex}=370 nm) of NCDs solution with 100 μM of various metal ions in the lake water. c) The corresponding pictures of detection under UV lamp.

Cell Culture: HeLa cells (human cancer cell lines) were grown in Dulbecco's Modified Eagle's Medium (DMEM) with 10% fetal bovine serum (FBS), 1% penicillin and streptomycin. HeLa cells were seeded into 12-well plates and incubated for 24 h prior to treatment. Then NCDs were added at a concentration equal to 1mg/ mL of pure dyes and incubated for 3 h at 37 ℃ with 5% CO_2. Then the cells were washed three with PBS and fixed with 2.5% glutaraldehyde for 10 min. Discard the glutaraldehyde solution and fully washed the cells with PBS three times. The cells were imaged after washing the culture medium three times with PBS. Then the cells observed under a Leica DM IL LED Fluorescence inverted microscope (FIM).

MTT Assay: HeLa cells were seeded into 96-well plates at a density of 1×10^4 per well in 100 μL of medium and grown overnight. Then the medium was replaced

with medium contain 50, 100, 200, 400 and 800 μg mL^{-1} NCDs, and incubated at 37°C for 24 h. After that, 20 μL of 0.5 mg/mL MTT solution was added to each cell well. After incubation for 3 h, the medium was then replaced with dimethyl sulfoxide (DMSO: 150 μL) per well and the absorbance was monitored with a microplate reader (Bio-TekELx800) at a wavelength of 490 nm. The cell viability was expressed as the absorbance ratio of cell viability relative to untreated control cells.

The cell viability was analyzed using the following equation.

$$\text{Cell viability} = I_{treated}/I_{control}$$

where $I_{control}$ is the optical density in the absence of the NCDs and $I_{treated}$ is the optical density in the presence of the NCDs.

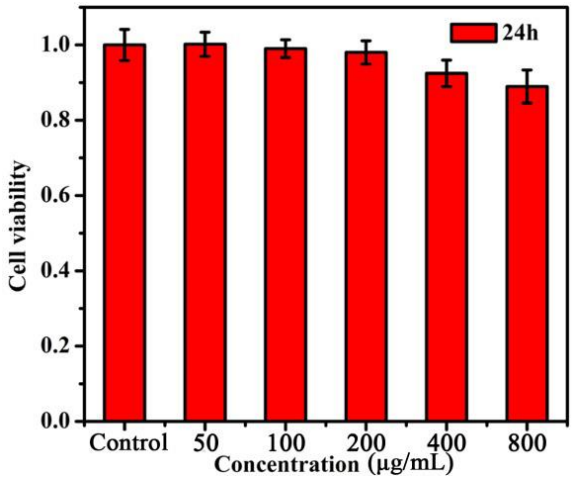

Fig. S8. Cell viability assays of HeLa cells treated with different concentrations of NCDs.

Table S1 Determination of metal ions in lake water by ICP-AES (LS2-045)

Content/ion	Pb^{2+}	Cd^{2+}	Cu^{2+}	Mn^{2+}	Cr^{3+}	Cr^{6+}	Ni^{2+}	Fe^{2+}	Zn^{2+}	Hg^{2+}
Concentration (nM)	0	266.9	298.9	872.7	0	0	426.0	179.1	871.8	0

Table S2: Comparison of different fluorescent carbon dots for Hg^{2+} detection.

	Probe	Analyte	Method	Limit of detection	Linear range	Reference
1	Carbon dots	Hg^{2+}	fluorescent detection	845 nM	1-15 μM	1
2	Carbon dots	Hg^{2+}	fluorescent detection	1.6 μM	6-80 μM	2
3	Carbon dots	Hg^{2+}	fluorescent detection	2.47 μM	4-18 μM	3
4	Nitrogen and sulfur co-doped carbon dots	Hg^{2+}	fluorescent detection	2 μM	0-40 μM	4
5	Nitrogen-carbon dots	Hg^{2+}	fluorescent detection	0.65 μM	0.001–5 μM	This work

Reference:

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2. C. Y. Wang, K. L. Zhuo, C. F. Wang, P. P. Xu, A. Q. Li and Y. J. Chen, *J Mater Sci.* 2015, **2**, 1.
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