Supplementary Information

A dual-emission carbon dots/gold nanoclusters fluorescent probe for ratiometric and colorimetric detection of Pb^{2+} and Hg^{2+}

Hongxin Cai[a,1], Yixin Shao[a,1], Lingling Yan[a,*], Hang Yu[a], Qiang Hu[a,*], Yongqiang Wang[a], Xiude Tu[b]

[a]*School of Physics and Electronic Information Engineering, Henan Polytechnic University, Jiaozuo, 454000, China*

[b]*Wuhan Second Ship Design and Research Institute, Wuhan, 430200, China*

∗ Corresponding author: Lingling Yan; yll@hpu.edu.cn and Qiang Hu; huqiang@hpu.edu.cn

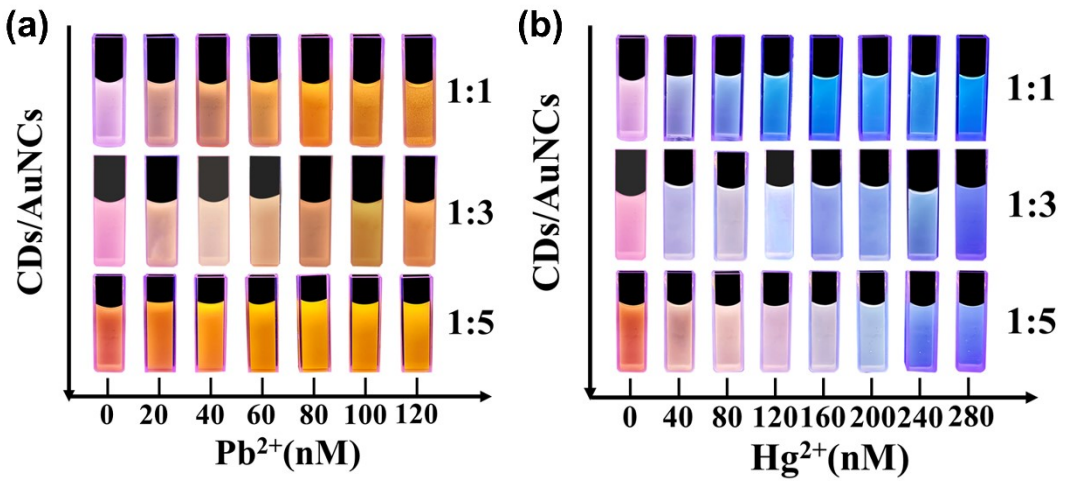

Fig. S1 The fluorescent photographs of the CDs/AuNCs with different volume ratios under a 365 nm UV lamp.

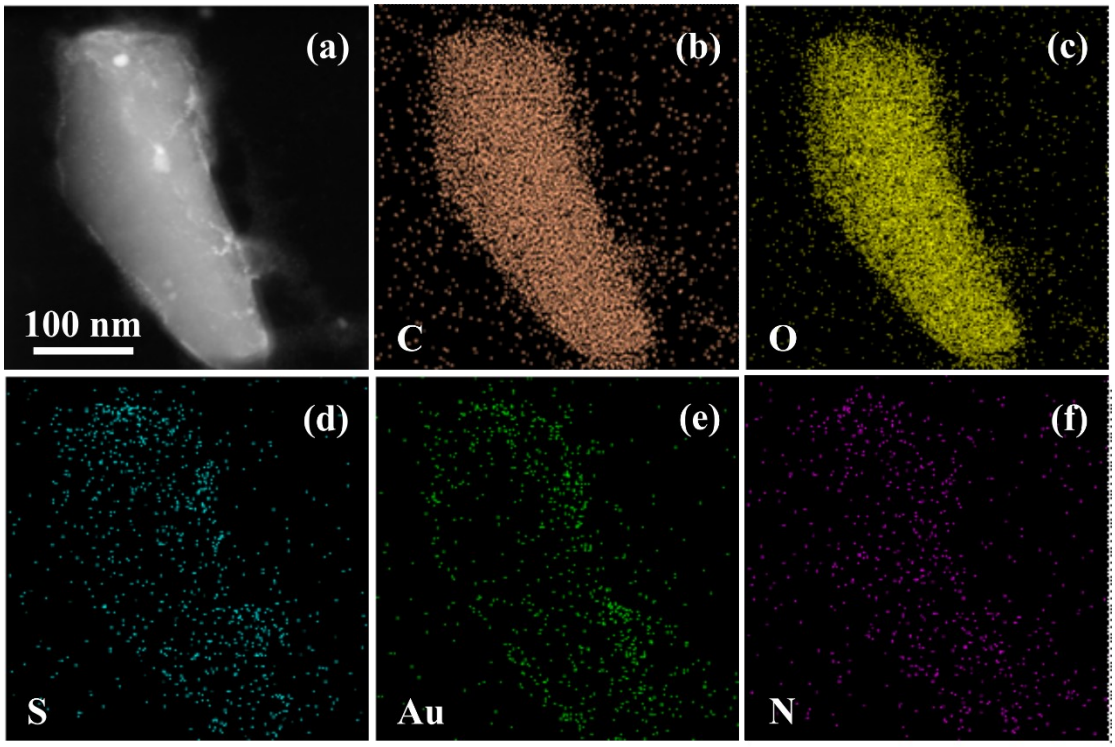

Fig. S2 (a) TEM image and (b-f) EDAX elemental mapping results of CDs/AuNCs.

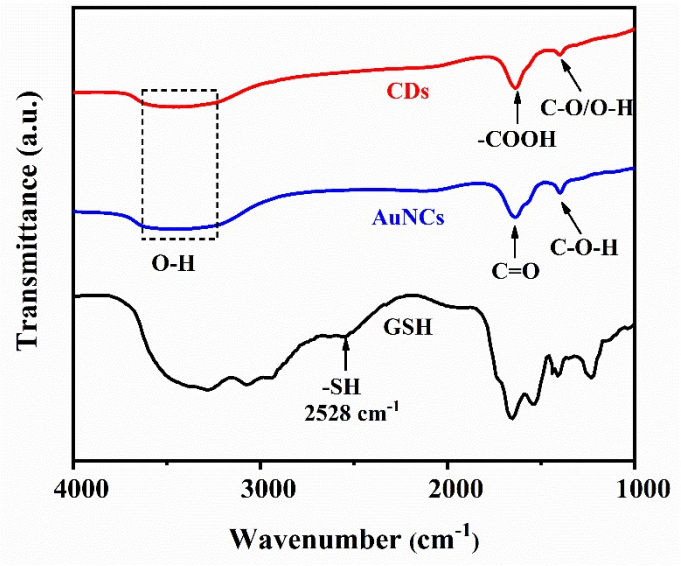

Fig. S3 FT-IR spectra of CDs, AuNCs, and GSH.

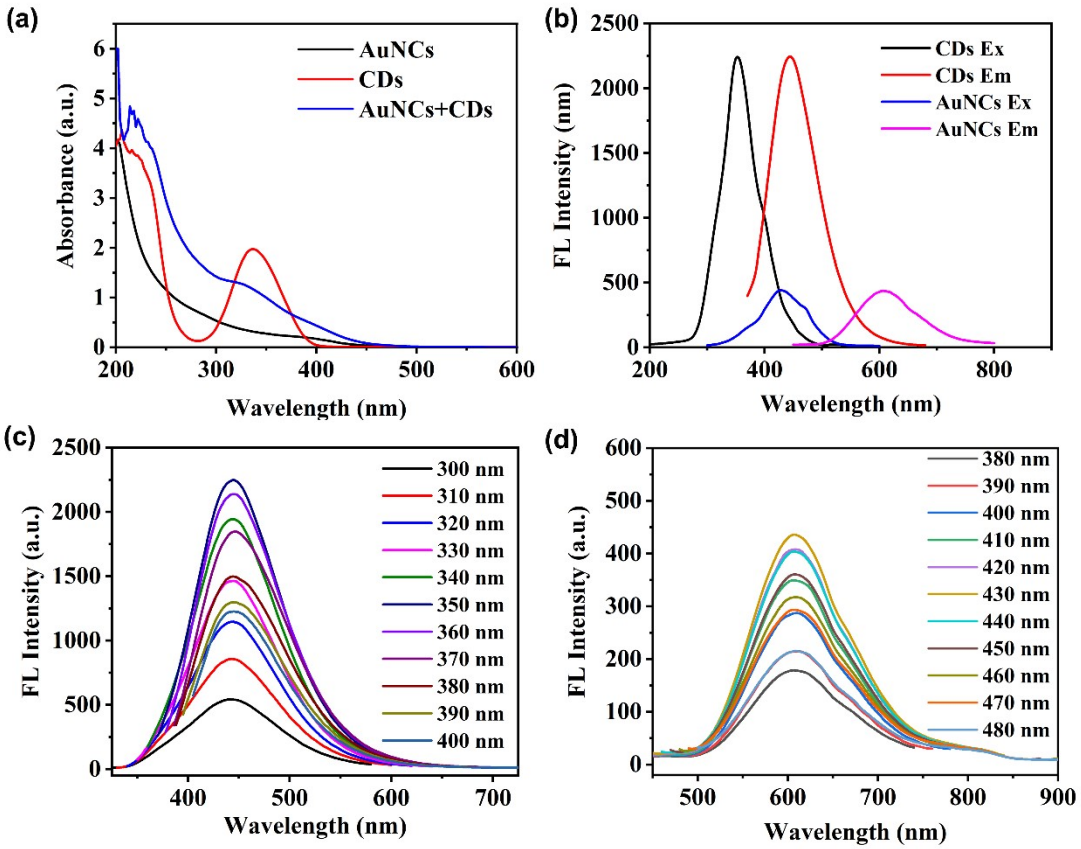

Fig. S4 (a) UV-Vis absorption spectra of AuNCs, CDs and CDs/AuNCs. (b) Excitation and emission spectra of CDs and AuNCs. Fluorescence spectra of (c) CDs and (d) AuNCs under different excitation wavelengths.

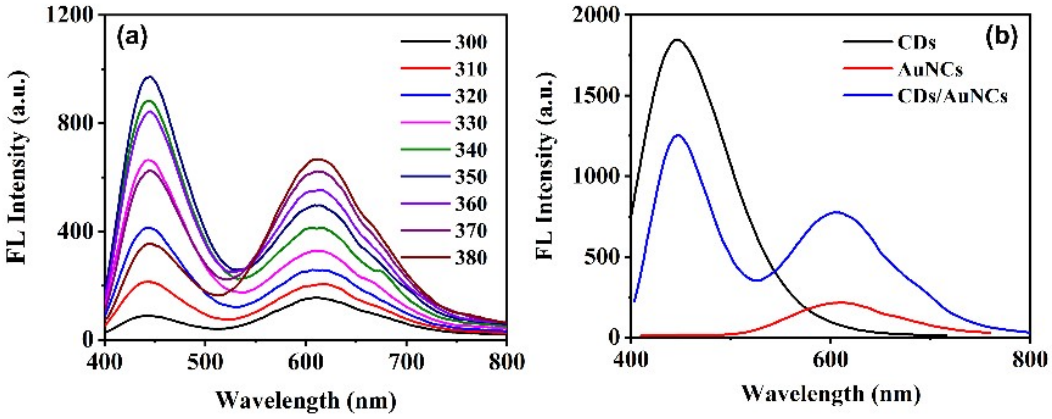

Fig. S5 (a) Emission spectra of the CDs/AuNCs probe under different excitation wavelengths. (b) Fluorescence spectra of CDs, AuNCs and CDs/AuNCs.

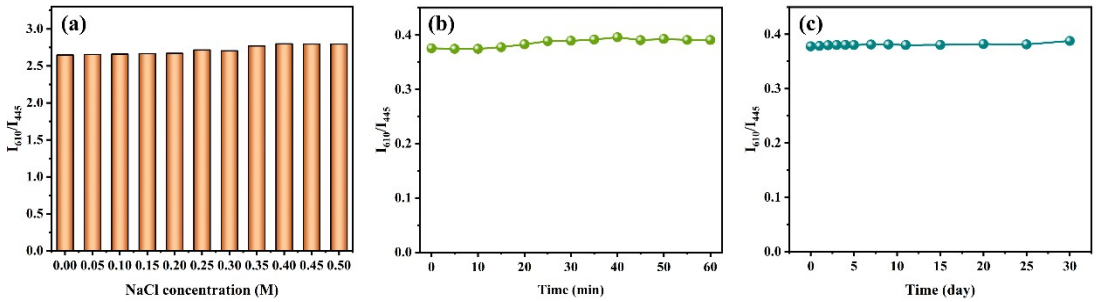

Fig. S6 (a) Fluorescence intensity of CDs/AuNCs at different NaCl concentrations. (b) Photostability test of CDs/AuNCs with a continuous 365 nm ultraviolet light irradiation. (c) Fluorescence intensity of CDs/AuNC with time. (I_{610} and I_{445} denotes the fluorescence intensities of AuNCs and CDs within the probe.)

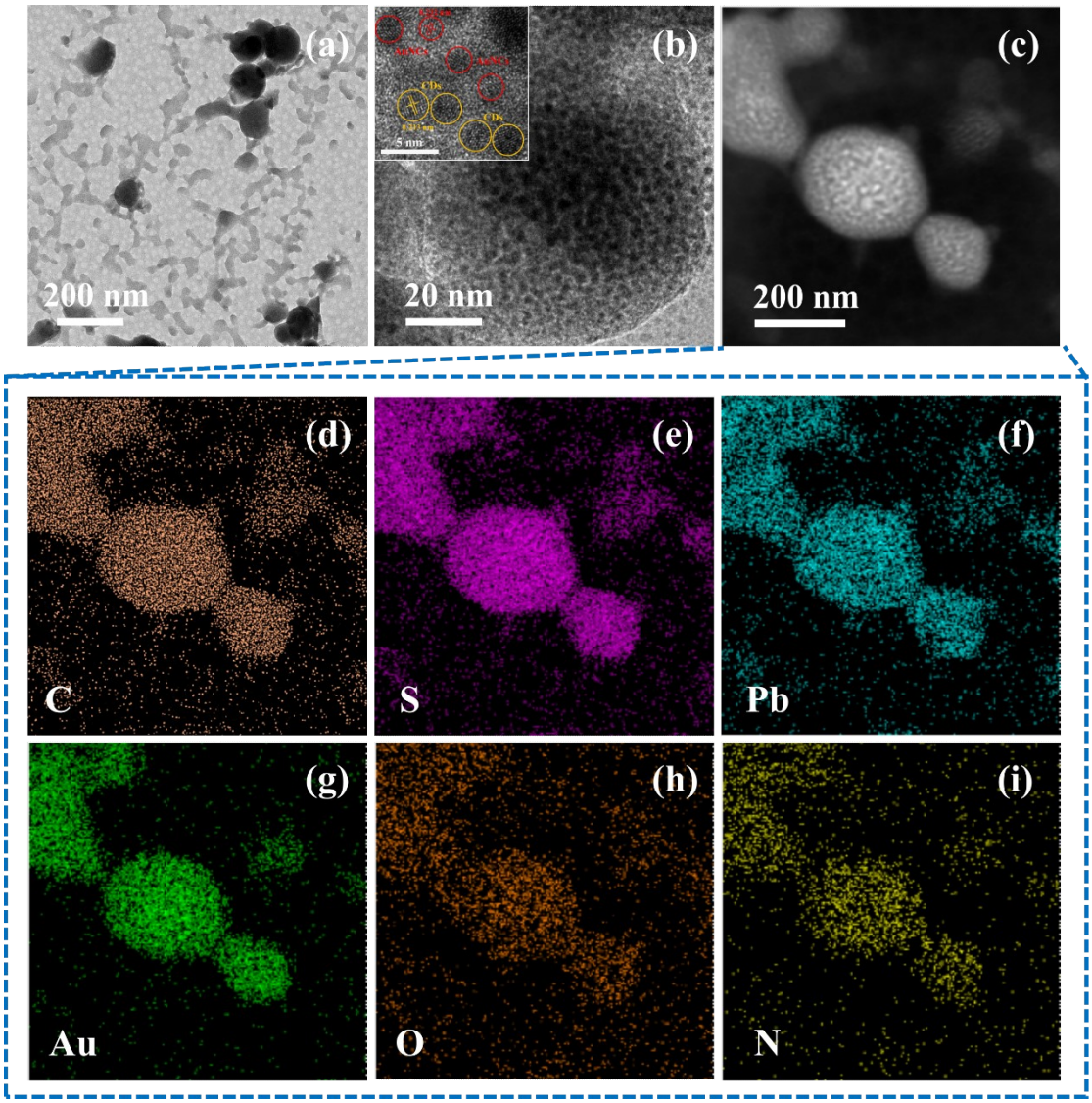

Fig. S7 (a-c) TEM images and (d-i) EDAX elemental mapping results of CDs/AuNCs after adding Pb^{2+}. Inset is HR-TEM image.

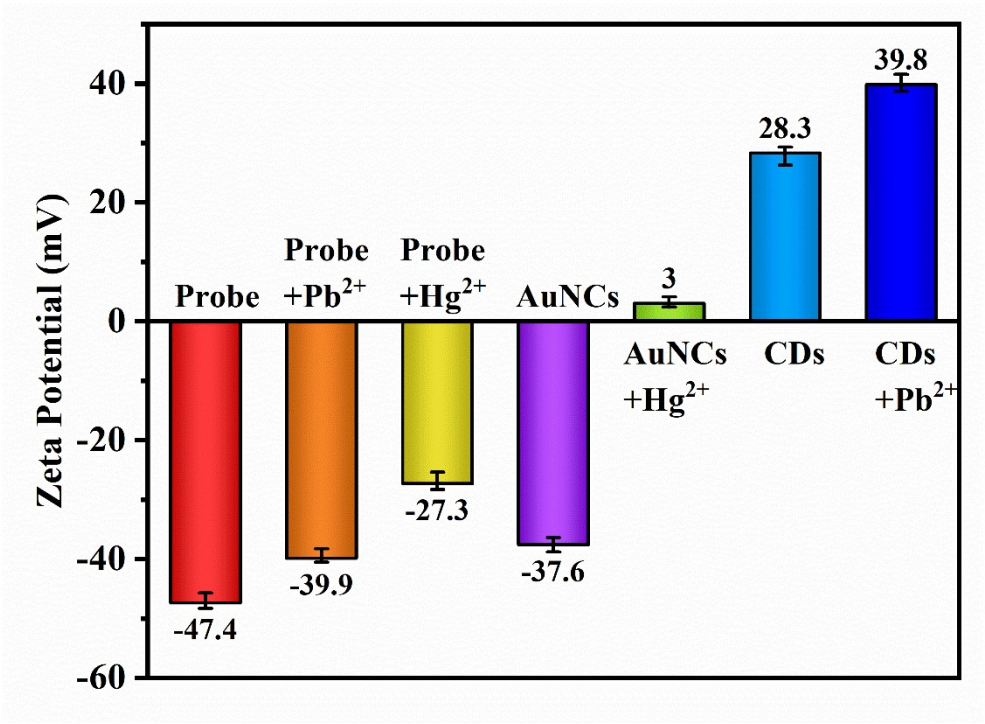

Fig. S8 Zeta potentials of the CDs/AuNCs probe, the probe with Pb^{2+}, the probe with Hg^{2+}, AuNCs, AuNCs with Hg^{2+}, CDs and CDs with Pb^{2+}.

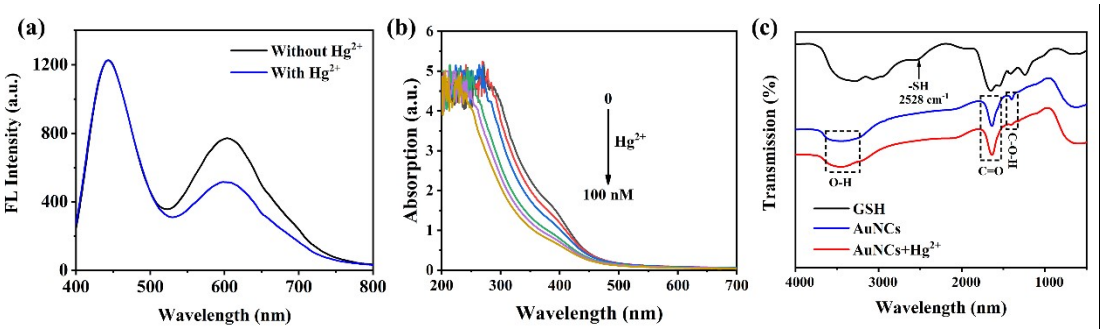

Fig. S9 (a) Fluorescence spectra the CDs/AuNCs probe with and without Hg^{2+}. (b) UV-Vis absorption spectra of AuNCs with different Hg^{2+} concentration. (c) FT-IR spectra of GSH and AuNCs in the absence and presence of Hg^{2+}.

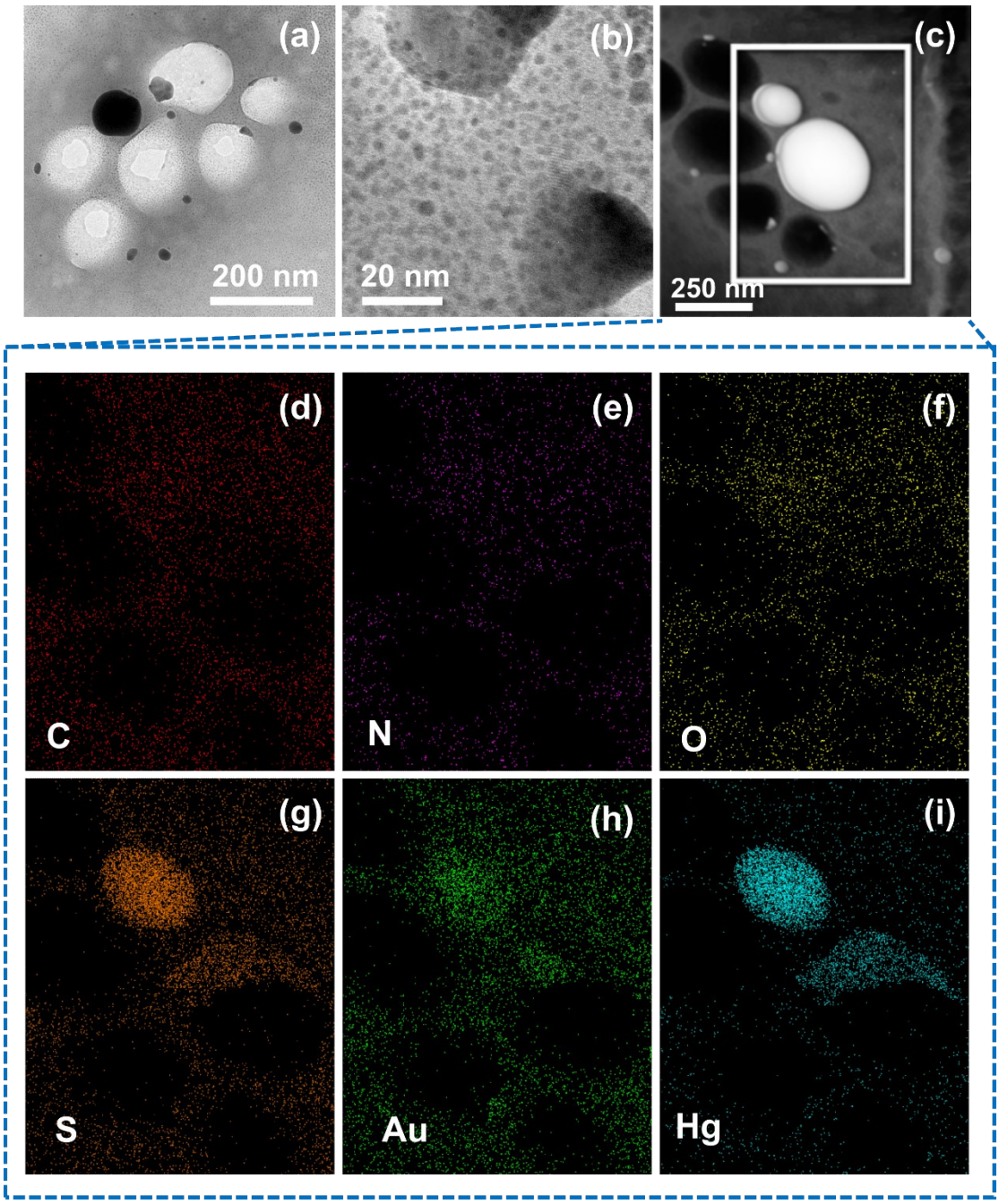

Fig. S10 (a-c) TEM images and (d-i) EDAX elemental mapping results of CDs/AuNCs after adding Hg^{2+}.

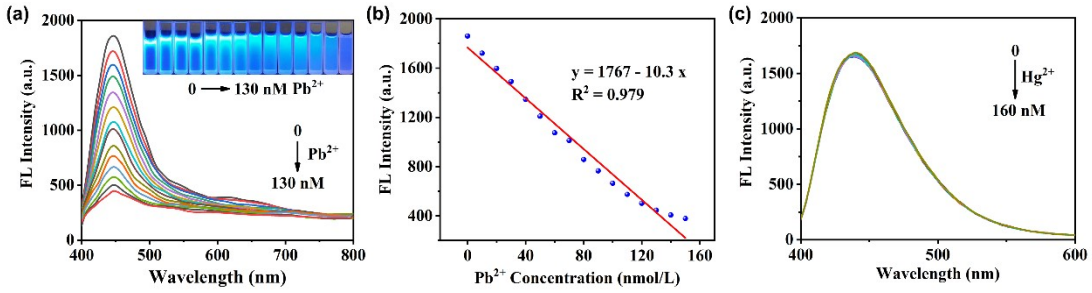

Fig. S11 (a) Fluorescence spectra of single CDs with different Pb^{2+} concentration. Inset: the color transition observed under UV illumination. (b) Correlation between the FL intensity ratio I_{610}/I_{445} and the concentration of Pb^{2+}. (c) Fluorescence spectra of single CDs with different Hg^{2+} concentration.

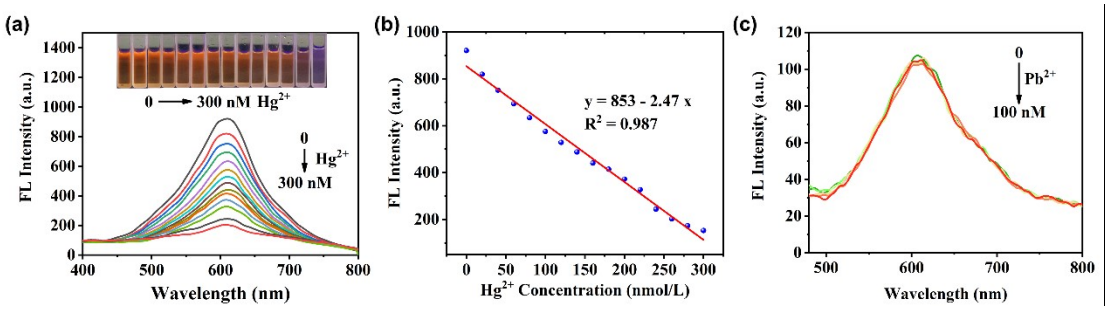

Fig. S12 (a) Fluorescence spectra of single AuNCs with different Hg^{2+} concentration. Inset: the color transition observed under UV illumination. (b) Correlation between the FL intensity ratio I_{610}/I_{445} and the concentration of Hg^{2+}. (c) Fluorescence spectra of single CDs with different Pb^{2+} concentration.

Sample	Added (nM)	Found (nM)	Recovery (%)	RSD (%)
Tap water (Pb^{2+})	40	41.45	103.63	3.76
	80	81.71	102.14	2.35
	120	111.79	93.16	4.29
Lake water (Pb^{2+})	40	40.41	101.02	1.36
	80	77.67	97.08	2.38
	120	114.14	95.11	3.75

Tab. S1 Detection of Pb^{2+} in Lake water and tap water samples (n = 3).

Sample	Added (nM)	Found (nM)	Recovery (%)	RSD (%)
Tap water (Hg^{2+})	80	71.26	89.07	3.24
	140	137.06	97.90	2.65
	200	206.57	103.28	3.81
Lake water (Hg^{2+})	80	74.50	93.12	4.17
	140	131.93	94.23	3.52
	200	191.34	95.67	2.28

Tab. S2 Detection of Hg^{2+} in Lake water and tap water samples (n = 3).