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

Revised Electronic Supplementary Information

Construction of Ratiometric Phosphorescent Assay with Long-Lived Carbon Quantum Dots and Inorganic nanoparticles for its application in environmental and biological system

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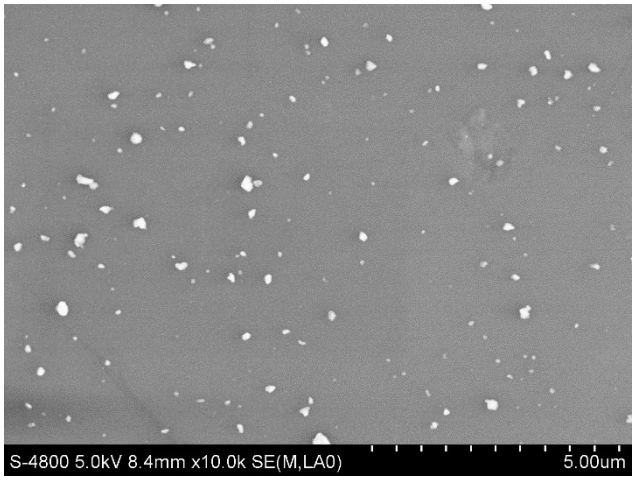

Fig. S1 The SEM image of $CaTiO_3:Pr^{3+}@SiO_2$.

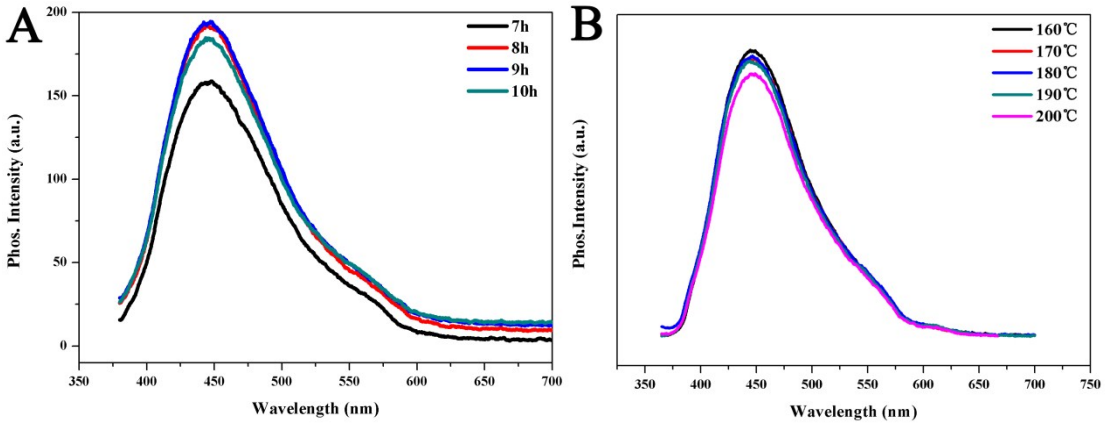

Fig.S2 The optimization of reaction time (A) and reaction temperature (B) of CDs.

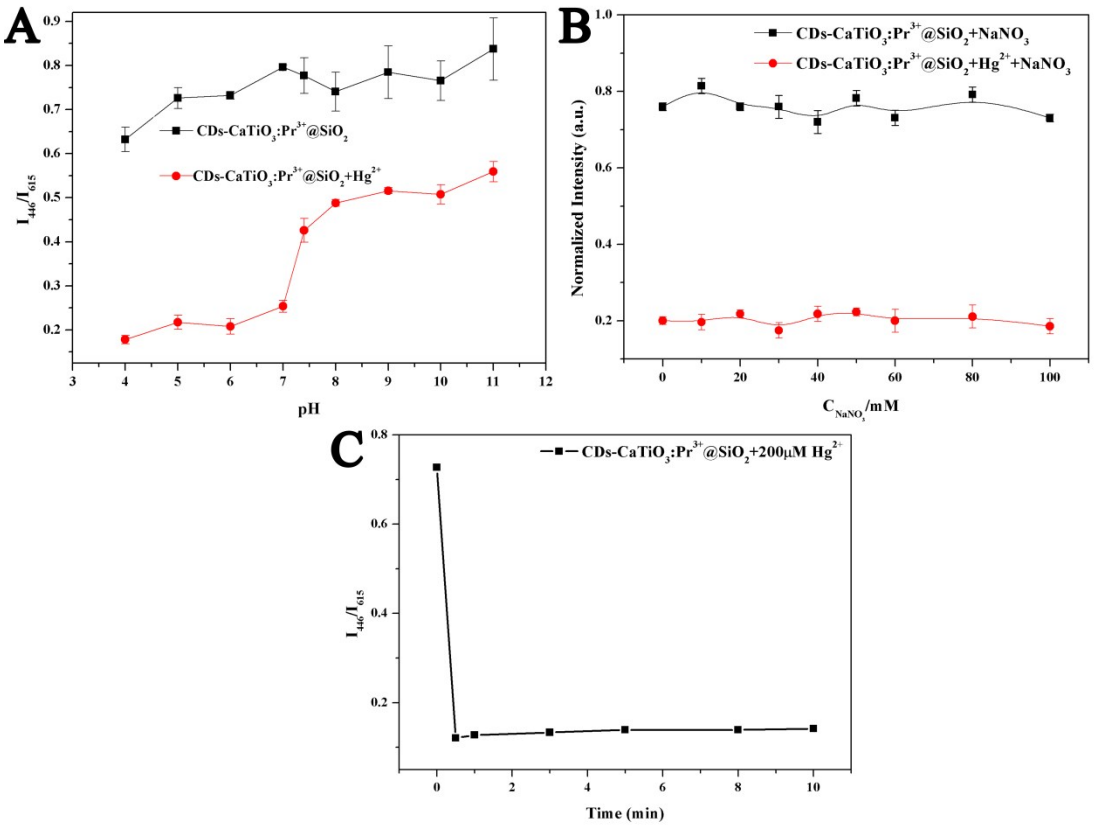

Fig.S3 Effect of pH on the ratio phosphorescence intensity (I_{446}/I_{615}) of CDs-$CaTiO_3$:Pr^{3+}@SiO_2 with HEPES buffer solution (10 mM, pH 7.0) in the absence (black line) and presence of Hg^{2+} (200 μM) (red line)（A）and the ratio phosphorescence intensity (I_{446}/I_{615}) in the absence and presence of Hg^{2+}(200 μM) under different ionic strengths ($NaNO_3$) (B); The ratio phosphorescence intensity (I_{446}/I_{615}) of CDs-$CaTiO_3$:Pr^{3+}@SiO_2 in the presence of Hg^{2+} (200 μM) versus incubation time (C).

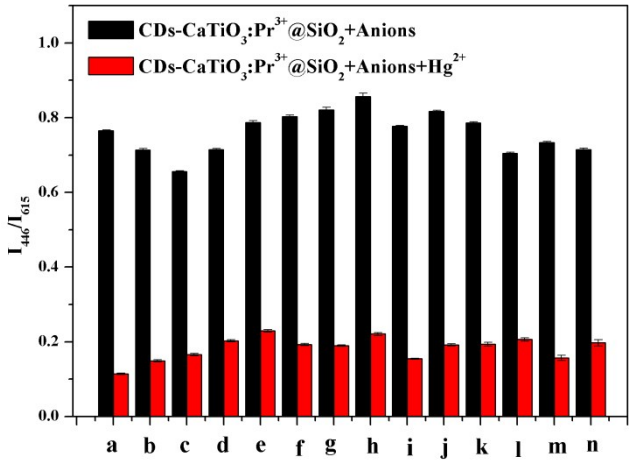

Fig.S4 Phosphorescence responses of CDs-$CaTiO_3$:Pr^{3+}@SiO_2 upon the addition of different anions (200 μM)((a) Blank (b) F^- (c) Cl^- (d) Br^- (e) I^- (f) $C_2O_4^{2-}$ (g) CO_3^{2-} (h) HPO_4^{2-} (i)$H_2PO_4^-$ (g) PO_4^{3-} (k)NO_3^- (l) S^{2-} (m) SO_3^{2-} (n) PPA) in absence and presence of Hg^{2+} (200 μM) (λ_{ex}=345 nm), where I_{446} and I_{615} refer to the phosphorescence intensity of CDs and $CaTiO_3$:Pr^{3+}@SiO_2, respectively.

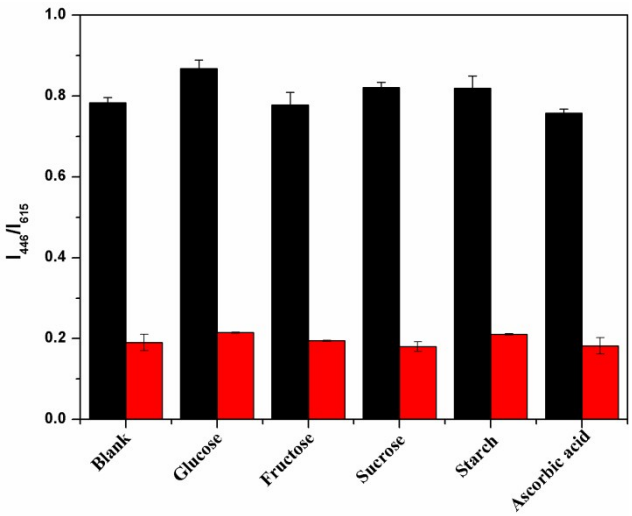

Fig.S5 Phosphorescence responses of CDs-$CaTiO_3$:Pr^{3+}@SiO_2 upon the addition of glucose, fructose, sucrose, starch and ascorbic acid (200 μM) in the absence and presence of Hg^{2+} (200 μM).

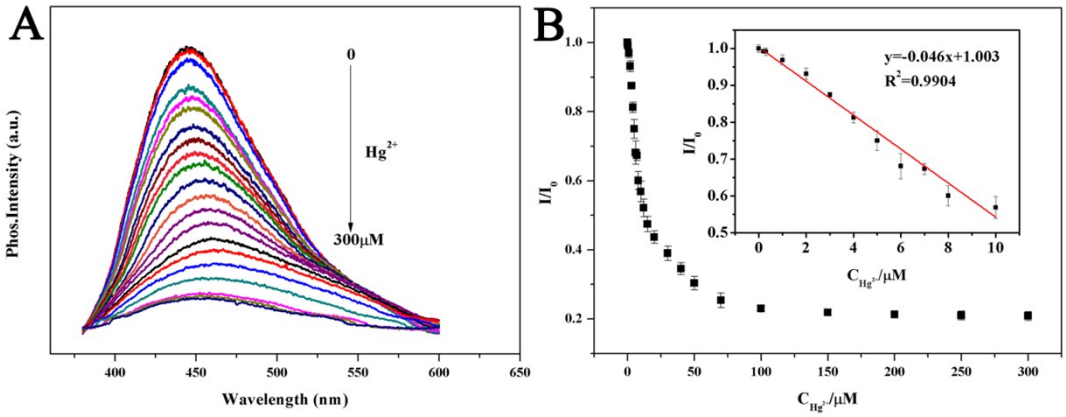

Fig.S6 The phosphorescence spectra of CDs in the presence of different Hg^{2+} concentrations from 0 to 300 μM in HEPES buffer solution (10 mM, pH 7.0) (A); Plot of I/I_0 versus the concentration of Hg^{2+} from 0 to 300 μM (where I_0 refers to the phosphorescence intensity of CDs and I is the phosphorescence intensity of CDs with the addition of various Hg^{2+} concentrations) (B).

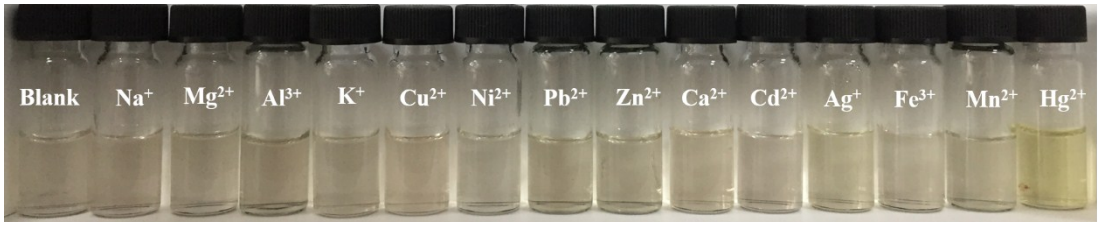

Fig. S7 Images of CDs were taken with addition of various metal ions under sunlight.

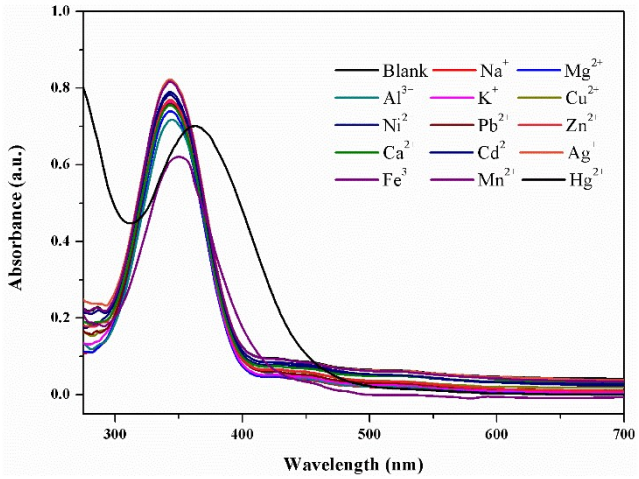

Fig. S8 The UV-Vis absorption spectra of CDs in the presence of different metal ions.

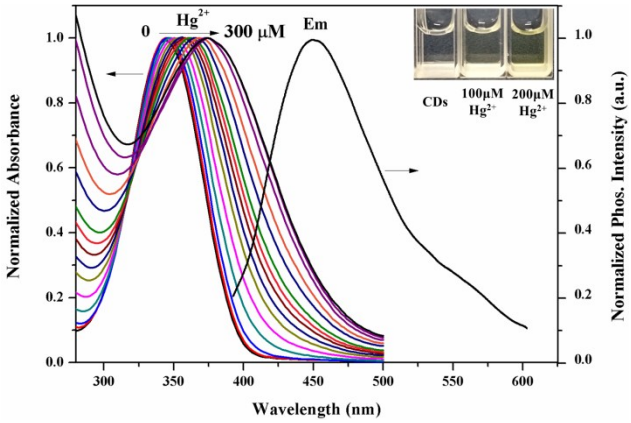

Fig.S9 The absorption spectra of CDs in the presence of various Hg^{2+} concentrations and the emission spectrum of CDs under the excitation wavelength of 345 nm.

Table S1. Comparison of different analysis materials for the detection of Hg^{2+} in water samples

Analysis Material	Analytes	Linear range (μM)	Detection limit (nM)	Real Sample	Detection methods	Reference
Eu^{3+}/CDs@MOF-253	Hg^{2+}	0.065–150	0.065	River sample Fountain water Tap water	Ratiometric fluorescence	1
GO-PPV@MSN-NH_2@SRh6G	Hg^{2+}	0.060-0.18	71	_	Fluorescence	2
Carbon nanoparticles -Rhodamine B	Hg^{2+}	0–6	42	_	Ratiometric fluorescence	3
Dual-emission Carbon dot	Hg^{2+}	0-40	9.0	serum samples River water	Ratiometric fluorescence	4
CDs- Rhodamine B	Hg^{2+}	0.5-10	25	_	Ratiometric fluorescence	5
BSA-Ag NCs	Hg^{2+}	0.05-25	48.7	_	Ratiometric fluorescence	6
Pyrene-functionalized magnetic nanoparticles	Hg^{2+}	4.0 - 40	50	Tap water Pond water Human Serum	Fluorescence	7
CDs-Ag NCs	Hg^{2+}	0-0.5	28	Lake water Tap water Mineral water	Ratiometric fluorescence	8
CDs-CdSe@ZnS QDs	Hg^{2+}	0.2-2.0	100	Tap water Lake water	Ratiometric fluorescence	9
CDs-$CaTiO_3$:Pr^{3+} @SiO_2	Hg^{2+}	0.07-10	9.65	Tap water Pond water Human Serum	Ratiometric phosphorescence	This work

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