Electronic Supplementary Information

Semiquantitative and visual detection of ferric ions in real samples using a fluorescent paper-based analytical device constructed with green emitting carbon dots

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Qualitative and quantification of Fe^{3+} according to the image

For the qualitative detection of Fe^{3+} using CDs-based PADs, 6 μL of different concentrations of Fe^{3+} were added to the surface of PADs and dried at room temperature. The dried PADs were placed in the darkroom and the images were taken by Xiaomi 10 smartphone in standard photography mode under the irradiation of a 365 nm ultraviolet lamp. During the photography process, the mobile phone camera was placed directly above the PADs, with a fixed height of 5 cm. Qualitative analysis was achieved by observing the color changes of the PADs with the naked eye. For the quantitative detection of Fe^{3+}, the images taken by the smartphone were processed with Color recognition picker APP. The mean RGB values were extracted by counting the RGB values of thousands of pixels in the specified area, and represented as I_R, I_G, I_B, respectively. The intensity of the green channel (I_G) is directly proportional to the logarithmic Fe^{3+} concentration in a certain range, thereby achieving quantitative detection of iron ions.

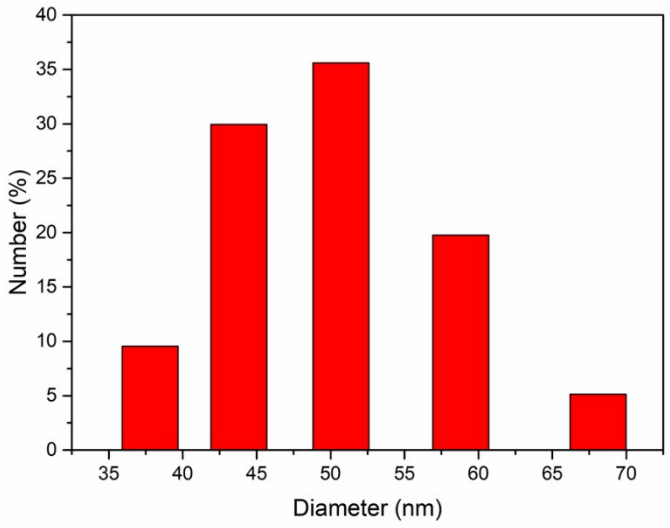

Fig. S1 Size distribution histogram of green emitting CDs.

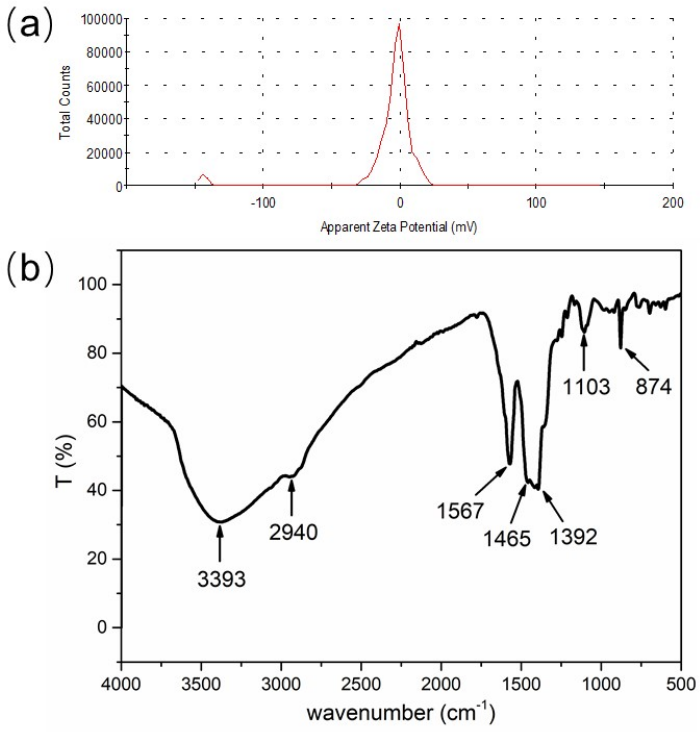

Fig. S2 (a) Zeta potential of CDs. (b) FT-IR spectrum of CDs.

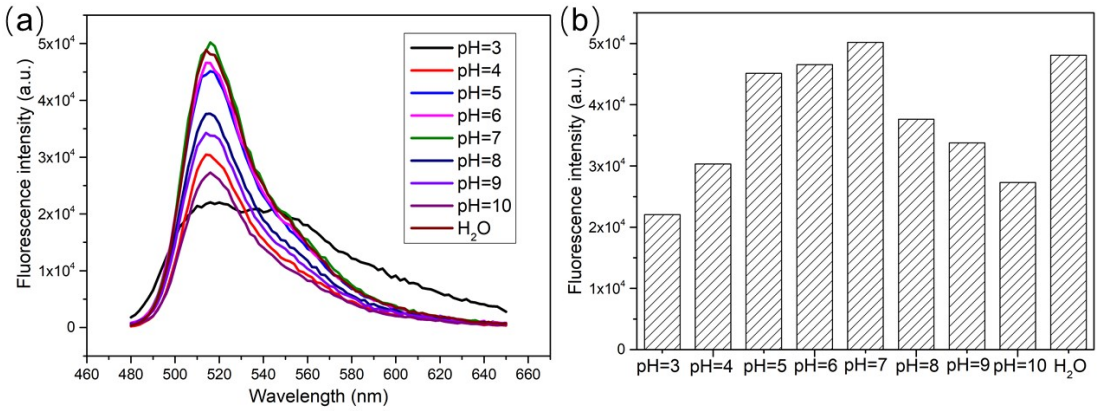

Fig. S3 (a) Fluorescence spectra of CDs in ultrapure water and buffers with different pH. (b) Fluorescence intensities of CDs at 514 nm in ultrapure water and buffers with different pH.

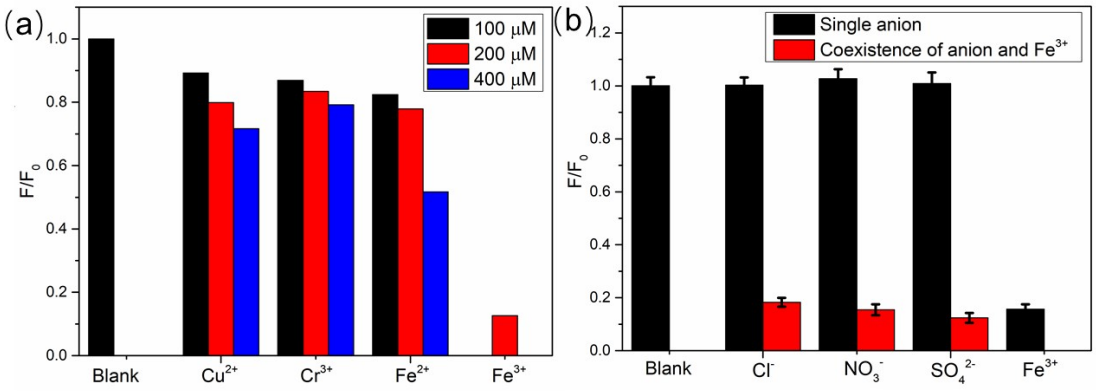

Fig. S4 (a) The relative fluorescence intensity of CDs with the addition of different concentrations of metal ions (100, 200, and 400 μM) and 200 μM Fe^{3+}. (b) The relative fluorescence intensity of CDs with the addition of Fe^{3+} and different kinds of anion (Cl^-, NO_3^-, and SO_4^{2-}) and the coexistence of them. All of the concentrations were 200 μM.

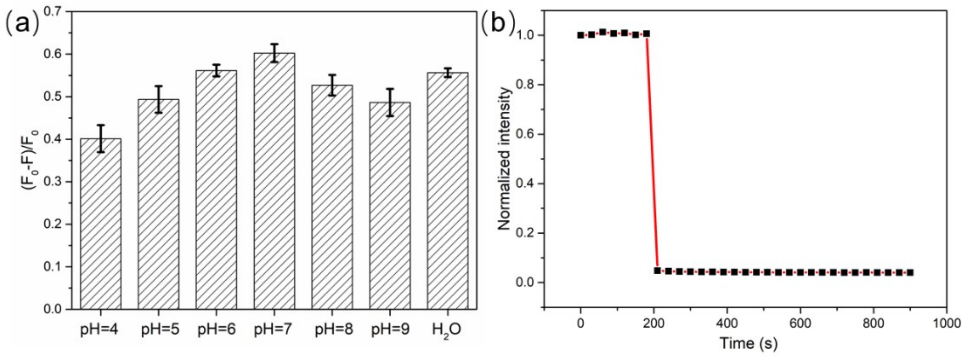

Fig. S5 (a) The quenching efficiency of CDs (0.05 mg/mL) with the addition of 150 μM Fe^{3+} in ultrapure water and buffers with different pH. (b) Time dependence of the fluorescence intensity of CDs (0.05 mg/mL) with the introduction of 200 μM Fe^{3+}.

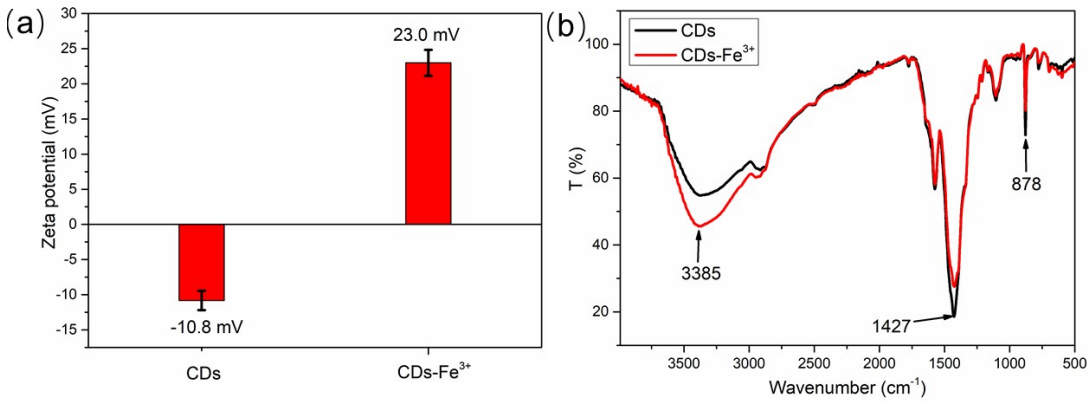

Fig. S6 (a) Zeta potential of CDs before and after adding Fe^{3+}. (b) FT-IR spectra of CDs before and after adding Fe^{3+}.

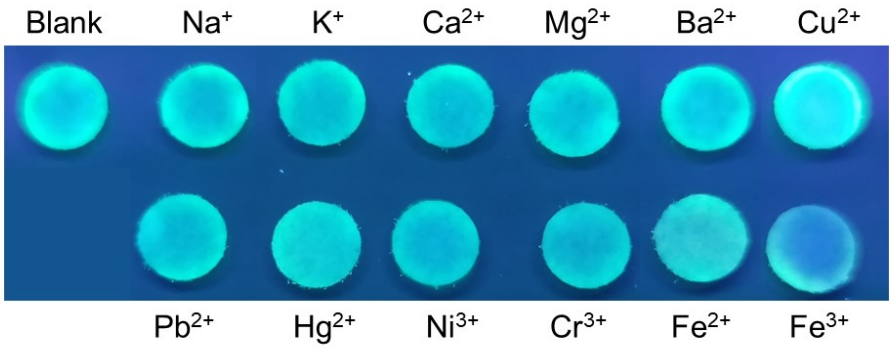

Fig. S7 The images of PADs under 365 nm UV lamp with the addition of different kinds of metal ions. The concentration of Fe^{3+} and other interfering ions are all 500 μM.

Table S1 Fitting results of the fluorescence lifetimes for the CDs and CDs- Fe^{3+}.

Sample	τ_1 (ns)	A_1	τ_2 (ns)	A_2	$\tau_{average}$ (ns)

CDs	4.72	1080.49	4.72	1064.48	4.72
CDs- Fe^{3+}	4.71	613.43	4.71	1543.74	4.71

Table S2 Results of the determination of Fe^{3+} in real samples using paper-based analytical devices based on green emitting CDs (n = 3).

Sample	**Measured (μM)**	**Added (μM)**	**Found (μM)**	**Recovery (%)**	**RSD (%)**
Tap water	None	200	210.6	105.3	4.8
		400	388.4	97.1	3.4
		800	779.2	97.4	4.3