Electronic Supplementary Material (ESI) for Analyst.

Supplementary Information

Green Synthesis of Up- and Down-Conversion Photoluminescent Carbon Dots from Coffee Beans for Fe^{3+} Detection and Cell Imaging

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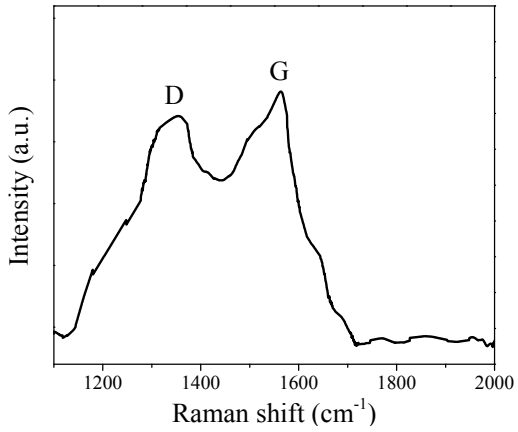

Figure S1. Raman spectrum of the CDs.

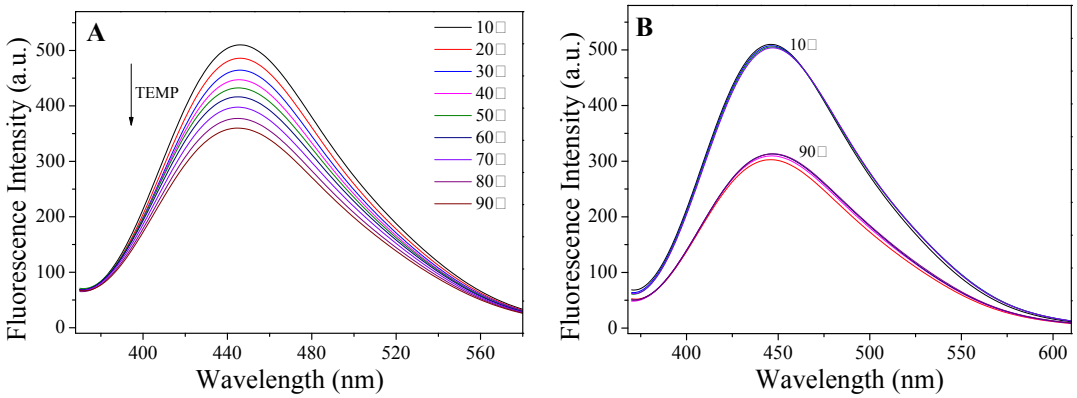

Figure S2. (A) Fluorescence spectra of CDs in the temperature range 10–90°C. (B) At the two temperatures 10 and 90 °C for heating-cooling cycle experiments.

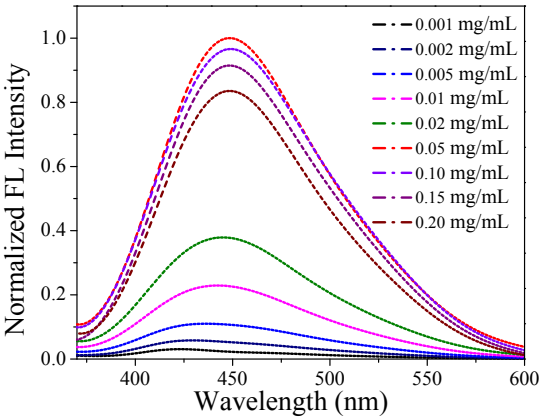

Figure S3. Fluorescence emission spectra of the CDs at different CDs concentrations.

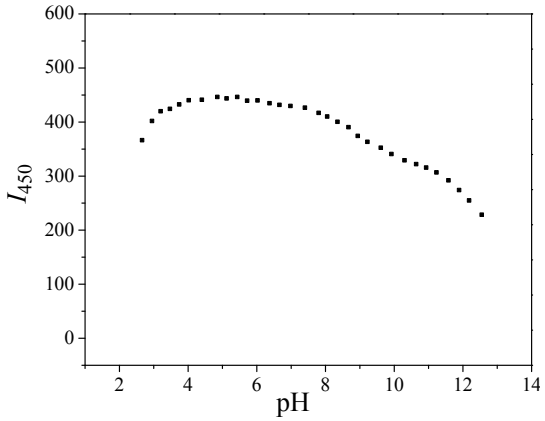

Figure S4. Effect of pH on the fluorescence intensity of CDs.

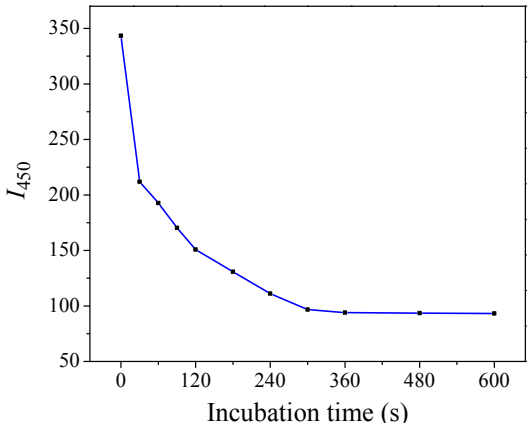

Figure S5. Time dependent fluorescence intensity of the CDs with the addition of 0.30 mM Fe^{3+} ions.

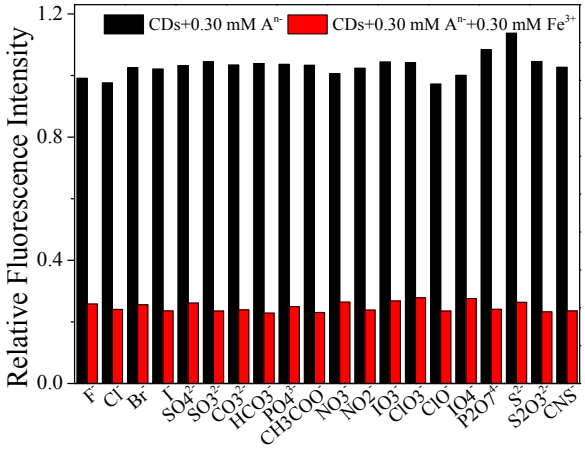

Figure S6. Fluorescence response of CDs to various tested anions (0.30 mM) (black bar) and to the mixture of 0.30 mM of tested anions with 0.30 mM Fe^{3+} (red bar).

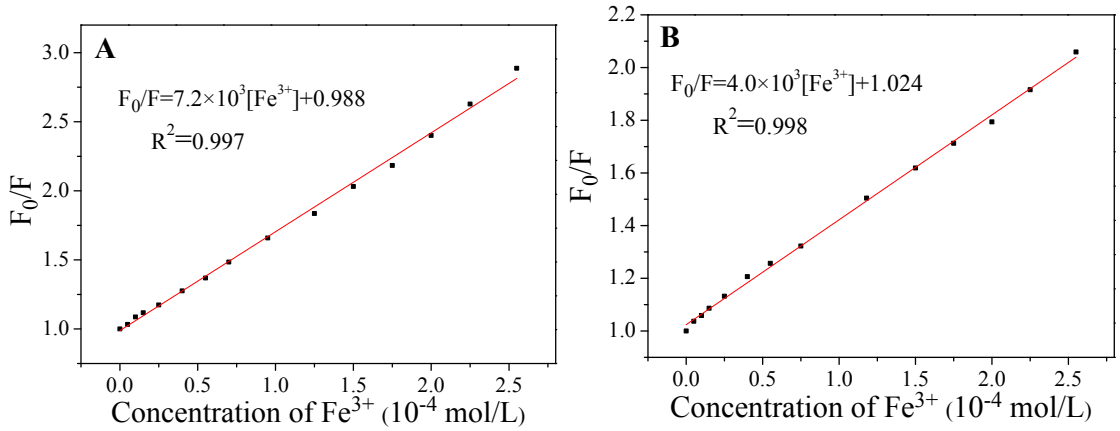

Figure S7. Stern-Volmer plot of the CDs quenched by various concentrations of Fe^{3+} ions (0-0.25 mM) at 360 nm (A) and 680 nm excitation (B). The plots of the ratio of the fluorescent intensity (F_0/F) of the CDs in the absence and presence of Fe^{3+} ions *vs* the concentration of Fe^{3+} are shown in Figure S7A and Figure S7B. The quenching efficiency of the fluorescence by Fe^{3+} was nearly fitted to the Stern−Volmer equation: $F_0/F = 1 + K_{sv}[Fe^{3+}]$ (K_{SV} is the Stern−Volmer quenching constant). The analysis of the Stern−Volmer plots shows that they follow a linear trend with the K_{SV} value to be 7.2×10^3 L/mol and 4.0×10^3 L/mol for down and up-conversion fluorescent assays, respectively.

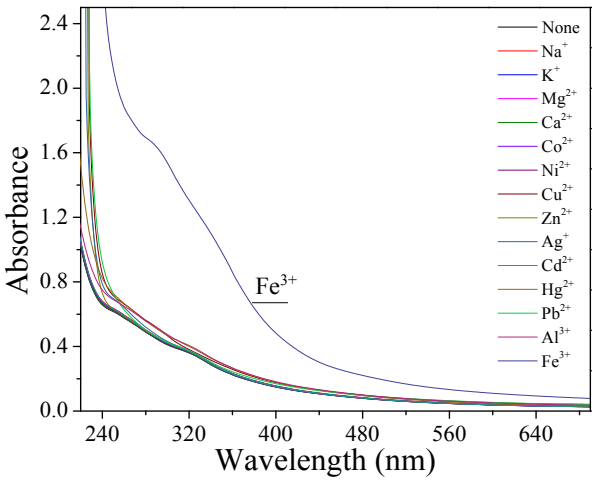

Figure S8. UV–Vis absorption spectra of CDs and after the addition of different metal ions.

Table S1 Comparison of different CDs based probes for sensing Fe^{3+} ions.

Precursors	Linear range (μM)	Detection limit (nM)	Ref.
Maltose	0.1-8.0	60 [a]	s1
Citric acid	0.4-100	2800 [a]	s2
Pigeon feathers	0-1.6	60.9 [a]	s3
Mangosteen pulp	0-180	52 [a]	s4
2,5-diaminobenzenesulfonic acid	0.3-546	90 [a]	s5
Mint leaf	0-0.38	374 [a]	s6
Aspartic acid	0-50	260 [a]	s7
Rose-heart radish	0.02-40	130 [a]	s8
p-aminosalicylic acid	0.05-10.0	13.7 [a]	s9
Coffee beans	0-100[a]	15.4[a]	This work
	0-100[b]	16.3[b]	

[a] Down-conversion fluorescence property

[b] Up-conversion fluorescence property

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