Electronic Supporting Information

Investigation into fluorescence quenching behaviors and applications of carbon dots

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Figure S1 The normalized PL spectra of CDs in phosphate buffer solution with different pH values. The concentration of CDs was 0.01 mg/mL; The PL was excited at 360 nm.



Figure S2 The influence of pH in CDs aqueous solution. The concentrations of CDs were at identical value; The PL was excited at 360 nm.



Figure S3 The lifetime of CDs by adding different amount of Fe³⁺.



Fe ³⁺ / μM	τ1 / ns	p1 / %	τ2 / ns	p2 / %	χ ²	average lifetime / ns
0	1.50	1.83	14.78	98.17	1.324	14.54
20	2.17	2.52	14.50	97.48	1.348	14.19
40	2.21	3.21	14.22	96.79	1.351	13.83
60	2.35	3.65	13.94	96.35	1.175	13.52
80	2.29	3.77	13.58	96.23	1.271	13.15
100	2.27	3.96	13.25	96.04	1.323	12.82
250	2.47	6.32	12.65	93.68	1.283	12.01
1750	2.48	7.37	10.86	92.63	1.157	10.24
2500	2.63	8.37	10.41	91.63	1.116	9.76

Figure S4 a) The PL spectra of CDs with different concentration of I⁻. b) Relative PL intensity $(F_0/F-1)$ of CDs solution as a function of the addition amount of I⁻. The concentration of CDs was 0.01 mg/mL; The PL was excited at 360 nm.



Figure S5 Ferric ion detection curve with different concentration of CDs.





Figure S6 The PL peak of CDs as a function of the concentration of Fe³⁺ (CDs=0.01 mg/mL).

Figure S7 The PL spectra of CDs with different concentration of Fe^{3+} . The concentration of CDs was 0.01 mg/mL; The PL was excited at 360 nm.



Figure S8 Relative PL intensity (F_0/F -1) of CDs as a function of hemin concentration. The concentration of CDs was 0.01 mg/mL; The PL was excited at 360 nm.



Figure S9 The lifetime of CDs exposure to high power UV light.



UV time / s	τ1 / ns	p1 / %	τ2 / ns	p2 / %	χ ²	average lifetime / ns
0	1.72	2.00	14.85	98.00	1.205	14.59
10	1.60	1.92	14.83	98.08	1.458	14.58
30	3.19	5.68	14.56	94.32	1.316	13.91
60	4.25	16.41	14.28	83.59	1.431	12.63
120	4.47	33.42	13.22	66.58	1.623	10.30
180	4.52	45.62	12.24	54.38	1.848	8.72
400	3.40	37.38	8.99	62.62	2.067	6.90
600	3.01	36.49	8.82	63.51	2.112	6.70
900	2.58	36.60	8.90	63.40	2.124	6.59
1200	2.34	37.82	8.87	62.18	2.288	6.40

Figure S10 The PL intensity of different adding sequences in $H_2O_2/Fe^{2+}/CDs$ system. The concentration of CDs, Fe^{2+} and H_2O_2 is 0.01 mg/mL, 250 μ M and 5*10⁻⁵⁰%, respectively. 1, the adding sequence was CDs, Fe^{2+} and H_2O_2 , respectively. 2, the adding sequence was CDs, H_2O_2 and Fe^{2+} , respectively. 3, the adding sequence was Fe^{2+} , CDs and H_2O_2 , respectively. 4, the adding sequence was Fe^{2+} , H_2O_2 , and CDs, respectively. 5, the adding sequence was H_2O_2 , Fe^{2+} and CDs, respectively. 6, the adding sequence was H_2O_2 and CDs, Fe^{2+} , respectively. Note: Two reagents were mixed and stayed for 5 min before the third reagent was added.



Figure S11 The influence of Fe²⁺ concentration in CDs/H₂O₂ system (CDs 0.01 mg/mL, H₂O₂ 5*10⁻⁵%). The concentration of Fe²⁺ (higher than 40 μ M) hardly affected the detection system, since Fe²⁺ mainly played catalysis role.







H ₂ O ₂ / %	τ1 / ns	p1 / %	τ2 / ns	p2 / %	χ ²	average lifetime / ns
0	1.80	2.03	14.85	97.97	1.258	14.59
2*10 ⁻⁵	3.02	7.27	14.58	92.73	1.261	13.74
4*10 ⁻⁵	3.35	13.11	14.34	86.89	1.397	12.90
6*10 ⁻⁵	3.61	22.32	13.92	77.68	1.570	11.62
8*10 ⁻⁵	3.65	31.03	12.86	68.97	1.754	10.00
10*10 ⁻⁵	3.66	38.83	11.87	61.17	1.717	8.68

Figure S13 a) Relative PL intensity (F_0/F -1) of CDs/Fe²⁺ as a function of H_2O_2 solution mass fraction with low concentration. The concentration of CDs was 0.001 mg/mL and the concentration of ferrous ion was 10 μ M. b) $H_2O_2/Fe^{2+}/CDs$ system in PBS buffer solution. c) $H_2O_2/Fe^{2+}/CDs$ system in HAC-NaAC buffer solution. d) The $H_2O_2/Fe^{2+}/CDs$ quenching system can be achieved by adding H_2O_2 step by step (Inset is linear relation). The concentration of CDs was 0.01 mg/mL in b-d.



Figure S14 AFM images of CDs in different concentrations. a) 0.003 mg/mL CDs, b) 0.1 mg/mL CDs c) 1 mg/mL CDs



Figure S15 a) Excitation-dependent PL of CDs. b) Excitation-dependent PL of CDs, which were synthesized in acid condition.

