## Supporting Information

# One-Step Synthesis of Nitrogen/Fluorine Co-Doped Carbon Dots for Use in Ferric Ions and Ascorbic Acid Detection

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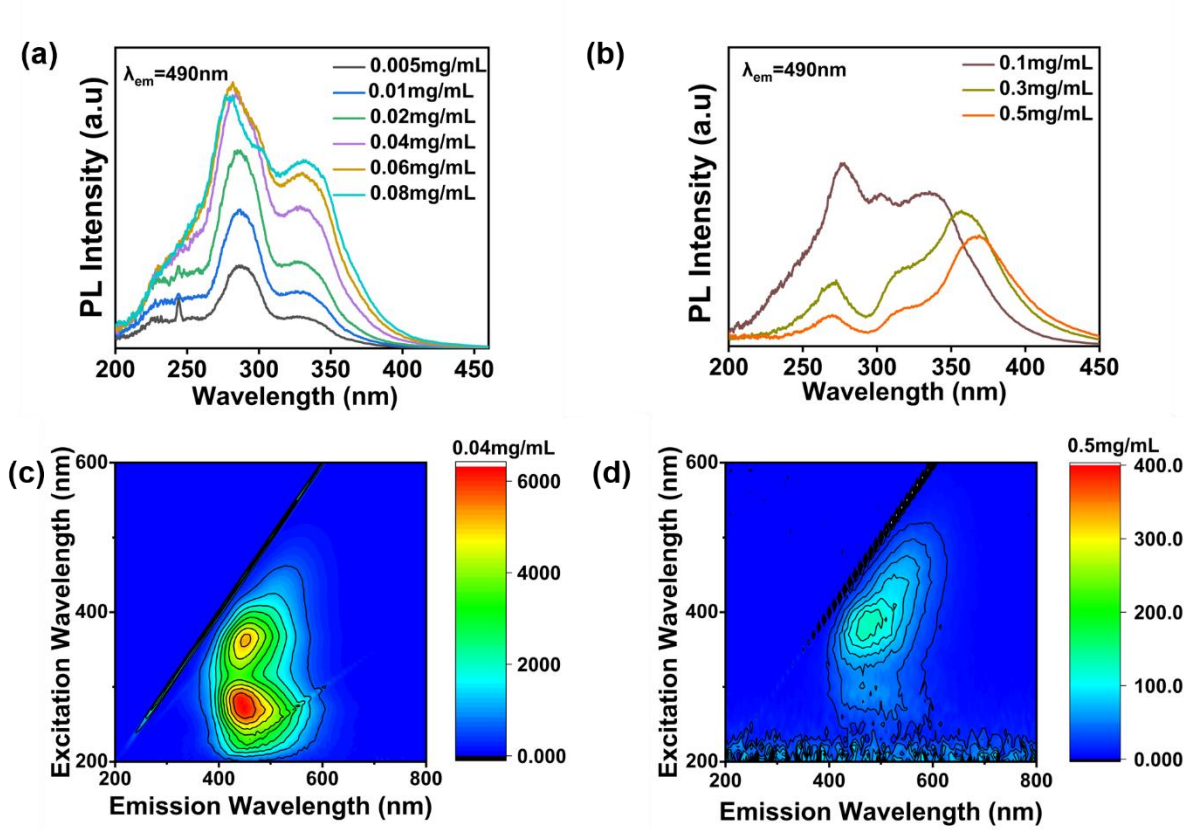


**Figure S1**. **(a)-(b)** The normalized excitation peaks under emission peaks at 490 nm with various concentrations of NCDs. **(c)-(d)** 3D fluorescent matrix scan of the NFCDs at 0.04 mg/mL and 0.5 mg/mL.

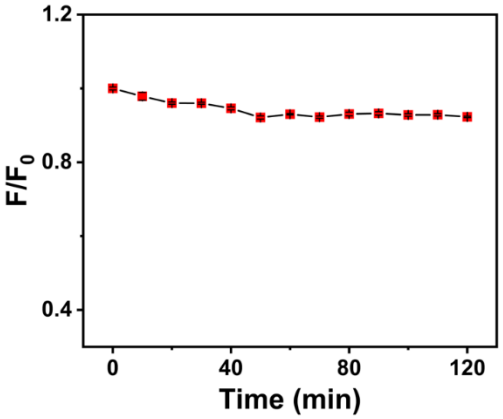


**Figure S2.** Relationship between $F/F_0$ and the irradiation time, where $F_0$ and F are the emission intensity before and after UV light irradiation, respectively.

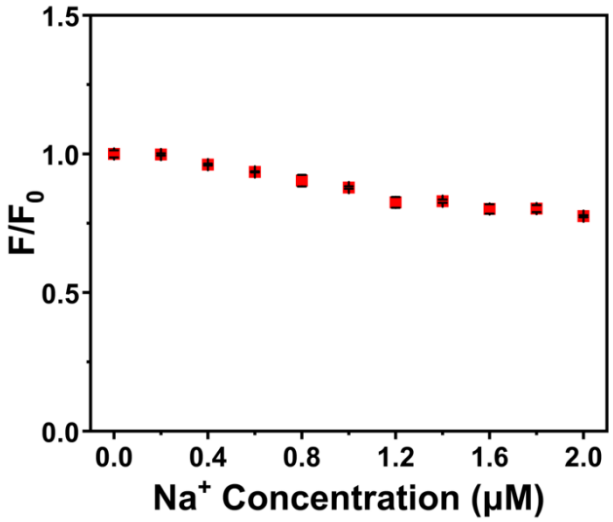


**Figure S3.** Relationship between $F/F_0$ and the ionic strength, where $F_0$ and F are the emission intensity in ultrapure water and NaCl solution, respectively.

**Table S1** Selectivity and sensitivity results of NFCDs for the detection of metal ions

| | $F/F_0$ without $Fe^{3+}$ | Error bar | F/F0 with $Fe^{3+}$ | Error bar |
|---|---|---|---|---|
| NFCDs | 1.0000 | 0.0060 | 0.0448 | 0.0010 |
| $Na^{+}$ | 1.0376 | 0.0107 | 0.1139 | 0.0009 |
| $K^{+}$ | 0.9808 | 0.0045 | 0.0942 | 0.0017 |
| $Al^{3+}$ | 0.9562 | 0.0043 | 0.1330 | 0.0032 |
| $Fe^{3+}$ | 0.0448 | 0.0010 | 0.0448 | 0.0010 |
| $Mg^{2+}$ | 1.0417 | 0.0104 | 0.0913 | 0.0026 |
| $Ni^{2+}$ | 0.7002 | 0.0069 | 0.1104 | 0.0009 |
| $Mn^{2+}$ | 1.0195 | 0.0077 | 0.1338 | 0.0005 |
| $Co^{2+}$ | 0.7822 | 0.0060 | 0.1133 | 0.0007 |
| $Ca^{2+}$ | 1.0378 | 0.0023 | 0.0999 | 0.0015 |
| $Sn^{2+}$ | 0.9850 | 0.0083 | 0.1113 | 0.0012 |
| $Pb^{2+}$ | 0.9627 | 0.0022 | 0.0898 | 0.0010 |
| $Ba^{2+}$ | 1.0431 | 0.0161 | 0.0901 | 0.0010 |

**Table S2**. Comparison of different probes and methods for detection of $Fe^{3+}$

| Fluorescent probe | Detection mode | Linear range/μM | LOD/μM | QY | Ref. |
|---|---|---|---|---|---|
| Borassus flabellifer derived CDs | turn-off | 10-100 | 2.01 | 19.4% | [1] |
| L-glutamic carbon quantum dots | turn-off | 0-50 | 4.67 | 17.8% | [2] |
| N-doped CDs | turn-off | 5-60 | 1.9 | 9.8% | [3] |
| N-doped CDs | turn-off | 10-300 | 0.9 | - | [4] |
| Graphite electrode CDs | turn-off | 10-200 | 1.8 | 16.4% | [5] |
| water hyacinth derived CDs | turn-off | 0-330 | 0.084 | 3.3% | [6] |
| FNCDs | turn-off | 0.2-300 | 0.08 | - | [7] |
| 1,2,4-triaminobenzene and formamide | turn-off | 1-60 | 0.28 | - | [8] |
| N-doped CDs | turn-off | 0.001-1000 | 1.68 | - | [9] |
| N,F co-doped CDs | turn-off | 5-30 | 1.03 | 21.03% | this work |

**Table S3**. sensitivity test of NFCDs with the presence of different organic molecules

| $F/F_0$ | R1 | R2 | R3 | mean values |
|---|---|---|---|---|
| FNCDs | 0.9876 | 0.9926 | 1.0198 | 1.0000 |
| LGA | 1.0230 | 0.9904 | 0.9830 | 0.9988 |
| D-Asn | 1.0011 | 0.9950 | 0.9869 | 0.9943 |
| L-Asn | 1.0166 | 1.0198 | 1.0127 | 1.0164 |
| L-Glu | 1.0807 | 1.0255 | 0.9993 | 1.0352 |
| S-MA | 1.0910 | 1.0733 | 1.0570 | 1.0738 |
| L-Met | 1.0407 | 1.0503 | 1.0765 | 1.0558 |
| L-Leu | 1.1416 | 1.1080 | 1.1317 | 1.1271 |
| L-Val | 1.0230 | 1.0000 | 0.9901 | 1.0044 |
| AA | 0.1687 | 0.1664 | 0.1681 | 0.1677 |

**Table S4.** Comparison of different probes and methods for detection of AA

| Fluorescent probe | Detection mode | Linear range/μM | LOD/μM | QY | Ref. |
|---|---|---|---|---|---|
| CDs/$Cr^{6+}$ | on-off-on | 0-200 | 0.35 | 11.83% | [10] |
| Co-CDs/$Fe^{3+}$ | on-off-on | 0.6-1600 | 18 | 30.4% | [11] |
| Co-CDs/TMB | on-off-on | 10-400 | 0.27 | 30.4% | [11] |
| CDs | on-off-on | 0.1-800 | 50 | 20.7% | [12] |
| N, Cu-CDs | turn-off | 0.02-40 | 0.018 | - | [13] |
| N-CDs | turn-off | 20-60 | 2.6 | 9.8% | [3] |
| N,F-CDs | turn-off | 5-100 | 4.22 | 21.03% | this work |

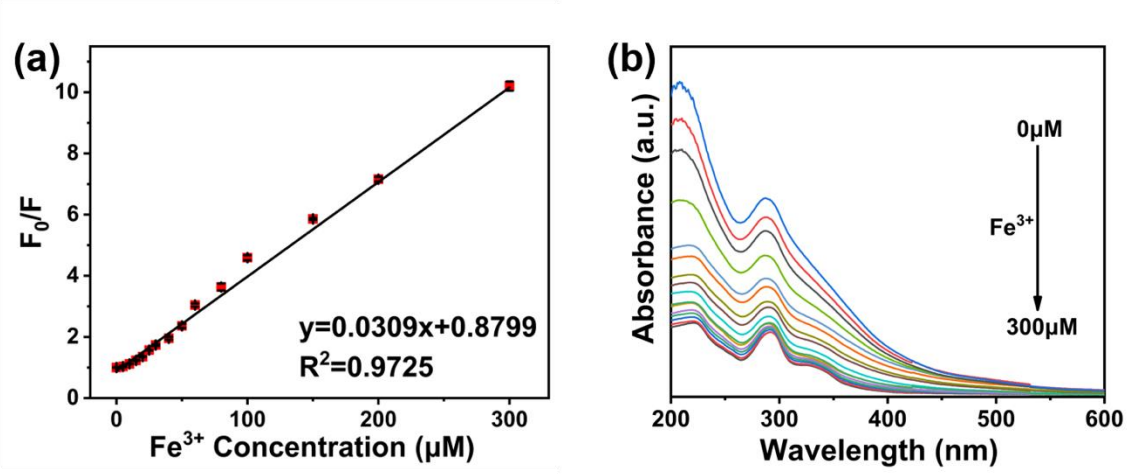


**Figure S4. (a)** Stern-Volmer relationship between $F_0/F$ and concentration of $Fe^{3+}$. **(b)** UV-vis spectra of NFCDs solution with different concentration of $Fe^{3+}$.

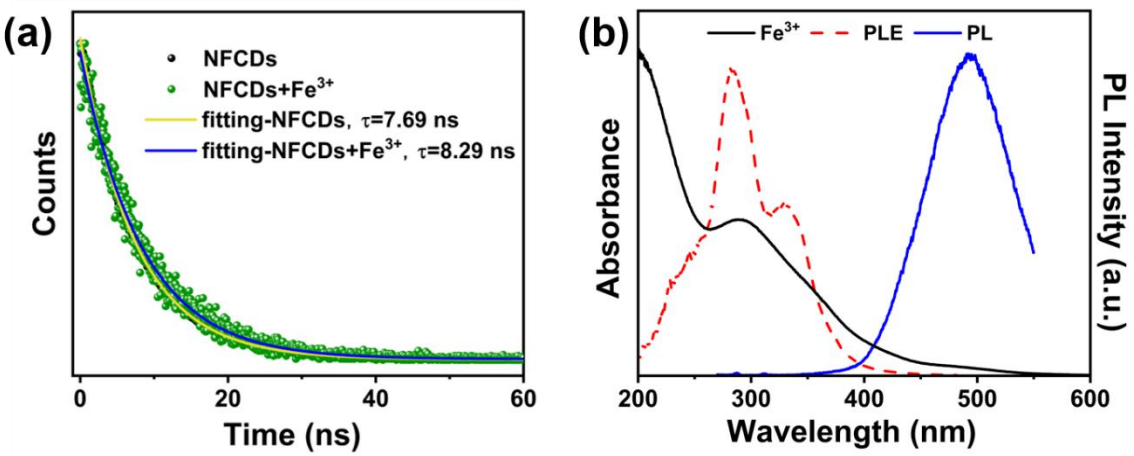


**Figure S5. (a)** The PL decay lifetime of NFCDs solution with and without the presence of $Fe^{3+}$. **(b)** UV-vis spectra of $Fe^{3+}$ solution, the emission peaks excited at 280nm and the excitation peak at emission of 490 nm of NFCDs solution.

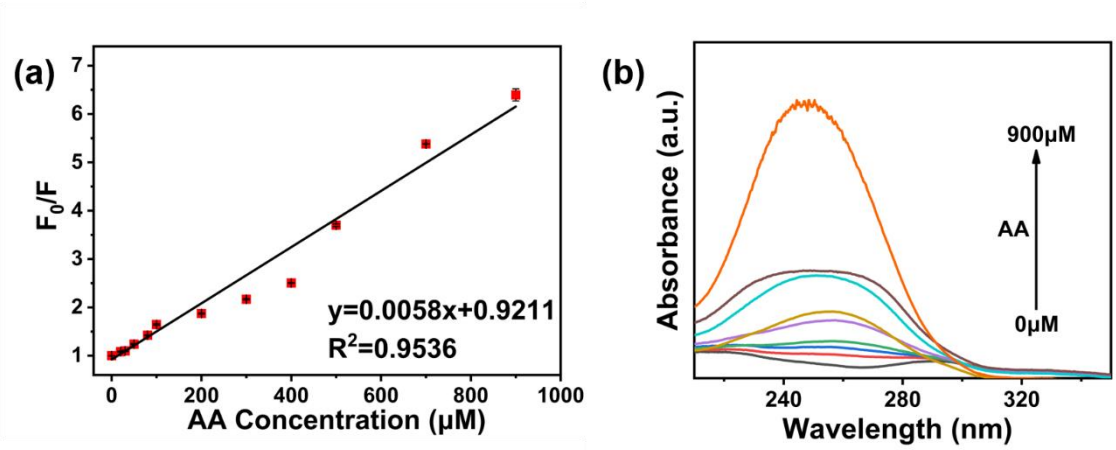


**Figure S6. (a)** Stern-Volmer relationship between $F_0/F$ and concentration of AA. **(b)** UV-vis spectra of NFCDs solution with different concentration of AA.

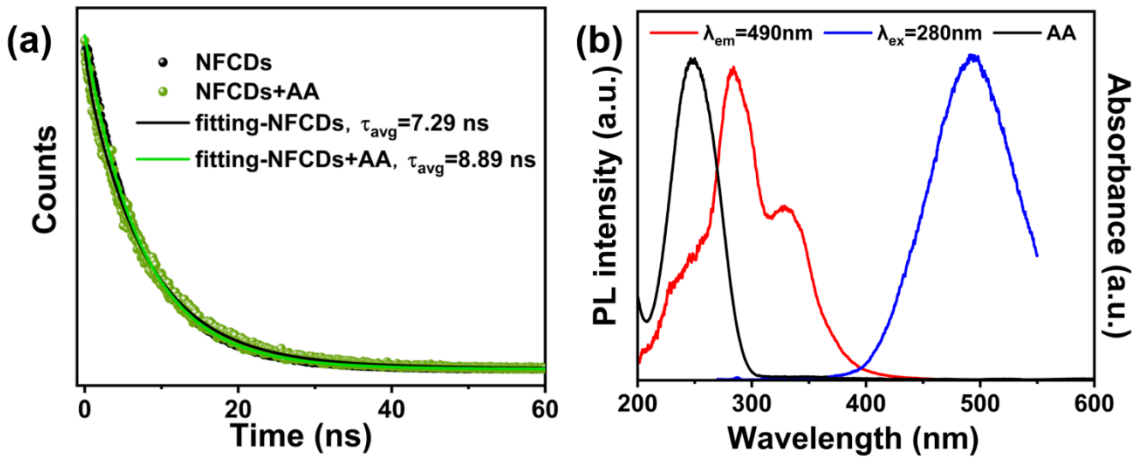


**Figure S7 (a)** The PL decay lifetime of NFCDs solution with and without the presence of AA. **(b)** UV-vis spectra of $Fe^{3+}$ solution, the emission peaks excited at 280nm and the excitation peak at emission of 490 nm of NFCDs solution.

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