Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Electronic supporting information

Highly Fluorescent Nitrogen and Boron Doped Carbon Quantum Dots for Selective and Sensitive Detection of Fe^{3+}

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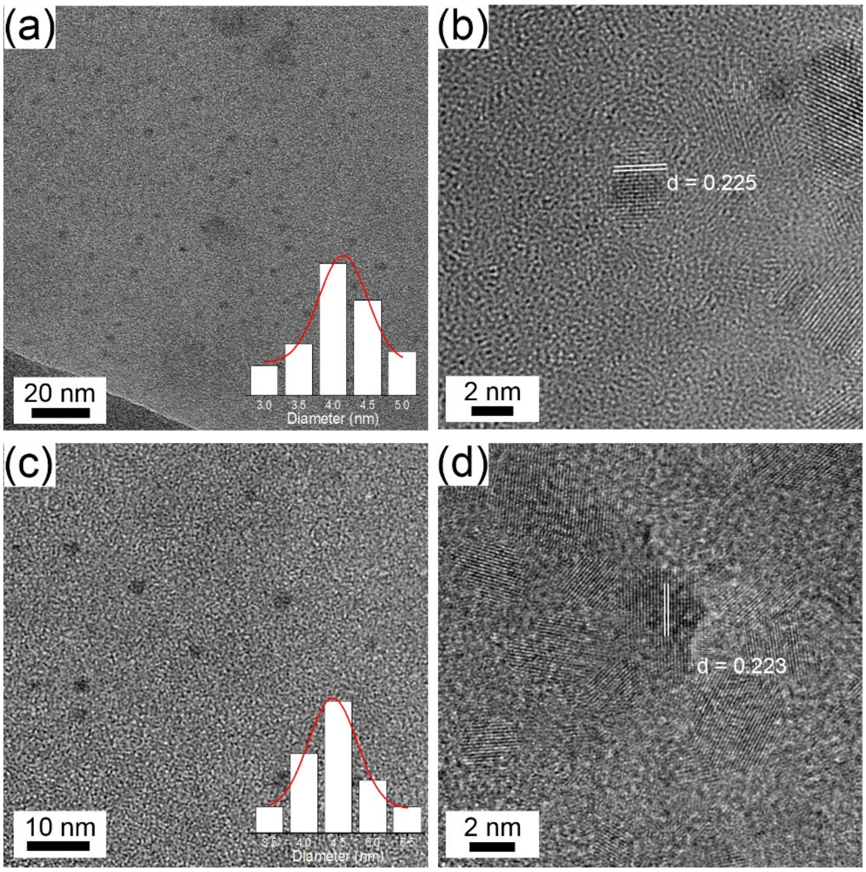

Fig. S1 TEM and high resolution-TEM images of BNCQD (a, b) and NCQD (c, d). Insert of (a) and (c) are the corresponding size distribution.

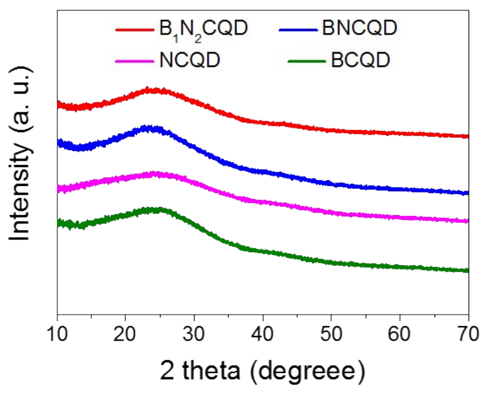

Fig. S2 XRD patterns of B_1N_2CQD, BNCQD, NCQD and BCQD.

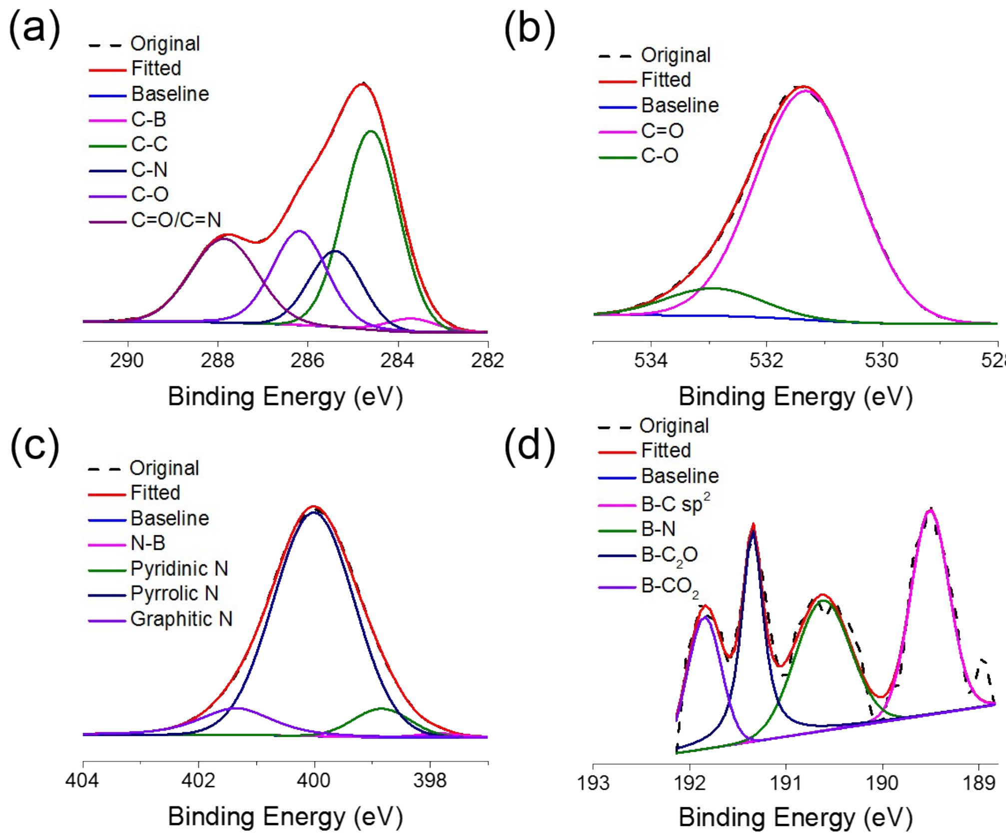

Fig. S3 High-resolution XPS C 1s (a), O 1s (b), N 1s (c) and B 1s (d) peaks of BNCQD.

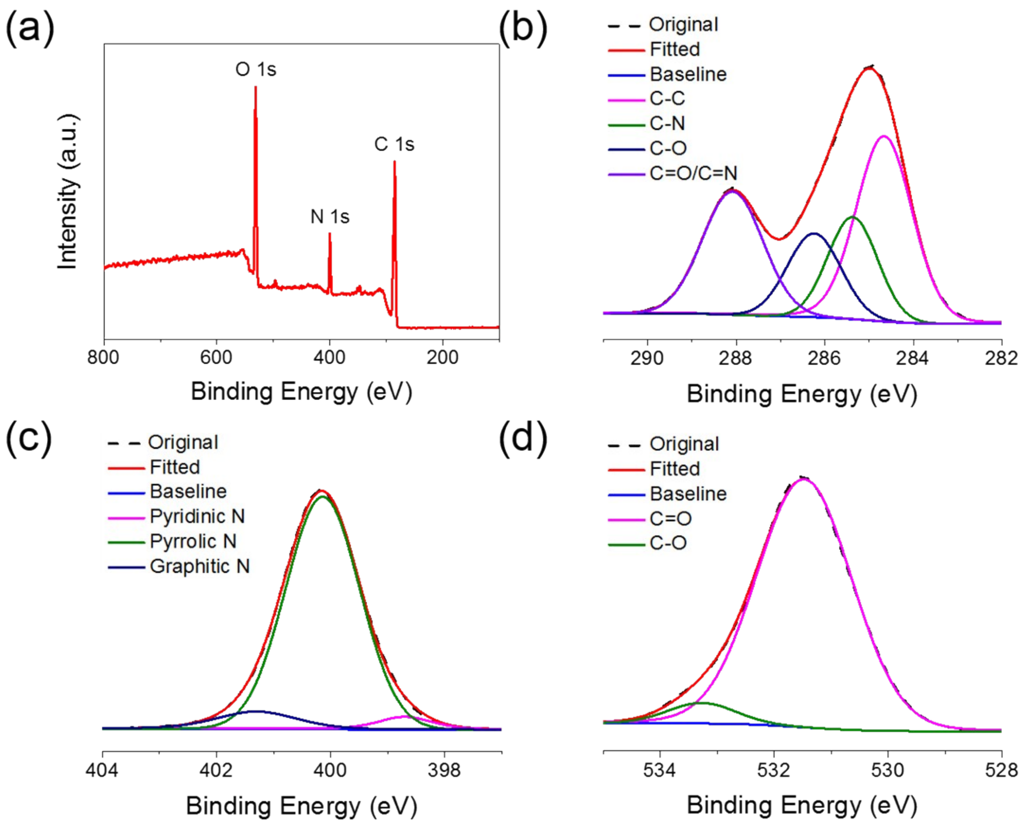

Fig. S4 XPS survey spectra (a) and detailed high-resolution C 1s (b), N 1s (c) and O 1s (d) peaks of NCQD.

Table S1. Elementary composition of three different carbon quantum dots based on XPS measurement.

Sample name	Carbon (at%)	Oxygen (at%)	Nitrogen (at%)	Boron (at%)
B_1N_2CQD	67.02	19.75	13.04	0.20
BNCQD	68.44	19.12	12.33	0.11
NCQD	66.61	23.69	9.7	-

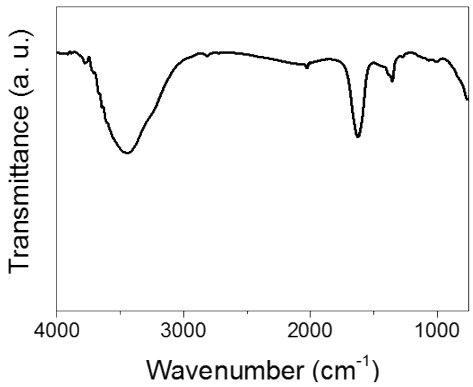

Fig. S5 FTIR spectrum of BCQD

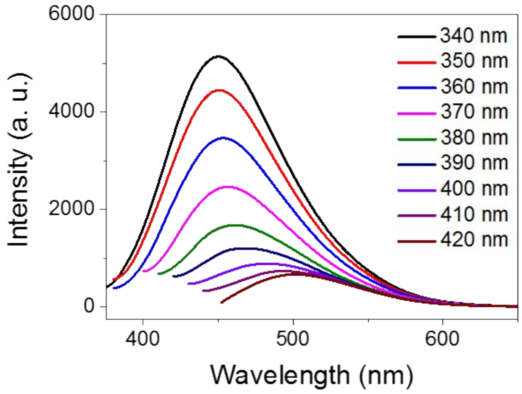

Fig. S6 Steady-state fluorescence spectra of BNCQD under various excitation wavelengths.

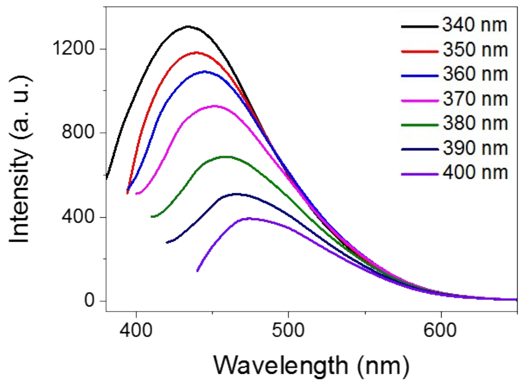

Fig. S7 Steady-state fluorescence spectra of BCQD under various excitation wavelengths.

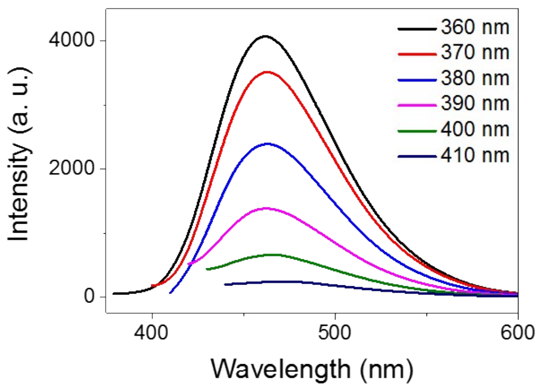

Fig. S8 Steady-state fluorescence spectra of NCQD under various excitation wavelengths.

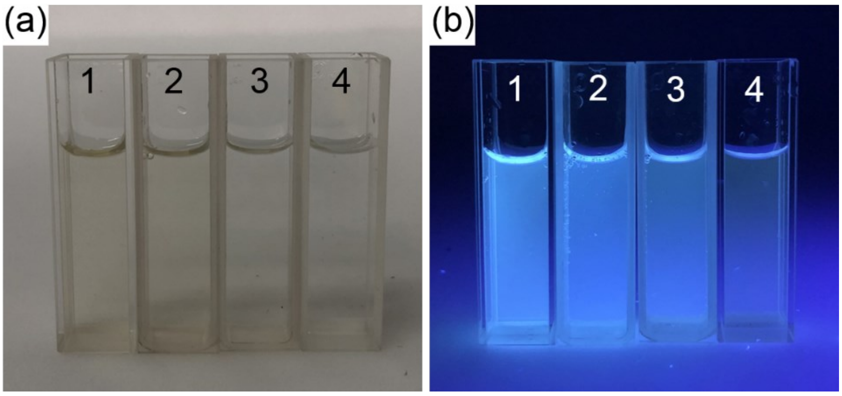

Fig. S9 Photographs of CQDs in aqueous solution under visible light (a) and UV beam of 365 nm. From left to right are B_1N_2CQD (1), BNCQD (2), NCQD (3) and BCQD (4), respectively.

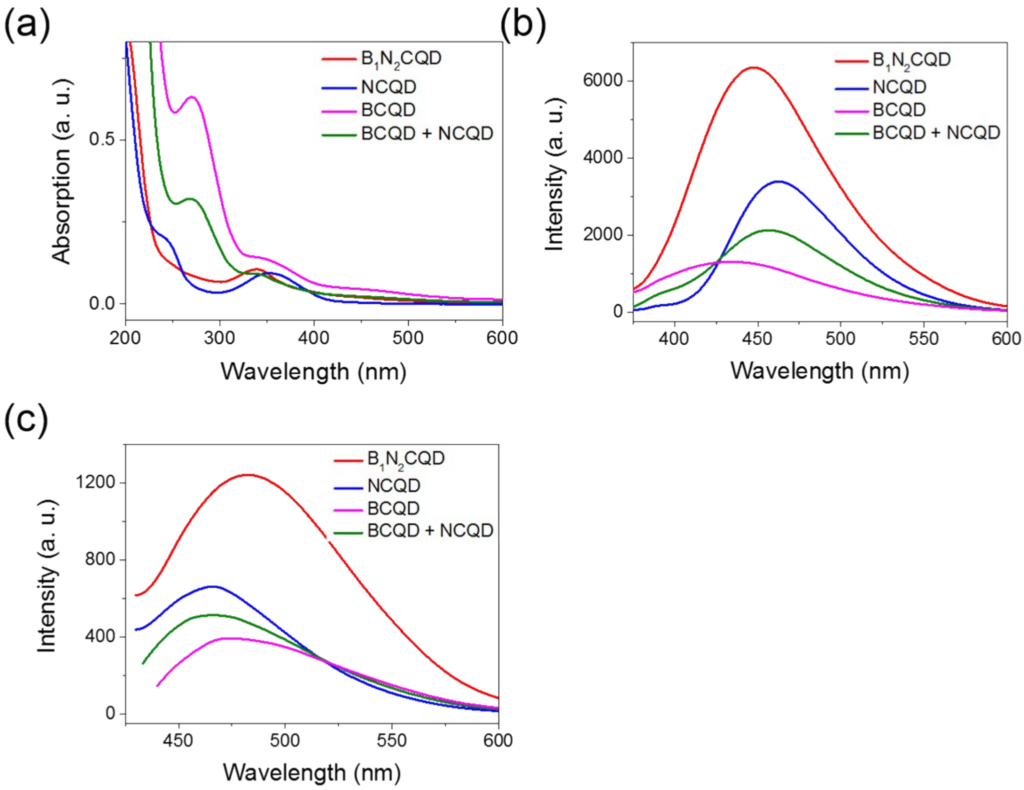

Fig. S10 UV-Vis (a) and steady-state fluorescence (b, c) spectra of B_1N_2CQD, NCQD, BCQD and the mixture of BCQD and NCQD. (b) and (c) are excited at 340 and 400 nm, respectively. The mixture of BCQD and NCQD consist of 50% BCQD and 50% NCQD.

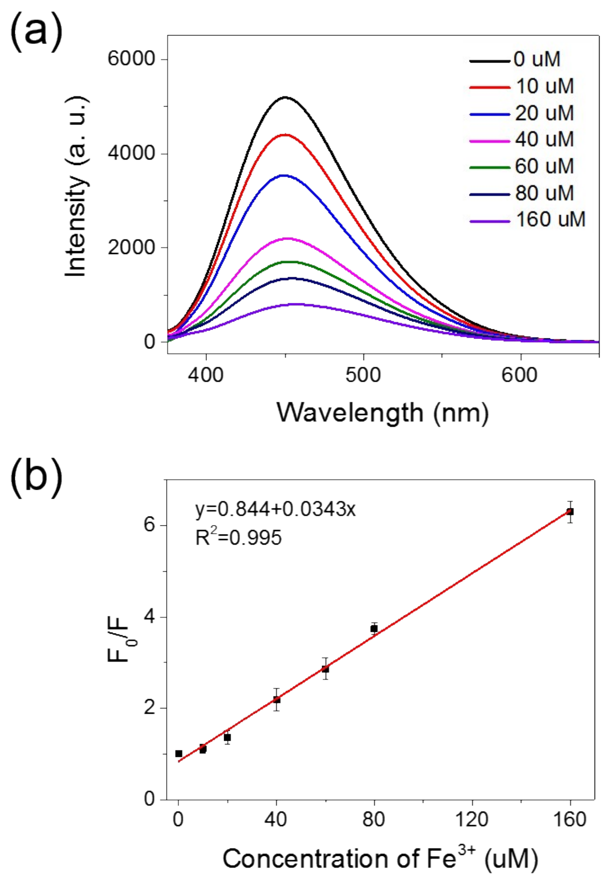

Fig. S11 (a) Fluorescence spectra of BNCQD upon the addition of various concentrations of Fe^{3+} from 0 to 160 uM. (b) Linear relationship between F_0/F and the concentration of Fe^{3+}, where F_0 and F are the emission intensity in the absence and presence of Fe^{3+}, respectively.

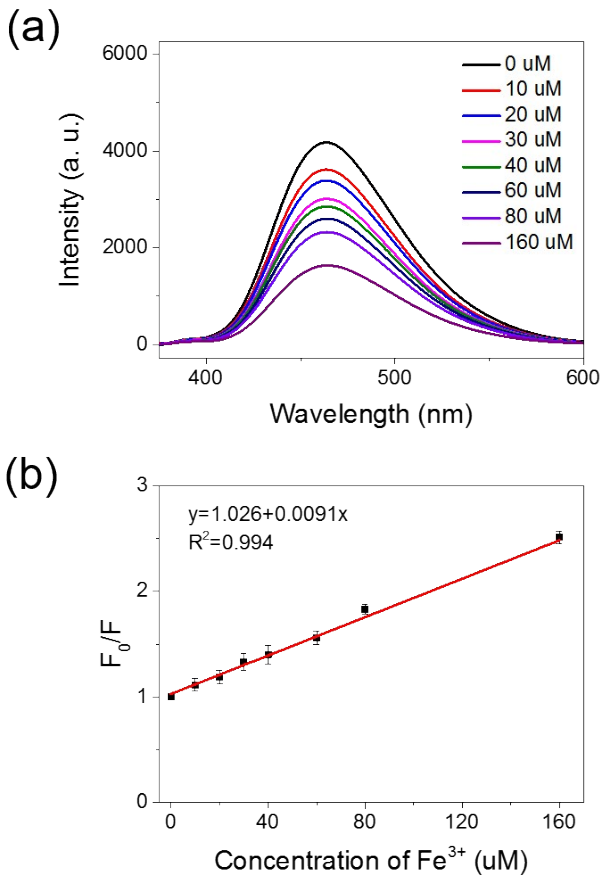

Fig. S12 (a) Fluorescence spectra of NCQD upon the addition of various concentrations of Fe^{3+} from 0 to 160 uM. (b) Linear relationship between F_0/F and the concentration of Fe^{3+}, where F_0 and F are the emission intensity in the absence and presence of Fe^{3+}, respectively.

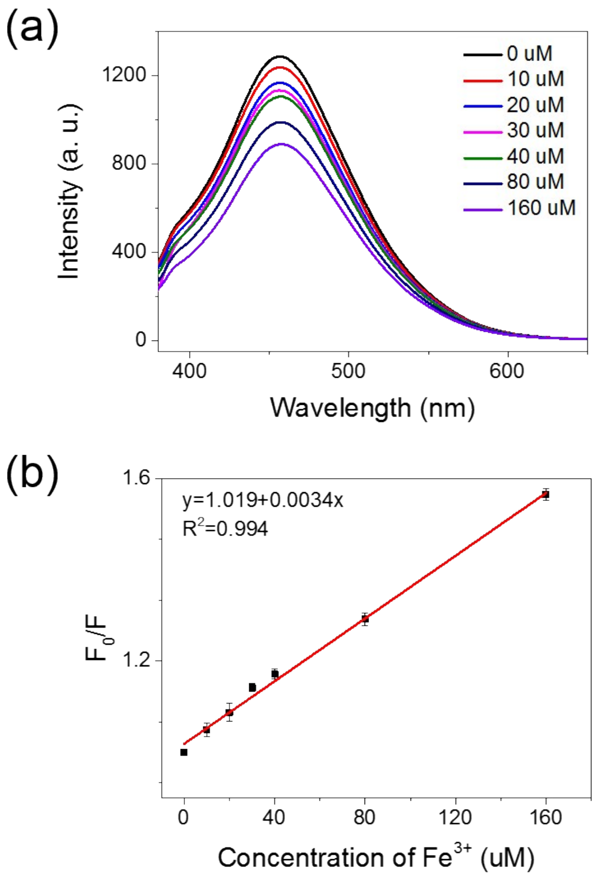

Fig. S13 (a) Fluorescence spectra of BCQD upon the addition of various concentrations of Fe^{3+} from 0 to 160 uM. (b) Linear relationship between F_0/F and the concentration of Fe^{3+}, where F_0 and F are the emission intensity in the absence and presence of Fe^{3+}, respectively.

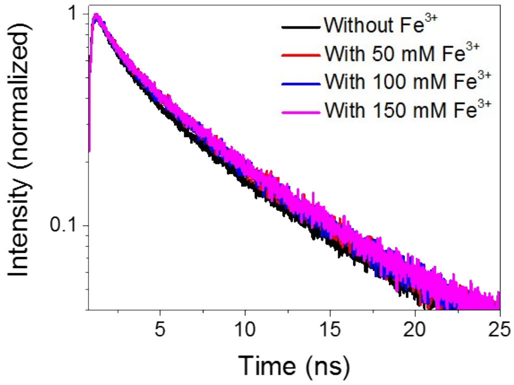

Fig. S14 Time-resolved fluorescence decays for B_1N_2CQD after additions of various concentrations of Fe^{3+}.

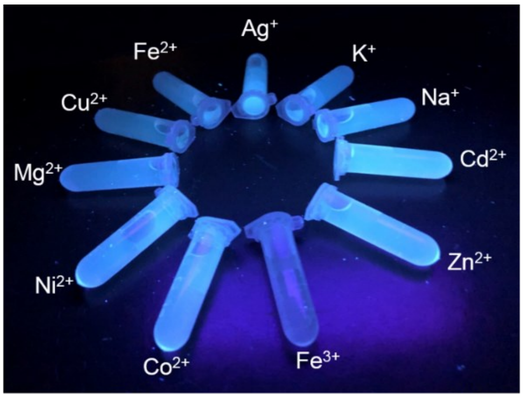

Fig. S15 Photograph of B_1N_2CQD under 254 nm UV light irradiation after adding various kind of metal ions.

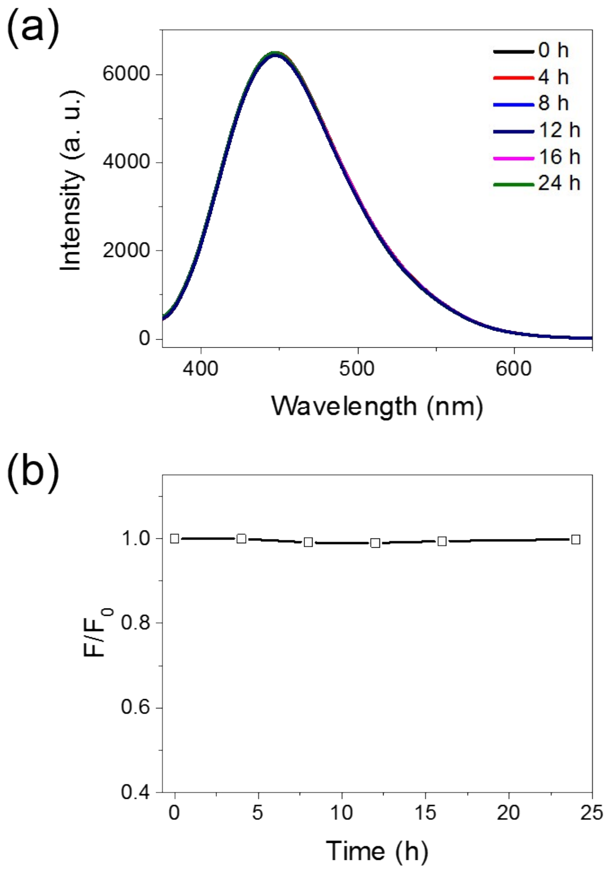

Fig. S16 (a) Fluorescence spectra of B_1N_2CQD after 365 nm UV light irradiation. (b) Linear relationship between F/F_0 and the irradiation time, where F_0 and F are the emission intensity before and after UV light irradiation, respectively.

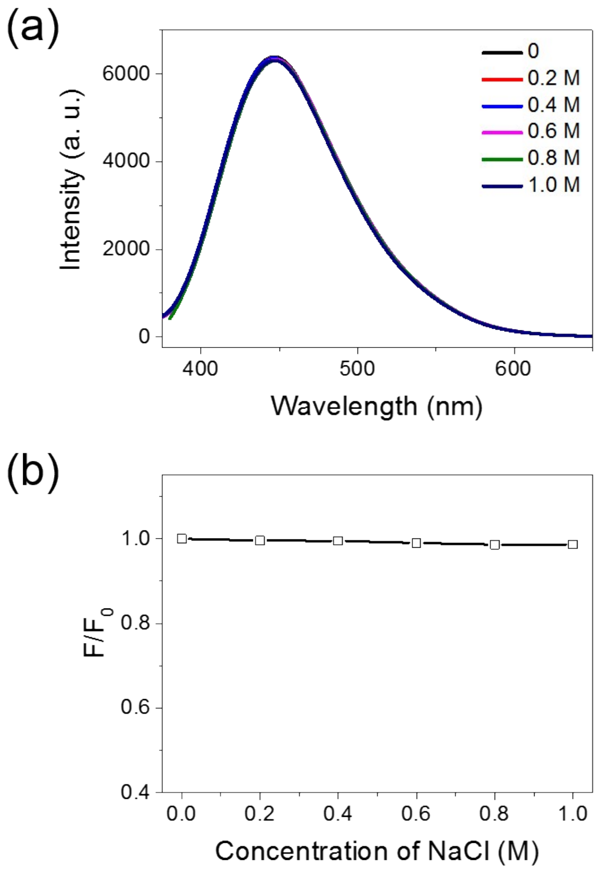

Fig. S17 (a) Fluorescence spectra of B_1N_2CQD in the condition of various concentrations of NaCl from 0 to 1.0 M. (b) Linear relationship between F/F_0 and the concentration of NaCl, where F_0 and F are the emission intensity in the absence and presence of NaCl, respectively.

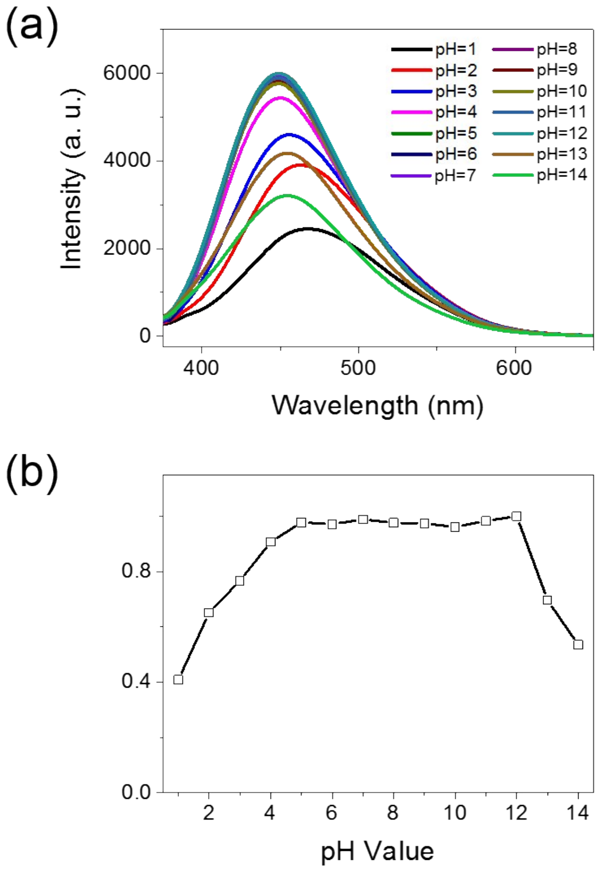

Fig. S18 (a) Fluorescence spectra of B_1N_2CQD in various pH value from 1 to 14. (b) Normalized fluorescence intensity in different pH value.

Table S2. Comparison of CQDs-based sensors for Fe^{3+} detection.

Entry	Fluorescent Probes	Carbon source	Linear range	LOD	Reference
1	BNCQDs	Ascorbic acid + 4-aminobenzenebornic acid	0-700 uM	7.5 uM	1
2	N-doped CDs	Alginic acid + ethanediamine	0-50 uM	10.98 uM	2
3	N-CDs	*Chionanthus retusus* fruit extract	0-2 uM	70 nM	3
4	B-CDs	Glucose + boric acid	0-16 uM	242 nM	4
5	CDs	citric acid + 1,10-phenanthroline	0-50 uM	35 nM	5
6	GN-CDs	Gallic acid + *o*-phenylenediamine	0-50 uM	800 nM	6
7	CDs	Folic acid	0-400 uM	2 uM	7
8	CDs	*Boswellia ovalifoliolata* bark extract	0-500 uM	0.41 uM	8
9	N-CQDs	Watermelon juice	0-300 uM	160 nM	9
10	C-QDs	Citric acid + Tris	0-50 uM	1.3 uM	10
11	B_1N_2CQD	citric acid + boric acid + ethylenediamine	0-160 uM	80 nM	This work

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