Electronic Supplementary Material

Ratiometric fluorescent sensors for nitrite detection in the environment based on carbon dot/ Rhodamine B systems

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Contents

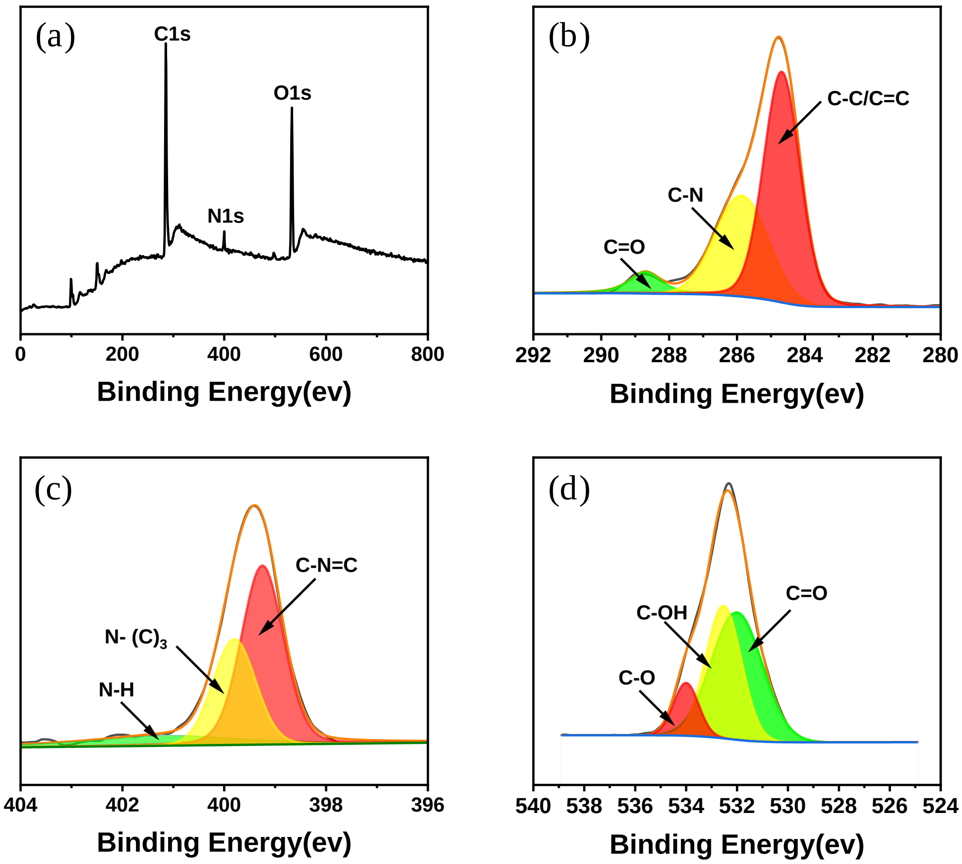

Fig. S1 (a) Broad range XPS spectra of BCDs; (b) The XPS C1s; (c) the XPS N1s and (d) the XPS O1s of BCDs.

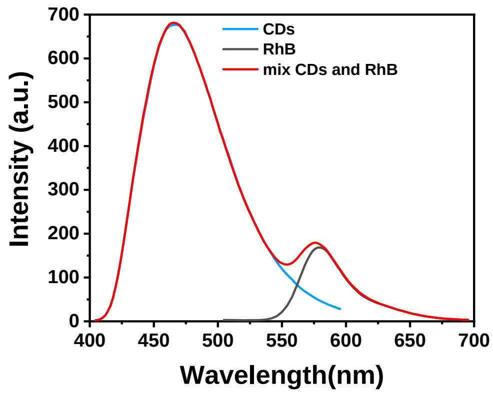

Fig. S2 Fluorescence emission spectra (λ_{ex} = 365 nm) of BCDs (the blue curve), RhB (the black curve) and mixing BCDs and RhB (the red curve), respectively.

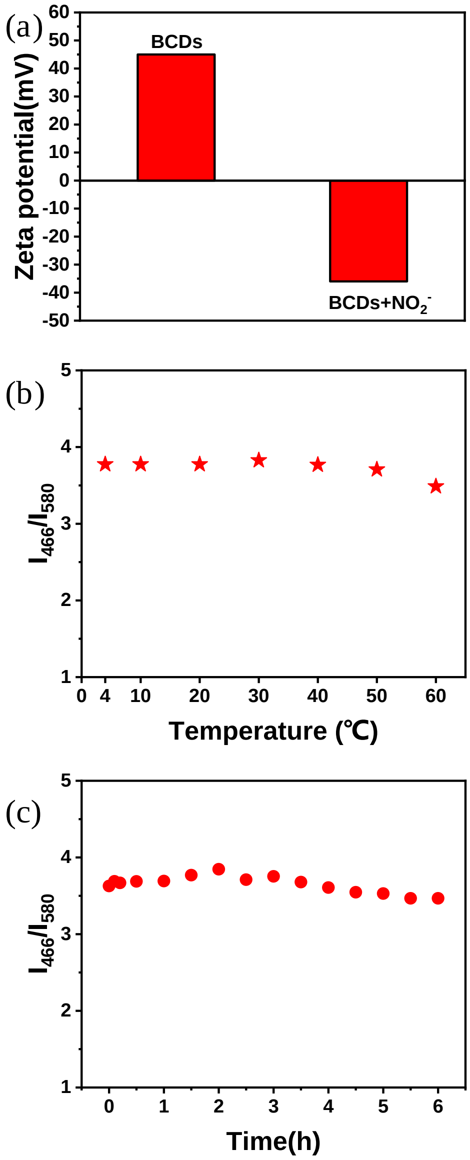

Fig. S3 (a) Zeta Potential of BCDs and BCDs+NO_2^-; (b) Photostability of ratiometric fluorescent probe with exposed to 365 nm UV lamp (I_{466} and I_{580} are the fluorescence intensities of BCDs and RhB); (c) Effect of temperature on ratiometric fluorescent probe.

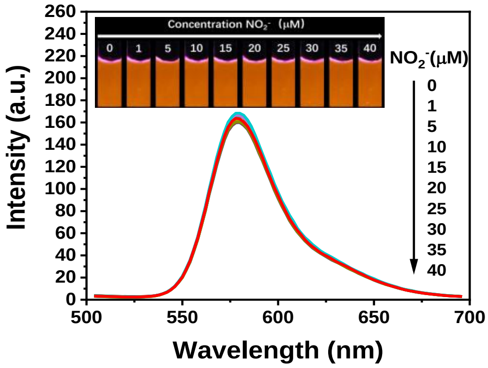

Fig. S4 The fluorescent emission spectra of RhB with the addition of NO_2^-.

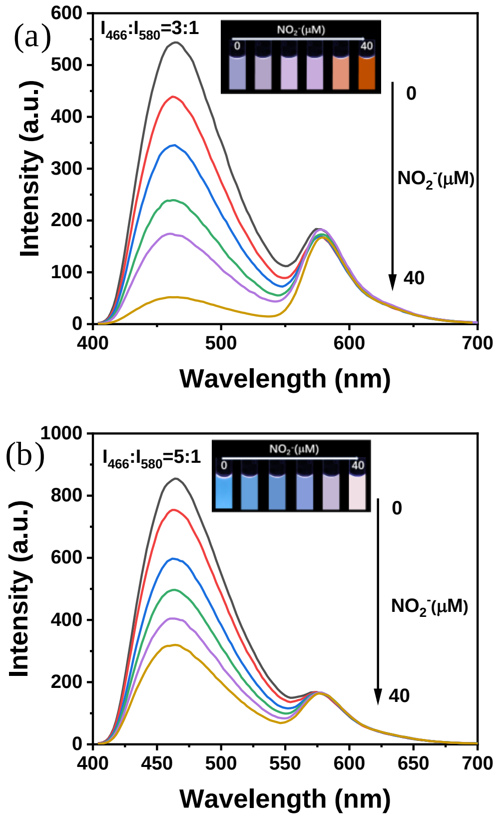

Fig. S5 Fluorescence spectra of the ratiometric fluorescent probe with the addition of NO_2^-. The initial fluorescence intensities of BCDs and RhB were adjusted to a ratio of (a) 3/1 and (b) 5/1. The insets show the corresponding fluorescent photos under a 365 nm UV lamp.

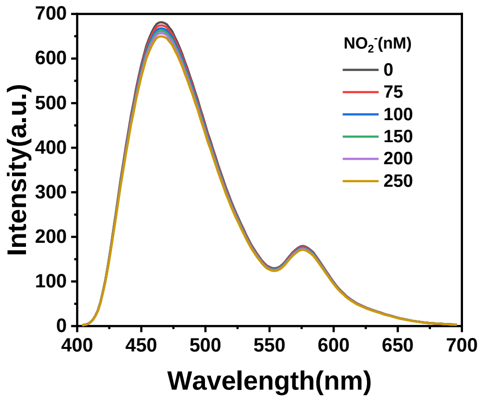

Fig. S6 Fluorescence spectra of NO_2^- with a concentration of 0 to 250 nM added to the ratiometric fluorescent probe solution.

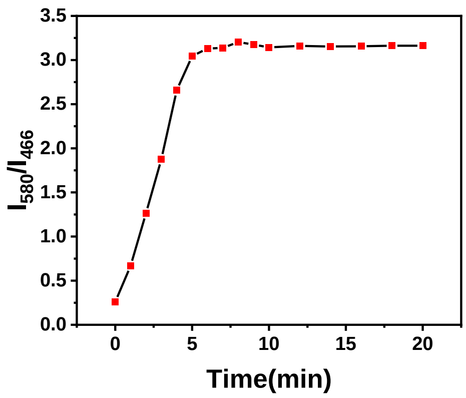

Fig. S7 The response time of ratiometric fluorescent probe to 40 μM NO_2^-.

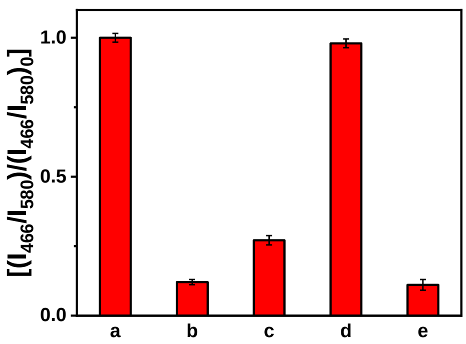

Fig. S8 The masking effect of 0.5 mM EDTA on Hg^{2+}. (a) Blank. (b) The addition of 40 μM NO_2^-. (c) The addition of 400 μM Hg^{2+}. (d) The addition of 400 μM Hg^{2+} with 0.5 mM EDTA. (e) A further addition of 40 μM NO_2^- in (d).

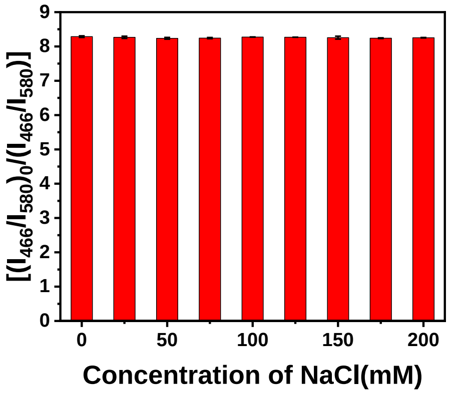

Fig. S9 Influence of ion strength on fluorescence intensity. Concentration: NO_2^-, 40 μM; NaCl, 0, 25, 50, 75, 100, 125, 150, 175, 200 mM; PBS pH 3, 30 mM.

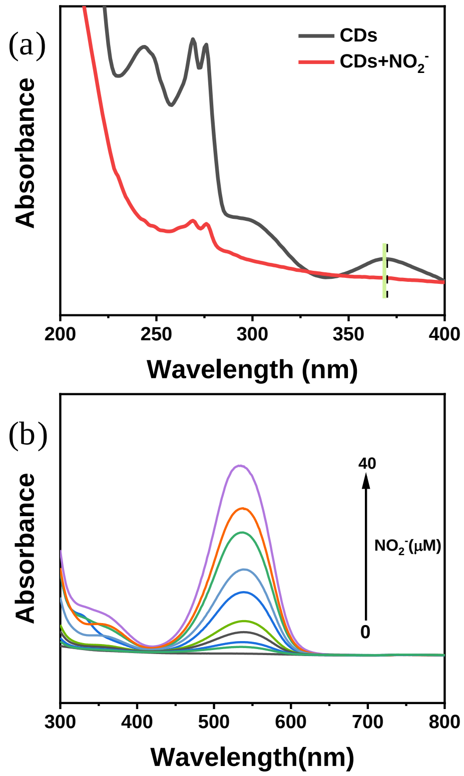

Fig. S10 (a) UV-vis spectrum of the BCDs and BCDs+NO_2^-; (b) UV-vis spectrum of the magenta dye is proportional to the concentration of NO_2^-. Concentration: NED, 0.15 mM; NO_2^-, 0 - 40 μM; PBS pH 3, 30 mM.

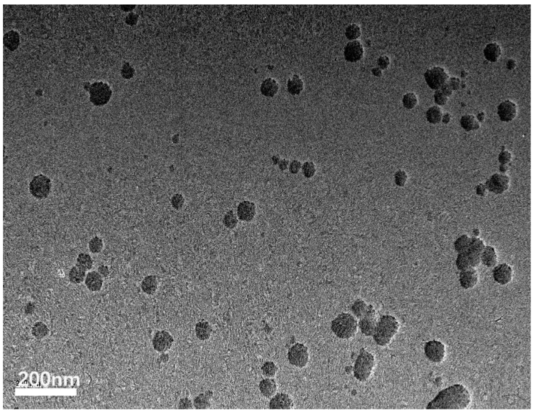

Fig. S11 TEM image of BCDs+NO_2^-.

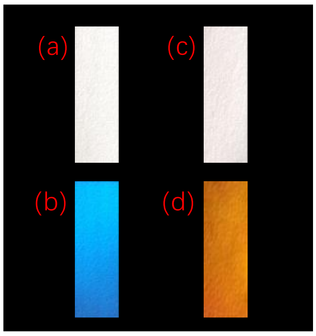

Fig. S12 (a) The fluorescent test paper without UV light; (b) The fluorescent test paper with UV light.

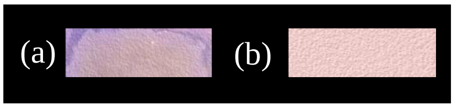

Fig. S13 (a) The fluorescent test paper without Nafion solution + 30 μM NO_2^- under UV light; (b) The fluorescent test paper with Nafion solution + 30 μM NO_2^- under UV light.

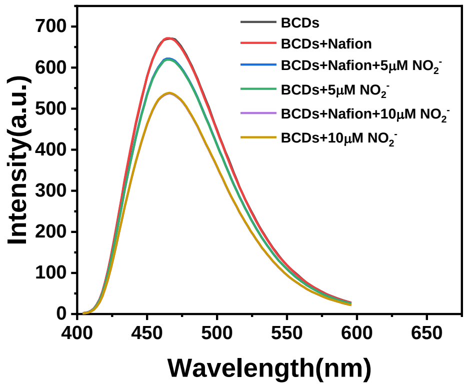

Fig. S14 Effect of 0.5% Nafion (10 μL) on BCDs (25 μL, 60 μg/mL) and the detection of NO_2^- by BCDs.

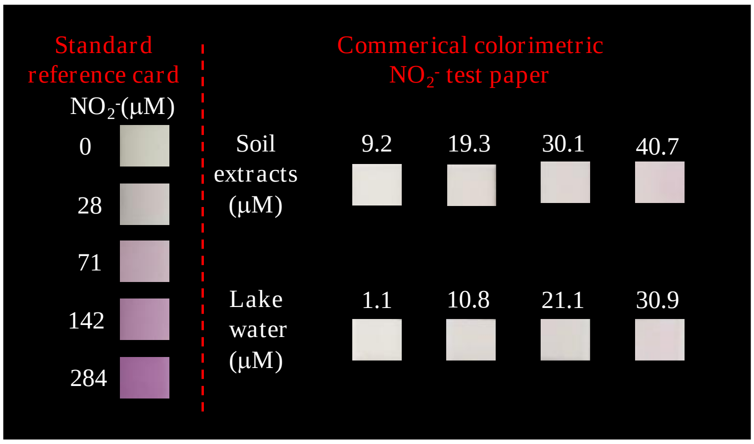

Fig. S15 Commercial test paper for the detection of NO_2^- in different environmental samples. The standard reference card on the right is provided by the merchant. The photos were taken under indoor light.

Table S1 Detection results of nitrite in standard concentration based on fluorescent probe system (n=3).

Spiked concentration (nM)	Found (nM)	Recovery (%)	RSD (%)
65	-4.19±0.13	-	-
70	-6.83±0.28	-	-
75	69.02±2.22	92.02	3.21
100	106.31±3.15	106.31	2.96
150	162.91±5.41	108.61	3.32
200	197.36±7.14	98.66	3.62
250	254.32±7.63	101.73	3.00

Table S2 Detection results of nitrite in soil and lake water samples based on standard method and fluorescent probe system.

Sample	Spiked concentration	Found[a]	Recovery (%)	RSD (%)	Standard method[b]	Relative error (%)
Soil samples	0	2.12±0.05	-	2.50	2.19±0.07	3.30
	2.3	4.43±0.12	101.10	2.69	4.53±0.09	2.26
	4.6	6.91±0.16	104.40	2.33	6.76±0.15	2.17
	6.9	9.36±0.19	105.03	2.06	9.23±0.16	1.39
Lake water samples	0	0.05±0.001	-	2.78	0.05±0.001	0
	0.46	0.50±0.01	97.83	2.82	0.52±0.01	4.00
	0.92	0.97±0.03	100.05	2.85	0.95±0.02	2.06
	1.38	1.42±0.02	99.28	1.17	1.43±0.02	0.70

[a] Concentrations of soil samples and lake water samples are in mg/kg and mg/L, respectively.
[b] Standard method of soil samples came from HJ 634-2012; Standard method of lake water came from GB 7493-87.

Table S3 Detection of real samples using different methods.

	Soil Extracts		Lake Water		Fish Pond Water	Gutter Water
Sample number	S-2	S-3	L-2	L-3	F-1	G-1
Fluorescence method(μM)	4.84± 0.11	7.12± 0.18	0.74± 0.03	0.83± 0.02	4.27± 0.12	18.97± 0.34
Standard method(μM)	4.97± 0.14	7.25± 0.15	0.76± 0.03	0.86± 0.05	4.14± 0.11	19.44± 0.53
Relative error (%)	2.69	1.83	2.70	3.53	3.15	2.46
Test paper						

Table S4 Comparison of the analytical performance of different methods for the detection of NO_2^-.

Method	Indicator	Linear range (μM)	LOD (μM)	Reference
Electrochemical	AuNPs-Fe_2O_3	1-1000	0.07	[1]
Colorimetric	Fuorescent probe P-NO_2^-	0.5-10	0.075	[2]
Ion Chromatography	-	0-86	2.82	[3]

Reference

1 S. H. Kang, P. Pana, H. M. Zhang, G. Z. Wang, Y. X. Wang, C. Zhang, Y. X. Zhang, H. J. Zhao, H. J. Zhou, and W. P. Cai, *Inorg. Chem. Front.*, 2019, **6**, 1432-1441

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