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Supplementary information

Cuttlefish ink-based N and S co-doped carbon quantum dots as fluorescent sensor for highly sensitive and selective para-nitrophenol detection

Xiaotong Huang,[#] Chunli Yang,[#] Yingxin Chen, Zebin Zhu, Lihua Zhou *

School of Biomedical and Pharmaceutical Sciences, Guangdong University of Technology,

Guangzhou, 510006, P.R. China.

* Corresponding author:

E-mail: qhzhoulh@gdut.edu.cn (L. Zhou); Tel: +8620- 85827854

Figure S1



Figure S1. The influence of pH at $\lambda ex=320 \text{ nm a}$), $\lambda ex=390 \text{ nm b}$), and $\log(I_{385 \text{ nm}}+I_{465 \text{ nm}})$ c) and NaCl at $\lambda ex=320 \text{ nm d}$), $\lambda ex=390 \text{ nm e}$), and $\log(I_{385 \text{ nm}}+I_{465 \text{ nm}})$ f). on the fluorescence intensity of N,S-CQDs.

Figure S2



Figure S2. Photograph of N,S-CQDs in the presence of different PNP concentrations under the white light a), and 365 nm UV lamp b). The concentration of PNP gradually decreases from left to right. The final PNP concentration from right to left was 0, 1.25, 2.5, 5, 8.75, 12.5, 20, 27.5, 37.5, 50, 75, 125 μ M.

Figure S3



Figure S3. The parameters used in eq 2, where s is the thickness of the excitation beam (s = 0.10 cm), g is the distance between the edge of the excitation beam and the edge of cuvette (g = 0.40 cm), and d is the width of the cuvette (d = 1.00 cm).

Figure S4



Figure S4. Influence of PNP concentrations on the corrected fluorescence intensity ratio (F_{cor} , $_0$ / F_{cor} in Table S1、S2) of N,S-CQDs at E_m =385 nm a); and E_m =465 nm b).

Table S1

PNP(µM)	$A_{ex}{}^1$	A_{em}^{2}	CF ³	$F_{obsd}{}^4$	F_{cor}^{5}	$E_{obsd}{}^{6}$	$\mathrm{E_{cor}}^7$	$F_{cor, 0}/F_{cor}$
0	0.075	0.029	1.12	834.1	933.8	0	0	1.00
5	0.120	0.062	1.22	688.0	837.8	0.1752	0.1029	1.11
12.5	0.189	0.132	1.41	578.8	816.6	0.3061	0.1256	1.14
20	0.254	0.198	1.62	508.1	822.0	0.3909	0.1198	1.14
37.5	0.395	0.318	2.11	350.2	739.6	0.5802	0.2080	1.26
50	0.503	0.432	2.63	232.2	611.8	0.7216	0.3448	1.53

Table S1 Parameters used to calculate IFE of PNP on the fluorescence of N,S-CQDs at Em=385 nm.

¹ A_{ex} is the absorbance of N,S-CQDs upon addition of PNP at 320 nm.

 $^2\,A_{em}$ is the absorbance of N,S-CQDs upon addition of PNP at 385 nm.

³ Correction factor, calculated as F_{cor}/F_{obsd} .

⁴ F_{obsd} is the measured FL of N,S-CQDs upon addition of PNP at 385 nm.

 5 F_{cor} is the FL corrected with eq 2 by removing IFE from $F_{obsd}.$

⁶ $E_{obsd} = 1 - F_{obsd}/F_{obsd,0}$. $F_{obsd,0}$ and F_{obsd} are the observed fluorescence intensities of CQDs in the absence and in the presence of PNP, respectively.

⁷ $E_{cor} = 1 - F_{cor}/F_{cor,0}$. $F_{cor,0}$ and F_{cor} are the corrected fluorescence intensities of N,S-CQDs in the absence and in the presence of PNP, respectively.

Table S2

PNP(µM)	Aex ⁸	A _{em} ⁹	CF^{10}	$F_{obsd}{}^{11} \\$	$F_{cor}{}^{12} \\$	$E_{obsd}{}^{13}$	E_{cor}^{14}	$F_{cor, 0}/F_{cor}$			
0	0.044	0.059	1.12	645.8	720.3	0.0498	0.0498	1.00			
5	0.086	0.062	1.17	609.5	714.8	0.1033	0.0571	1.01			
12.5	0.188	0.105	1.37	492.7	675.2	0.2751	0.1093	1.07			
20	0.231	0.126	1.47	431.5	632.5	0.3652	0.1656	1.14			
37.5	0.331	0.128	1.63	336.5	547.7	0.5050	0.2775	1.32			
50	0.465	0.350	2.34	241.9	565.0	0.6441	0.2547	1.27			

Table S2 Parameters used to calculate IFE of PNP on the fluorescence of N,S-CQDs at Em=465 nm

 9 $A_{\rm em}$ is the absorbance of CQDs upon addition of PNP at 465 nm,

 10 Correction factor, calculated as $F_{cor}/F_{obsd}.$

⁸ A_{ex} is the absorbance of CQDs upon addition of PNP at 390 nm,

 $^{^{11}}$ F_{obsd} is the measured FL of N,S-CQDs upon addition of PNP at 465 nm.

 $^{^{12}}$ F_{cor} is the FL corrected with eq 2 by removing IFE from $F_{obsd}.$

¹³ $E_{obsd} = 1 - F_{obsd}/F_{obsd,0}$. $F_{obsd,0}$ and F_{obsd} are the observed fluorescence intensities of CQDs in the absence and in the presence of PNP, respectively.

¹⁴ $E_{cor} = 1 - F_{cor}/F_{cor,0}$. $F_{cor,0}$ and F_{cor} are the corrected fluorescence intensities of CQDs in the absence and in the presence of PNP, respectively.