Electronic Supplementary Information (ESI)

Highly selective detection of 2,4,6-trinitrophenol by using newly developed terbium-doped blue carbon dots

Bin Bin Chen[a], Ze Xi Liu[b], Hong Yan Zou[b] and Cheng Zhi Huang*[ab]

[a] *Key Laboratory of Luminescent and Real-Time Analytical Chemistry (Southwest University), Ministry of Education, College of Chemistry and Chemical Engineering, Southwest University, Chongqing 400715, China. E-mail: chengzhi@swu.edu.cn, Tel: (+86) 23 68254059, Fax: (+86) 23 68367257*

[b] *Chongqing Key Laboratory of Biomedical Analysis (Southwest University), Chongqing Science & Technology Commission, College of Pharmaceutical Science, Southwest University, Chongqing 400716, China*

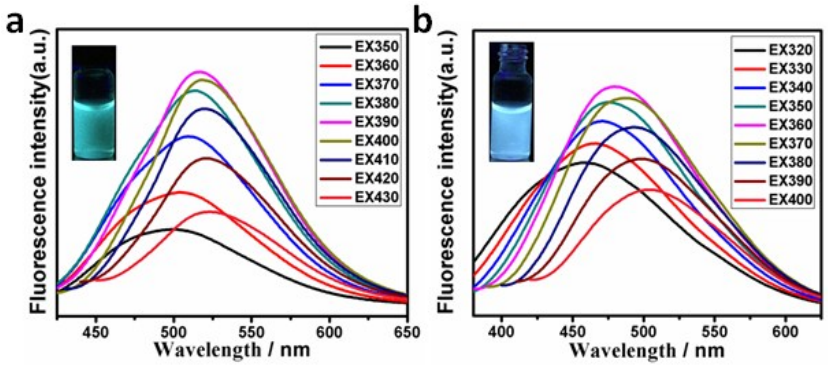

Fig. S1 The preparation of Tb-CDs by using different Tb salts. (a) $TbCl_3$ (Inset: Tb-CDs solution under the 365 nm UV lights lamp); (b) $Tb_2(SO_4)_3$ (Inset: Tb-CDs solution under the 365 nm UV lights lamp).

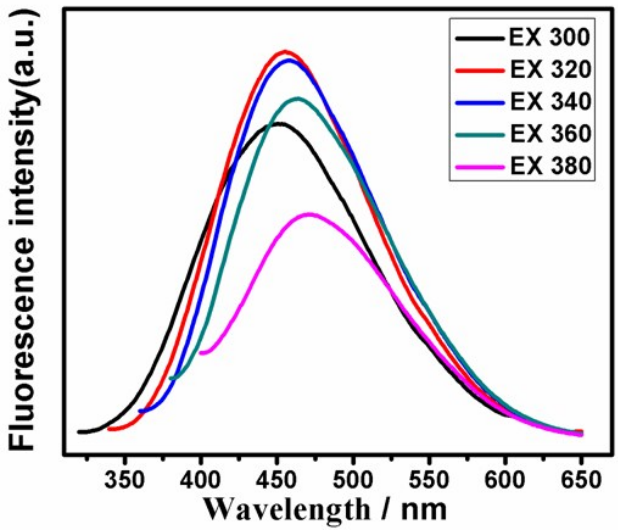

Fig.S2 The emission spectrum of Tb-CDs.

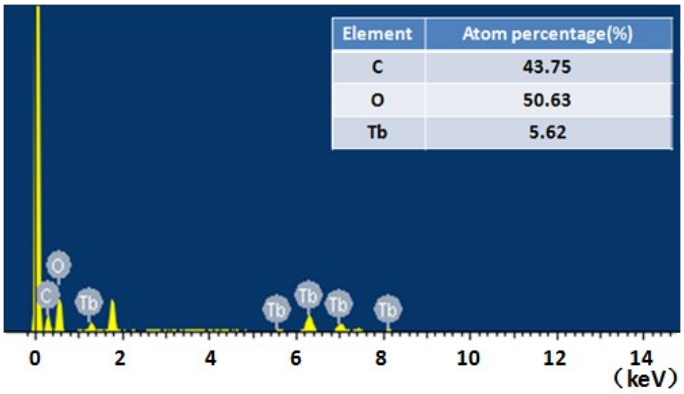

Fig.S3 The EDX analysis of Tb-CDs.

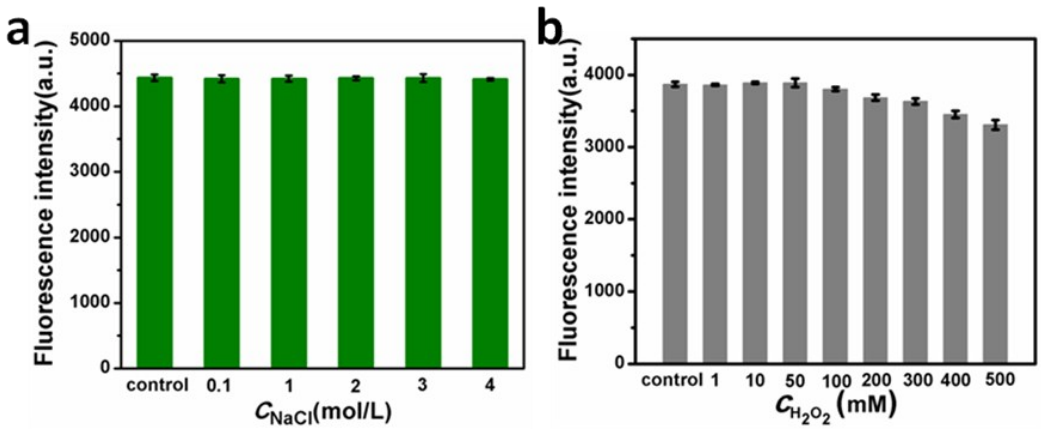

Fig.S4 The stability investigation of the as-prepared Tb-CDs. (a) The stability in a salty medium; (b) the antioxidant capacity of Tb-CDs. $C_{\text{Tb-CDs}}$, 0.4 mg/ml.

Table. S1 Zeta potentials vary from different pH value.

pH	Zeta potential (mV)
1.81	23.5
2.21	16.2
3.23	1.8
4.10	-7.5
5.02	-19.5
6.10	-22.5
7.00	-27.0

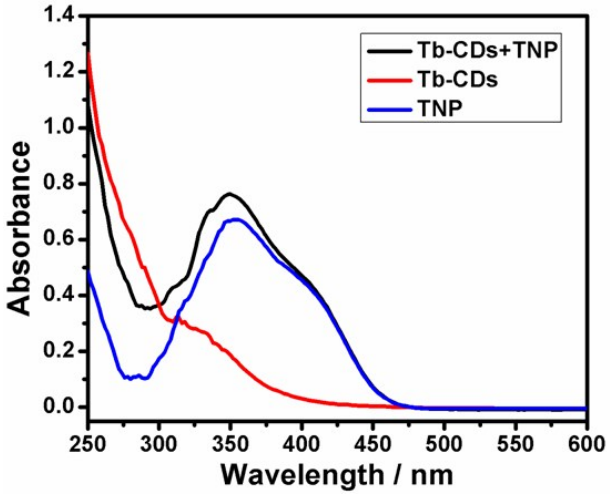

Fig.S5 The UV-Vis absorption spectra of TNP in the absence and presence of Tb-CDs.

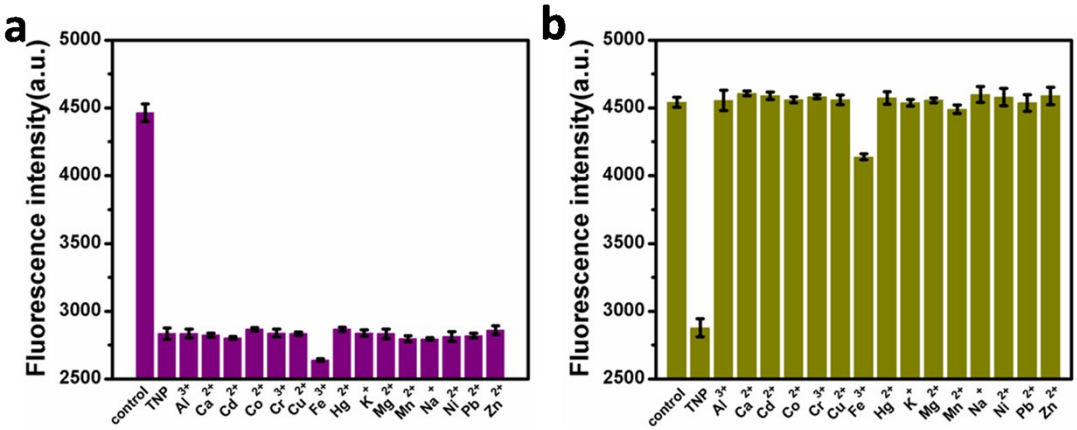

Fig.S6 Selective detection of the Tb-CDs for TNP in BR buffer (pH 7.0). Fluorescence responses of the Tb-CDs in the presence (a) and absence (b) of 75 μM TNP. The concentration of metal ions was 100 μM.

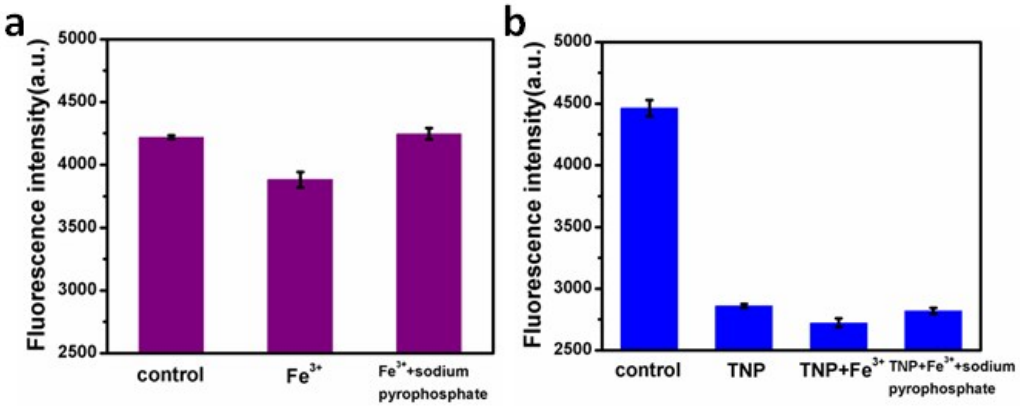

Fig.S7 Fluorescence responses of the Tb-CDs in the absence (a) and presence (b) of 75 μM TNP. $C_{Fe^{3+}}$, 100μM; $C_{\text{sodium oyrophosphate}}$, 1mM.

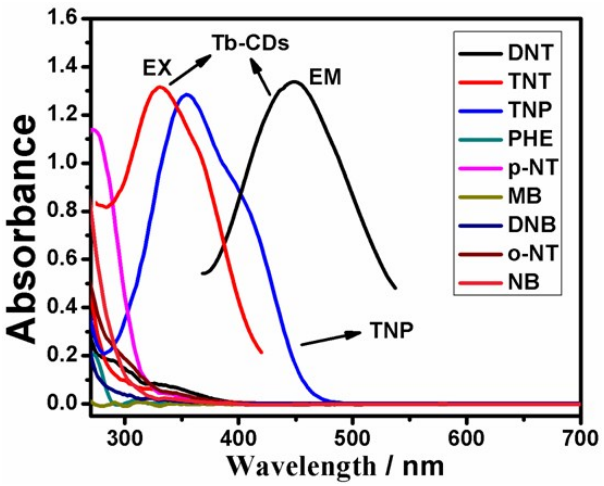

Fig.S8 The UV-Vis absorption spectra of all nitroaromatic explosives and the fluorescence excitation and emission spectra of Tb-CDs.

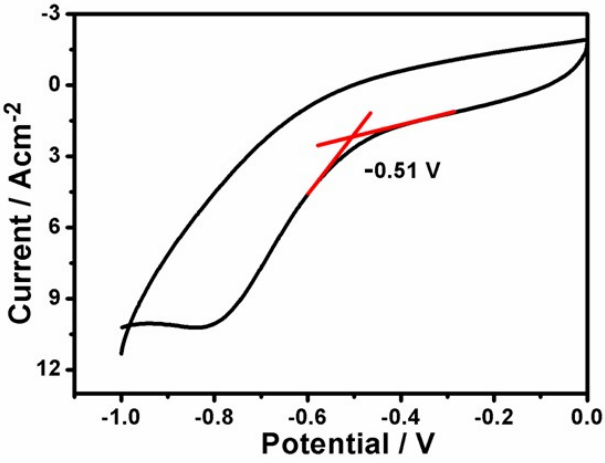

Fig.S9 Cyclic voltammograms of the Tb-CDs in the solution state. The HOMO and LUMO energy levels of Tb-CDs could be estimated according to the empirical formula:

$$E_{HOMO} = -e(E_{ox}+4.4)$$
$$E_{LUMO} = -e(E_{red}+4.4)$$

Where E_{ox} and E_{red} are the onset of oxidation and reduction potential for Tb-CDs, respectively. The E_{red} was determined to be -0.51 V. The corresponding E_{LUMO} was calculated to be -3.89 eV. However, the HOMO energy could not be obtained due to the irreversible of the oxidation behavior. To determine the HOMO levels, we combined the E_{red} with the optical energy band gap (E_g, resulting from the absorption edge in the absorption spectrum):

$$E_{HOMO} = E_{LUMO} - E_g$$ [40]

E_g was estimated to be 4.42 eV. So, the E_{HOMO} was calculated to be -8.31 eV.

Table. S2 The comparison of the determination of TNP.

Methods	Linear detection range	Detection limit	Reference
Colorimetric method with π-stacked organic crystalline solid	/	15.2 μM	1
Fluorescent method with cadmium–pamoate metal–organic framework	0.76-11.5 ppm	1.76×10^{-8} g/L	2
Fluorescent method with metal-organic framework	10-400 ppm	/	3
Fluorescent method with photoluminescent carbon nanodots	0.08-100μM	22 nM	4
Colorimetric method with Redox-Switchable Copper(I) Metallogel	/	50 μM	5
Fluorescent method with graphene quantum dots	1-60 μM	0.3 μM	6
Fluorescent method with Graphitic Carbon Nitride Nanosheets	0-0.5 μM 0.5-10 μM	8.2 nM	7
Fluorescent method with DAP-RGO	/	125 nM	8
Fluorescent method with Tb-CDs	500nM-100μM	0.2 μM	This work

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