Electronic Supplementary Information (ESI)

Silicon doped carbon dots-based fluorescent sensor for doxorubicin detection

Shixiang Dong, Lin Zhang,* Jia Ge,* Xilin Dong, Haoran Liu, Changyu Wang, Zhaohui Li*

College of Chemistry, Henan Joint International Research Laboratory of Green Construction of Functional Molecules and Their Bioanalytical Applications, Zhengzhou University, Zhengzhou 450001, China

*Corresponding authors. E-mail address: jiage@zzu.edu.cn; linzhang@zzu.edu.cn, zhaohui.li@zzu.edu.cn.

Characterization instrumentation

The sizes and morphologies of the Si-CDs were observed by a transmission electron microscopy (TEM). X-ray photoelectron spectroscopy spectra (XPS) was recorded on an X-ray photoelectron spectrometer (ESCALAB 250XI). Ultraviolet-visible absorption spectra (UV-Vis) were measured on a TU-1900ultraviolet spectrophotometer, the fluorescence performances of Si-CDs were analyzed by fluorescence spectrometer(F-7100), respectively.

Fluorescence quantum yield measurement

The quantum yield (QY) of Si-CDs was determined using previously reported methods. [1, 2] QYc was calculated using Eq. (1), with quinine sulfate (QYs =0.55) in 0.1 mol/L H_2SO_4 as the reference.

$$QY_c = QY_s \times \frac{K_c}{K_s} \times (\frac{\eta_c}{\eta_s})^2 \times 100\% \qquad (1)$$

where QYc is the quantum yield, K is the slope of the linear fit between integrated fluorescence intensity and absorbance, η is the refractive index of the solvents (η_c=η_s=1.33), and the subscripts “c” and “s” refer to Si-CDs and quinine sulfate solutions, respectively.

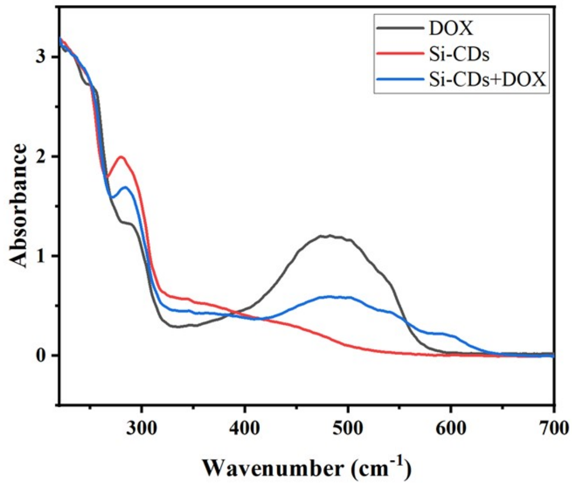

Fig. S1. UV-vis absorption spectrum of Si-CDs (black), DOX (red), Si-CDs+DOX (blue).

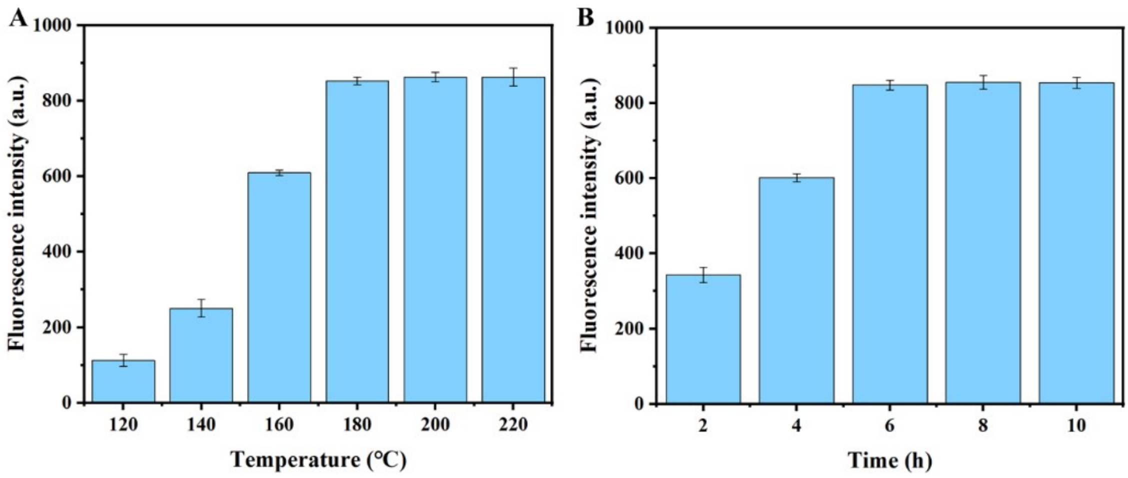

Fig. S2. (A) Effect of the synthesis temperature on the fluorescence intensity of Si-CDs; (B) Effect of the synthesis time on the fluorescence intensity of Si-CDs

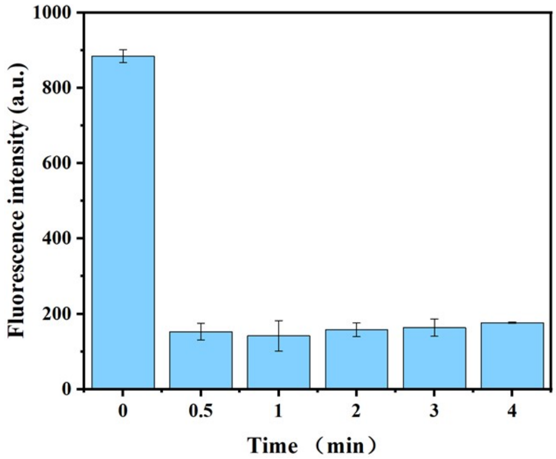

Fig. S3. Time-dependent interaction between Si-CDs and DOX (200 μmol/L) at room temperature.

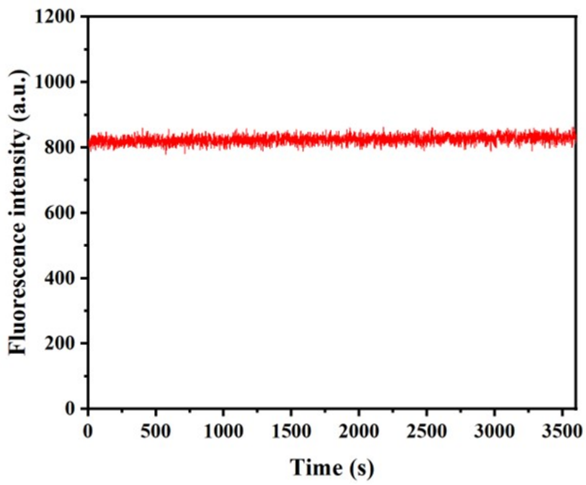

Fig. S4. Fluorescence intensity of Si-CDs as function of time.

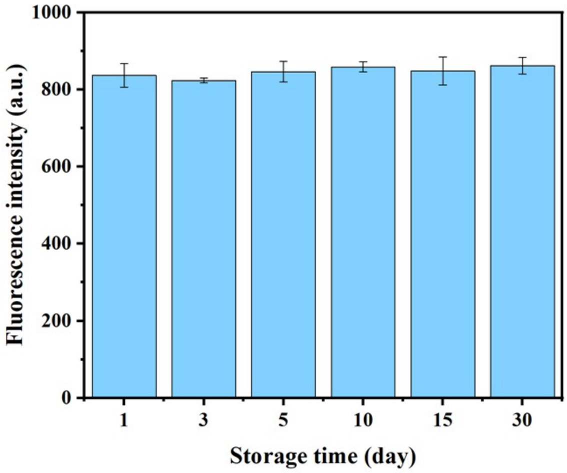

Fig. S5. The stability investigation of Si-CDs stored for different period.

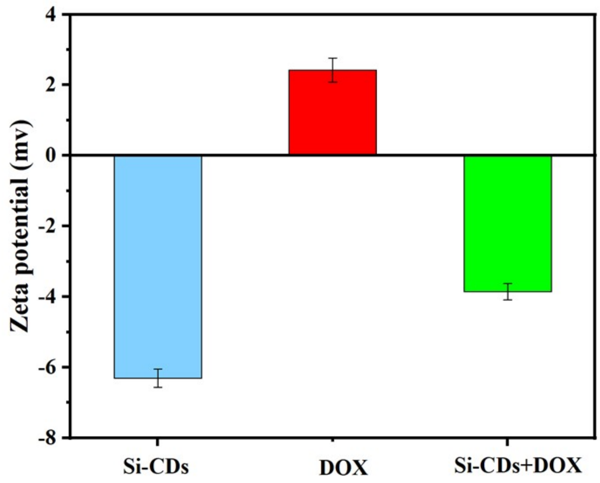

Fig. S6. Zeta potential of Si-CDs (blue), DOX (red) and Si-CDs+DOX (green)

Table S1. Comparison with other developed fluorescent probes for DOX detection.

Determination of DOX	LOD (nM)	Linear range (μM)	Ref.
CC/DTT-AuNCs	5	0.05-2	[3]
CdS@PCN-224	3.57	0.01-1	[4]
PEI-CDs	75.2	0.1-150	[5]
MUA-CDs	600	0.25-19.96	[6]
P-CQDs	120	1-30	[7]
Si-CDs	6	0.05-50	This work

References：

1 J. Chen, M. Q. Zhang, Z. J. Xu, R. X. Ma and Q. D. Shi, *Sci. Total Environ.*, 2023, **896**, 165136.

2 K. X. Chen, Q. F. Chen and M. Zhu, *Int. J. Biol. Macromol.*, 2025, **309**, 142926.

3 K. Y. Huang, H. X. He, S. B. He, X. P. Zhang, H. P. Peng, Z. Lin, H. H. Deng, X. H. Xia and W. Chen, *Sens. Actuators, B*, 2019, **296**, 126656.

4. W. X. Dong, Z. P. Li, W. Wen, B. Liu and G. M. Wen, *ACS Appl. Mater. Interfaces*, 2021, **13**, 57497-57504.

5. M. Yang, Y. J. Yan, E. Z. Liu, X. Y. Hu, H. Hao and J. Fan, *Opt. Mater.*, 2021, **112**, 110743.

6. L. Zhang, H. Z. Xing, W. Liu, Z. H. Wang, Y. M. Hao, H. P. Wang, W. J. Dong, Y. Liu, S. M. Shuang, C. Dong and X. J. Gong, *ACS Appl. Nano Mater.*, 2021, **4**, 13734-13746.

7. J. T. Zhu, H. Y. Chu, J. W. Shen, C. Z. Wang and Y. M. Wei, *Opt. Mater.*, 2021, **114**, 110941.