Supplementary Materials for:

Lysosome targeting, Cr(VI) and L-AA sensing, and cell imaging based on N-doped blue-fluorescence carbon dots

Lihong Shi [a,*], Xiaorui Dong[a], Guomei Zhang[a], Yan Zhang[a], Caihong Zhang[a], Chuan Dong[a], Shaomin Shuang[a,*]

Fluorescence QY measurements

The relative fluorescence QY(Φ) of N-CDs was calculated using the equation of $\Phi_x = \Phi_{std} I_x A_{std} \eta_x^2 / (I_{std} A_x \eta_{std}^2)$. Quinine sulfate in 0.1 M H_2SO_4 was chosen as a reference with a quantum yield (Φ_{std}) of 0.54 at 360 nm. In the equation, I_x and I_{std} are FL intensities of N-CDs and the reference, respectively. A_x and A_{std} denote the optical densities of N-CDs and the reference, respectively. η_x and η_{std} represent the refractive indices of N-CDs and the reference, respectively. The absorbances of all samples in a 1.0 cm cuvette were kept under 0.1 at excitation wavelength to minimize re-absorption effects.

MTT assay

For cell cytotoxicity text, HeLa cells were first plated on a Costar 96-well tissue-culture cluster and cultured at 37°C with 5% CO_2 in air for 3 h to adhere cells onto the surface. The well without cells and treatment with N-CDs was taken as a zero set. The medium was then changed with 100 μL of fresh DMEM supplemented with 10% FBS containing N-CDs, and cells were allowed to grow for another 24 h. At least five parallel samples were performed in each group. Cells without treatment with N-CDs were taken as a control. After adding 20 μL of 5.0 mg mL^{-1} MTT reagent into individual well, the cells were further incubated for 4 h, followed by removing the culture medium

[a] College of Chemistry and Chemical Engineering, Shanxi University, Taiyuan, 030006, PR China
* Corresponding author. E-mail address: shilihong@sxu.edu.cn, smshuang@sxu.edu.cn.

with MTT, and then 150 μL of DMSO was added. The resulting mixture was shaken for 10 min at room temperature. The OD of the mixture was measured at 490 nm with a SunRisemicroplate reader (Tecan Austria GmbH, Grödig, Austria).The cell viability was estimated using the equation of Cell Viability (%) = ($OD_{Treated}/OD_{Control}$) × 100%, where $OD_{Control}$ and $OD_{Treated}$ were obtained in absence and presence of N-CDs, respectively.

Synthesis process of N-CDs

Blue-fluorescence N-CDs were fabricated through hydrothermal carbonization of folic acid and p-phenylenediamine. The formation process of N-CDs likely involve decomposition, polymerization, carbonization, and nuclear burst. Firstly, folic acid and p-phenylenediamine formed intermediates through dehydration and decomposition. Afterwards, these intermediates were polymerized, carbonized and aromatized to form aromatic clusters. Simultaneously, the aromatic clusters may undergo nuclear explosions to form N-CDs. To get good FL properties, we investigated the influence of reaction temperature and time on FL properties of resultant N-CDs. As shown in Fig. S1, the optimum reaction condition for N-CDs is 220°C for 4 h.

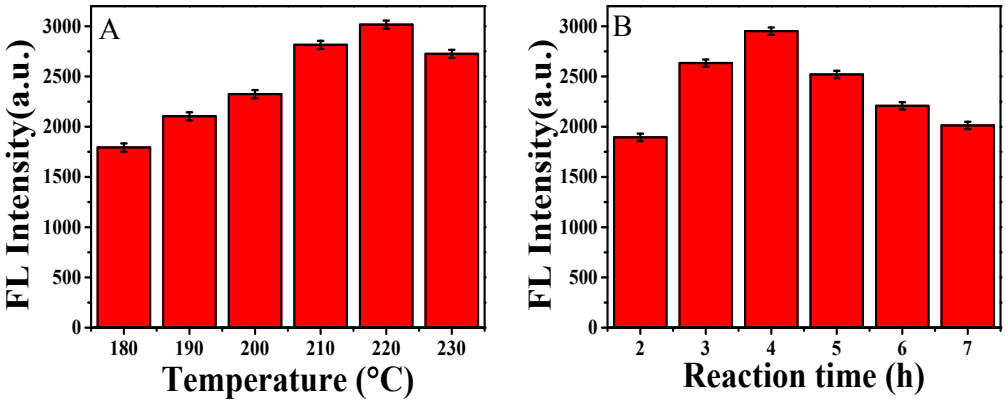

Fig. S1 FL intensity of N-CDs prepared under different reaction temperature (A) and time (B).

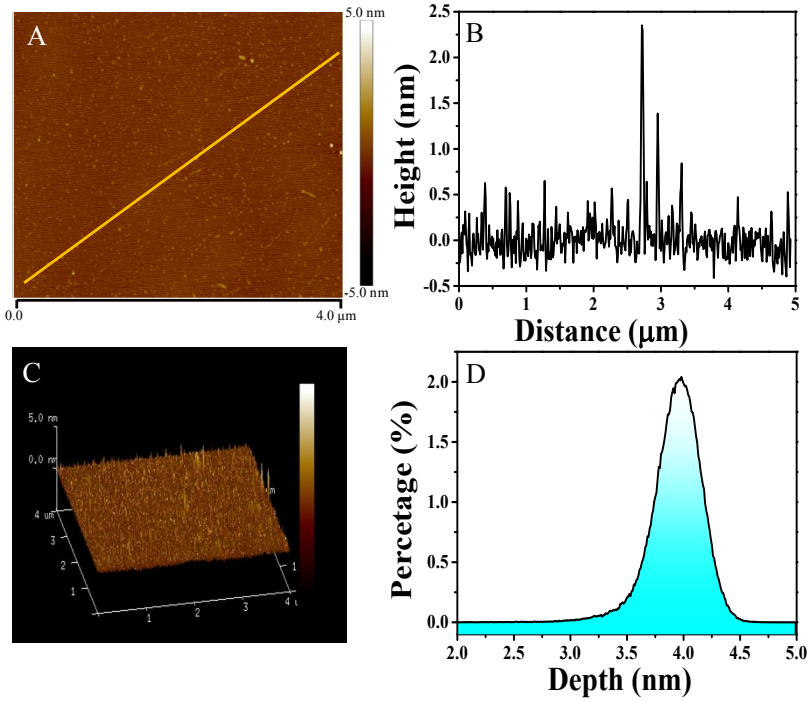

Fig. S2 (A) AFM topographic image of N-CDs. (B) Distribution of height profile along line in AFM topographic image. (C) AFM three-dimensional image of N-CDs. (D) The height distribution of N-CDs.

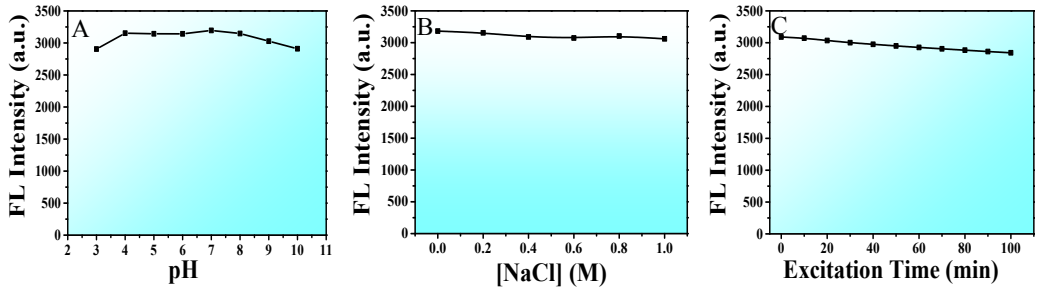

Fig. S3 (A) Effect of pH on FL intensity of N-CDs. (B) Effect of NaCl concentration on FL intensity of N-CDs. (C) Effect of excitation time on FL intensity of N-CDs.

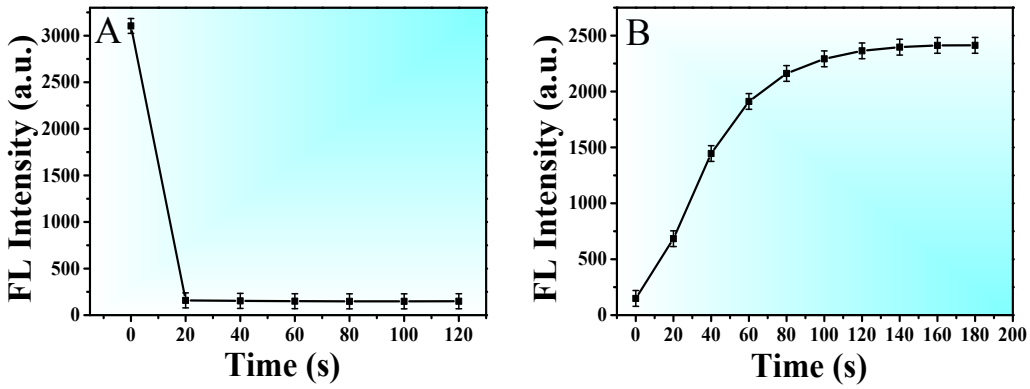

Fig. S4 (A) Time-dependence of FL intensity of N-CDs/Cr(VI) under 360 nm excitation. (B) Time-dependence of FL intensity of N-CDs/Cr(VI)/L-AA solution under 360 nm excitation.

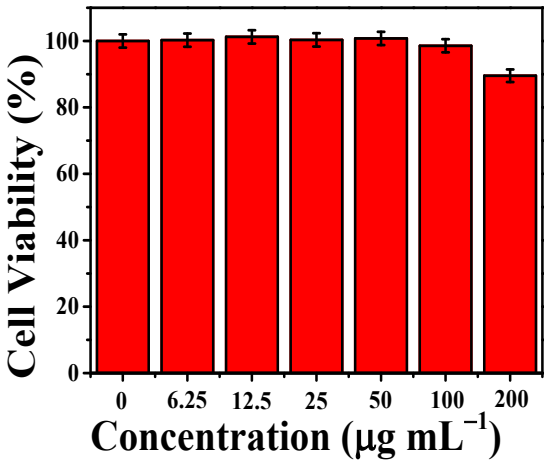

Fig. S5 Toxic effect of N-CDs on HeLa cells.

Table S1 Comparison of different CDs based Cr(VI) probes.

Fluorescent probes	CDs precursor	Linear range (μM)	Detection limit (nM)	Ref.
CDs	waste tea extract	1.9−115.4	810	[1]
CDs	flax straw, EDA	0.5−80	190	[2]
Ag-doped CDs	FA, PE, $AgNO_3$	0.1−6	43.7	[3]
CDs	m-phenylenediamine, citric acid	0−5	140	[4]
N-CDs	citric acid, ethylenediamine	0−10	260	[5]
CDs	4-aminoacetanilide, hydrochloride, 4-acetamidobenzaldehyde	1−400	130	[6]
P,N-CDs	EDA, ethylenediamine	7−70	710	[7]
N-CDs	folic acid, p-phenylenediamine	0.10−150	9.4	This work

Table S2 Comparison of various CDs based L-AA probes.

Fluorescent probes	CDs precursor	Linear range (μM)	Detection limit (μM)	Ref.
Tea-CDs/Cr(VI)	waste tea extract	500−5000	87.02	[1]
CDs/Cr(VI)	flax straw, EDA	0−200	0.35	[2]
S,N-CDs/Cr(VI)	glucose, H_2SO_4, EDA	6.6−892	0.076	[8]
CDs/NO_2^-	nicotinic acid, folic acid	0.1−800	50	[9]
N-CDs/Cr(VI)	CA ,Glu	1−750	0.3	[10]
N-CDs/Cr(VI)	p-PD, ammonia	5−50	0.32	[11]
CDs@EDTA/Cr(VI)	orange peels, EDTA	0.1−400	0.1	[12]
N-CDs/Cr(VI)	folic acid, p-phenylenediamine	750−2250	25	This work

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