Supplementary Materials for:

Hg^{2+} detection, pH sensing and cell imaging based on bright blue-fluorescent N-doped carbon dots

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Materials

Folic acid and citric acid were obtained through Shanghai Aladdin Reagent Co., Ltd. (Shanghai, China). $AlCl_3$, $BaCl_2$, $CaCl_2$, $CdCl_2$, $CoCl_2$, $CuCl_2$, $FeCl_3$, $HgCl_2$, $MgCl_2$, $MnCl_2$, NaCl, $NiCl_2$, $PbCl_2$ and $ZnCl_2$ were obtained through Beijing Chemical Corp (Beijing, China). Dialysis membranes with a MWCO of 500–1000 Da were obtained through Beijing Solarbio Science & Technology Co., Ltd. (Beijing, China). HepG-2 cells were obtained from the Cell Bank of the Chinese Academy of Sciences (Shanghai, China).

Apparatus

Transmission electron microscopy (TEM) studies were carried out in a JEOL JEM-2100 instrument operating at an accelerating voltage of 200 kV. Samples for TEM measurements were obtained via placing a drop of colloidal solution on a carbon coated copper grid and then drying at room temperature. The UV-vis absorption spectrum was recorded through HITACHI U-2910 UV. The fluorescence spectrum was operated with a Hitachi F-4500 fluorescence spectrophotometer (Tokyo, Japan). Fourier transform infrared (FTIR) spectra were recorded on a Bruker tensor 2 spectrometer at a resolution of 4 cm^{-1}. A 1 mg sample (ratio 1:200) diluted in KBr was pressed into the pan.

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Cell imaging

In a 5% CO_2 incubator, HepG-2 cells in the exponential phase were seeded into 15 mm glass culture dishes at an initial density of 1 × 106 cells/mL with DMEM containing 10% FBS and incubated at 37^{o}C. After incubation, the medium was discarded and HepG-2 cells were treated with mixture of N-CDs (200 μg/mL) and DMEM for 40 min. The extracellular N-CDs were removed by rinsing twice with phosphate buffer solutions (pH =7), and then cells were incubated with PBS buffer (0.01 M) containing a range of concentration of Hg^{2+}. Immediately, fluorescence images were captured on laser scanning confocal microscope (LSCM). For intracellular pH sensing, under the above conditions, HepG-2 cells was cultured by taking the place of pH 8.

QY measurements

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

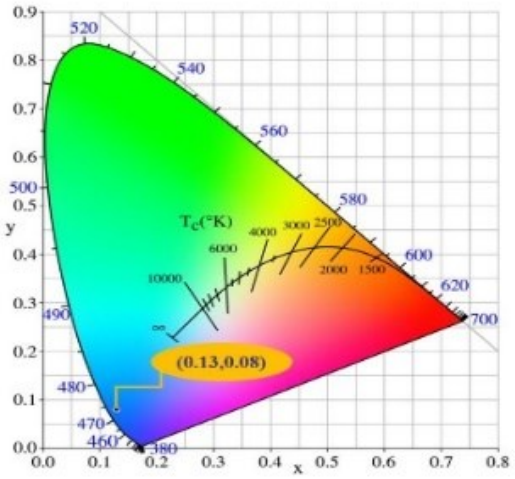

Fig. S1 CIE chromaticity coordinate from the PL spectra of N-CDs.

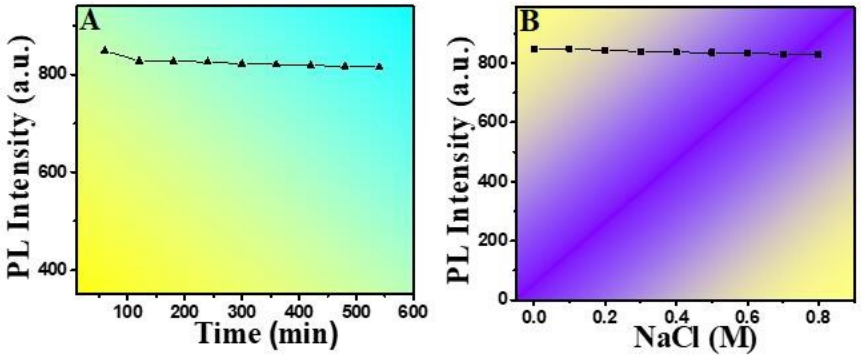

Fig. S2 (A) Influence of storage times on the PL intensity of N-CDs. (B) E□ect of ionic strength on the PL intensity of N-CDs

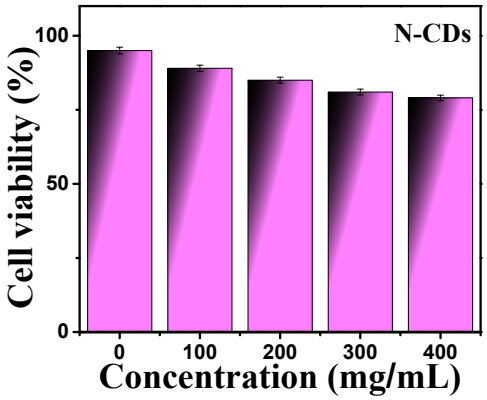

Fig. S3 Cytotoxicity test of N-CDs.

Table S1 Comparison of different fluorescent N-CDs based probes for Hg^{2+} detection.

Fluorescent probes	Raw material	Linear range	Detection limit	Ref.
CDs	citric acid and polyethyleneimine	0 μM–8 μM	0.24 μM	[1]
CDs	Musk melon	1 μM–25 μM	0.33 μM	[2]
N, S-CDs	glycerol and cystine	1 μM–75 μM	0.50 μM	[3]
CDs	citric acid and diethylenetriamine	0 μM–30 μM	0.20 μM	[4]
CDs	adipic acid and triammonium citrate	4 μM–18 μM	2.47 μM	[5]
N-CDs	citric acid and melamine	2 μM–14 μM	0.44 μM	[6]
N-CDs	sodium citrate and urea	0.001 μM−5 μM	0.65 μM	[7]
CDs	cellulose	6 μM−80 μM	1.6 μM	[8]
N-CDs	citric acid and folic acid	50 μM−400 μM	0.124 μM	This work

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