Electronic Supplementary Information

Easy synthesis of photoluminescent N-doped carbon dots from winter melon for bio-imaging

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Experimental Section

Materials

Winter melon was purchased from a local supermarket. The other chemicals were used as received without further purification.

Synthesis of N-doped CDs

The N-doped CDs were prepared by a facile and one-step procedure with a hydrothermal treatment. Briefly, winter melon juices (WGJ) were extracted from the crushed winter melon, and then 20 mL WGJ was placed into an autoclave reactor heated at 180 °C for 2 h. After cooling down to room temperature, the yellow solution was obtained and filtered through 0.22 μm Millipore syringe filters to remove larger dots. Finally, the resultant solution was dialyzed for 24 h to obtain N-doped CDs.

Quantum yield measurements

The quantum yield (QY) of the N-doped CDs can be obtained by the following method: The UV-vis absorption and PL emission spectra with 360 nm excitation of CDs and reference (quinine sulfate dissolved in 0.1 M H_2SO_4, QY= 0.54 with 360 nm excitation) were recorded. QY was calculated by the following equation (1):[S1]

$$QY_{sam} = QY_{ref} \frac{I_{sam} A_{ref} n_{sam}^2}{I_{ref} A_{sam} n_{ref}^2} \quad (1)$$

Here, *sam* and *ref* refer to CDs sample and reference, respectively. QY means quantum yield. *I* is the emission intensity at 360 nm excitation. And *A* means the UV-vis absorption intensity at 360 nm. The *n* presents the refractive index with 1.33 as the default for both quinine sulfate and CDs solvent.

Cell Culture

The hepG2 cells (human liver hepatocellular carcinoma cell line) were cultured in the DMEM medium with 10% fetal bovine serum and 1% penicillin/streptomycin. The incubators were maintained at 37 °C, 5% CO_2, and 95% O_2. The growth medium was changed every other day.

Cytotoxicity test

CCK-8 assay was performed on hepG2 cells to evaluate the cytotoxicity of N-doped CDs: hepG2 Cells were plated in 96-well plates at a density of 2×10^4 cells per well. The N-doped CDs with a concentration range from 0 to 1 mg/mL were added into the wells, and subsequently incubated for 24 h. Each concentration was tested with 8 repeats. The medium was removed and the cells were washed with Dulbecco's phosphate buffered saline. And then 90 μL of fresh DMEM and 10 μL of CCK-8 solution (5 mg/mL) were introduced. After further incubation for 1 h in dark field, the medium containing CCK-8 was measured absorbancy (Abs) at 450 nm with spectrophotometer. The cell viability was calculated according to the given equation (2):

$$Cell\ viability = \frac{Abs_{sam}}{Abs_{con}} \times 100\ \% \quad (2)$$

Here, Abs_{con} means Abs of the control group and Abs_{sam} means Abs of the sample.

In vitro cellular uptake

The hepG2 cells were seeded into 4-well confocal dish at a density of 2 x 10^4 cells per well. 1mg/mL N-doped CDs was added into cells and cultured at 37 °C for 24 h. The cellular uptake of N-doped CDs by hepG2 cells was captured by confocal fluorescent microscopy after washed with PBS three times and the emission was measured over the range of 420-500 nm, λ_{ex}= 405 nm.

Characterization

The morphology and dimension of N-doped CDs was obtained by transmission electron microscope (TEM) (JEM-2010F, JEOL, Japan) with an accelerating voltage of 120 kV. The size distribution of N-doped CDs was measured by Dynamic Light Scattering (DLS) using a Zetasizer Nano Z90 (Malvern, UK). Fourier transform infrared spectroscopy (FTIR) was recorded using Thermo Nicolet 6700 spectrometer (Thermo Fisher Scientific, USA) with the spectral range from 4000 to 400 cm^{-1}. Ultraviolet-visible (UV–Vis) absorption spectra were performed on a UV–Vis spectrophotometer (2501PC, SHIMADZU, Japan). The X-ray photoelectron spectra (XPS) measurements were examined by a Thermo Scientific spectrometer *(*ESCALAB 250Xi, UK) using Al Kα as the X-ray excitation source. Fluorescence measurements were recorded on a fluorescence spectrofluorometer (RF5301, SHIMADZU, Japan) with slit widths of 3 nm. Cellular fluorescent image was recorded using a Laser Scanning Confocal Microscope (LSM710, Carl Zeiss, Germany).

References

S1. B. De and N. Karak, *RSC Adv*., 2013, **3**, 8286.

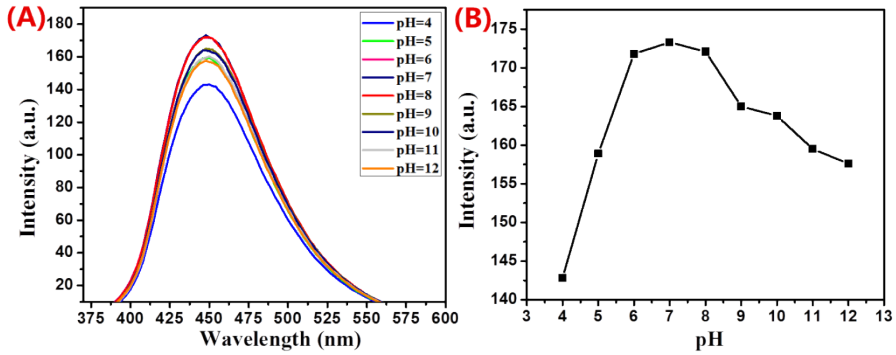

Fig. S1 Effect of pH on the PL intensity of N-doped CDs at 448 nm (λ_{ex}= 360 nm).

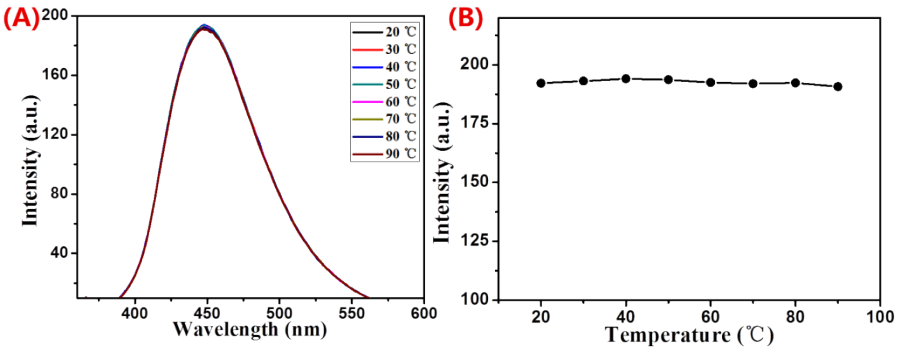

Fig. S2 Dependence of PL intensity on excitation temperature for N-doped CDs at 448 nm (λ_{ex}= 360 nm).

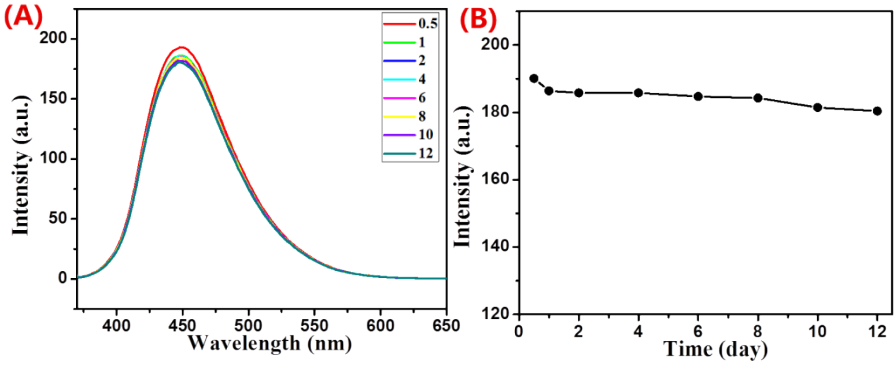

Fig. S3 Dependence of PL intensity on excitation time for N-doped CDs at 448 nm (λ_{ex}= 360 nm).