Electronic Supplementary Information

Simple synthesis of green luminescent N-doped carbon dots for malachite green determination

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Chemicals/reagents

Fuchsin basic was obtained from Sinopharm Chemical Reagent Co., Ltd.. Ethylenediamine tetraacetic acid disodium salt (EDTA-2Na) was purchased from Beijing Chemical Works. N, N-dimethylformamide (DMF) was purchased from Tianxin Fine Chemical Development Center. Malachite green (MG) was purchased from Shanghai Specimen Model Factory. Arabidopsis thaliana were provided by the Institute of Biomedical Sciences in Shanxi University. Britton-Robinson (BR) buffer solutions were prepared from NaOH, H_3BO_3 and H_3PO_4.

Quantum yield (QY)

The quantum yield (QY) of N-CDs was calculated using fluorescein (QY = 95 % in 0.1 M NaOH) as a reference. In a typical experiment, the fluorescence spectra and UV-vis absorption spectra of N-CDs and fluorescein were obtained separately, and the integral area (F) of the fluorescence spectrum was calculated. QY can be obtained by the following formula:

$$QY_u = QY_s * (F_u/F_s) * (A_s/A_u) * (\eta_u/\eta_s)^2$$

where u/s represent N-CDs/fluorescein. A represent for absorbance, and η stand for refractive indexes.

Fig. S1

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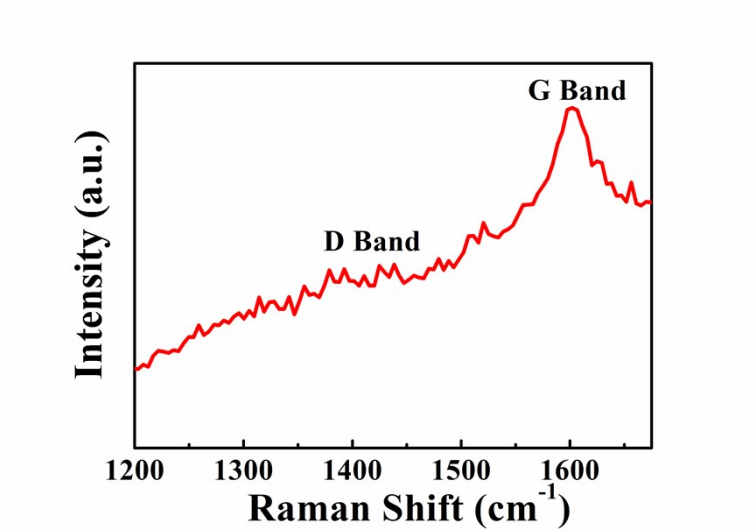

Fig. S1 Raman spectra of N-CDs.

Fig. S2

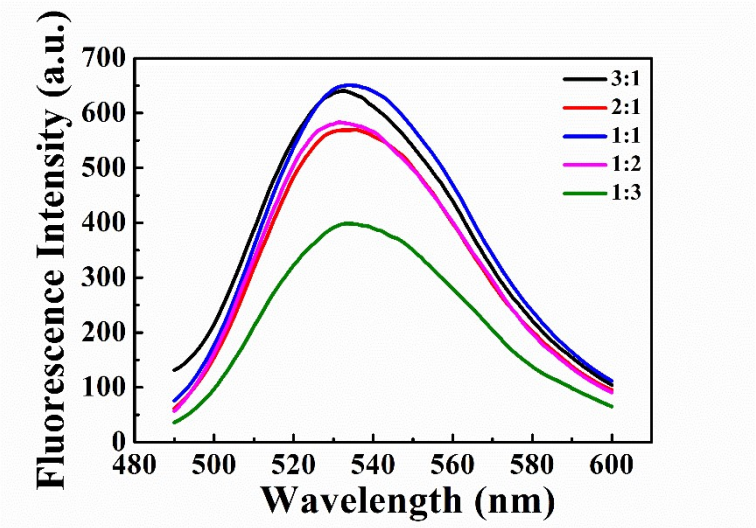

Fig. S2 Fluorescence spectra of N-CDs when the molar mass ratio of the precursors were different ($n_{(fuchsin\ basic)}$: $n_{(EDTA\text{-}2Na)}$ = 3:1; 2:1, 1:1, 1:2, 1:3).

Table S1 The instruments used in the experiment.

Instruments	Manufacturer	Model
Ultraviolet-visible spectrometer	Purkay, China	TU-1901
Fluorescence spectrophotometer	Shimadzu, Japan	RF-5301
Transmission electron microscope	JEOL, Japan	JEM-2100
Infrared spectrometer	Bruker, Germany	VERTEX 70
Steady-state transient fluorescence spectrometer	PTI, USA	FLS920
X-ray photoelectron spectrometer	Thermo Fisher Scientific	Escalab 250Xi
X-ray diffractometer	Bruker, Germany	Bruker D8
Confocal laser scanning microscope	Zeiss, Germany	LSM880 + Airyscan

Table S2 Comparison of MG detection by different methods.

Method	Linear range (μM)	LOD (nM)	Time (min)	Sample	Ref.
Ag NWS@PDMS	0.5-100	10	/	Fruits	[4]
$Eu(MAA)_3Phen$	0.5-20	117.29	5	Water	[2]
HDPB/ABPE	0.2-40	4.0	2.5	Water/fish	[6]
MIP@PS@CdTe	0.01-20	4.7	4	Water/fish	[32]
NCQDs	10-80	5.16×10^3	1	Water	[11]
Fe_3O_4@Au MCS	10^3-0.1	10^2	180	Water	[3]
AgNDS SERS	10^{-2}-10^{-6}	9.4×10^{-4}	30	Water	[5]
AuNPs/GQDs-WS_2/GCE	0.01-10	3.38	120	Fish	[33]
N-CDs	0.99-311.57	27.28	1	Water	This work

Table S3 Detection of MG in real water samples. (n = 5)

Sample	**Initial concentration**	**Added (μM)**	**Detected (μM)**	**Recoveries (%)**	**RSD (%)**
Jinyang Lake	Not detected	2.00	2.06±0.10	103.00	2.35
		5.00	5.11±0.06	102.20	2.08
		8.00	7.96±0.04	99.50	0.66
		10.00	9.89±0.13	98.90	1.82