Electronic Supplementary Information for

A facile large-scale microwave synthesis of highly fluorescent carbon dots from benzenediol isomers

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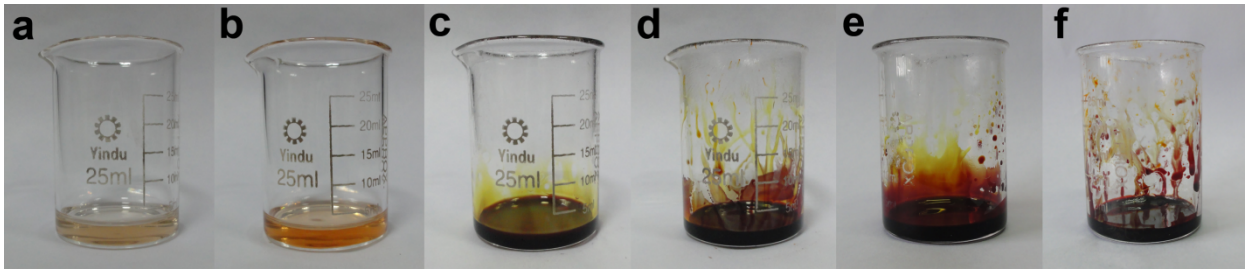

Figure S1. Photographs of the products when the mixed solutions of 1.000 g *m*-$C_6H_6O_2$, 2 mL DDW and 100 μL H_2SO_4 were heated in the microwave oven (800 W) after 0 s (a), 20 s (b), 30 s (c), 40 s (d), 50 s (e) and 60 s (f).

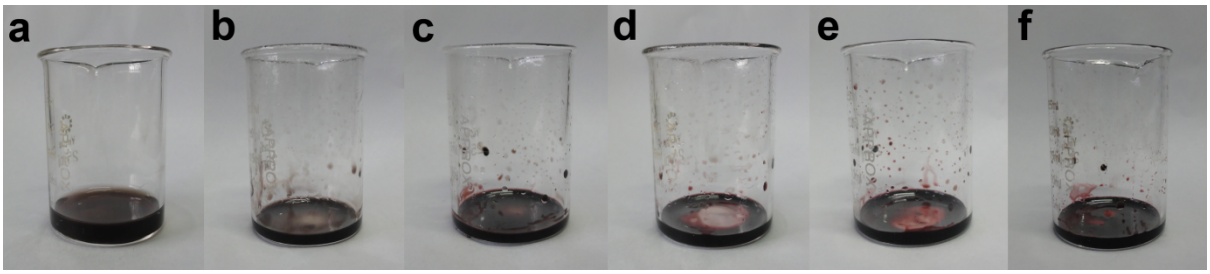

Figure S2. Photographs of the products when the mixed solutions of 0.500 g *o*-$C_6H_6O_2$, 2 mL DDW and 100 μL H_2SO_4 were heating in the microwave oven (800 W) after 0 s (a), 20 s (b), 30 s (c), 60 s (d), 90 s (e) and 120 s (f).

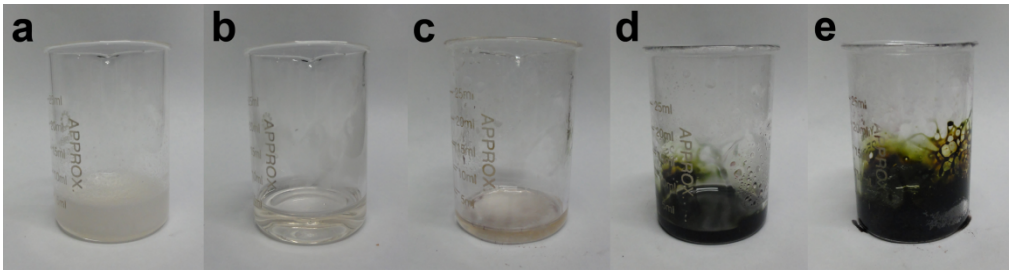

Figure S3. Photographs of the products when the mixed solutions of 0.500 g *p*-$C_6H_6O_2$, 4 mL DDW and 200 μL H_2SO_4 were heated in the microwave oven (800 W) after 0 s (a), 10 s (b), 30 s(c), 40 s (d) and 50 s (e).

Table S1. The output of m-CDs prepared with different microwave time (1.000 g *m*-$C_6H_6O_2$)

	Microwave Time/s					
	30	40	50	60	100	120
output/g	0.026	0.490	0.569	0.754	0.823	0.752

Table S2. The output of o-CDs prepared with different microwave time (0.500 g *o*-$C_6H_6O_2$)

	Microwave Time/s			
	70	80	90	120
output/g	0.172	0.179	0.184	0.206

Table S3. XPS analysis of C-O/C=O of CDs.

samples	C-O/C=O
o-CDs	5.8
m-CDs	8.6
p-CDs	5.5

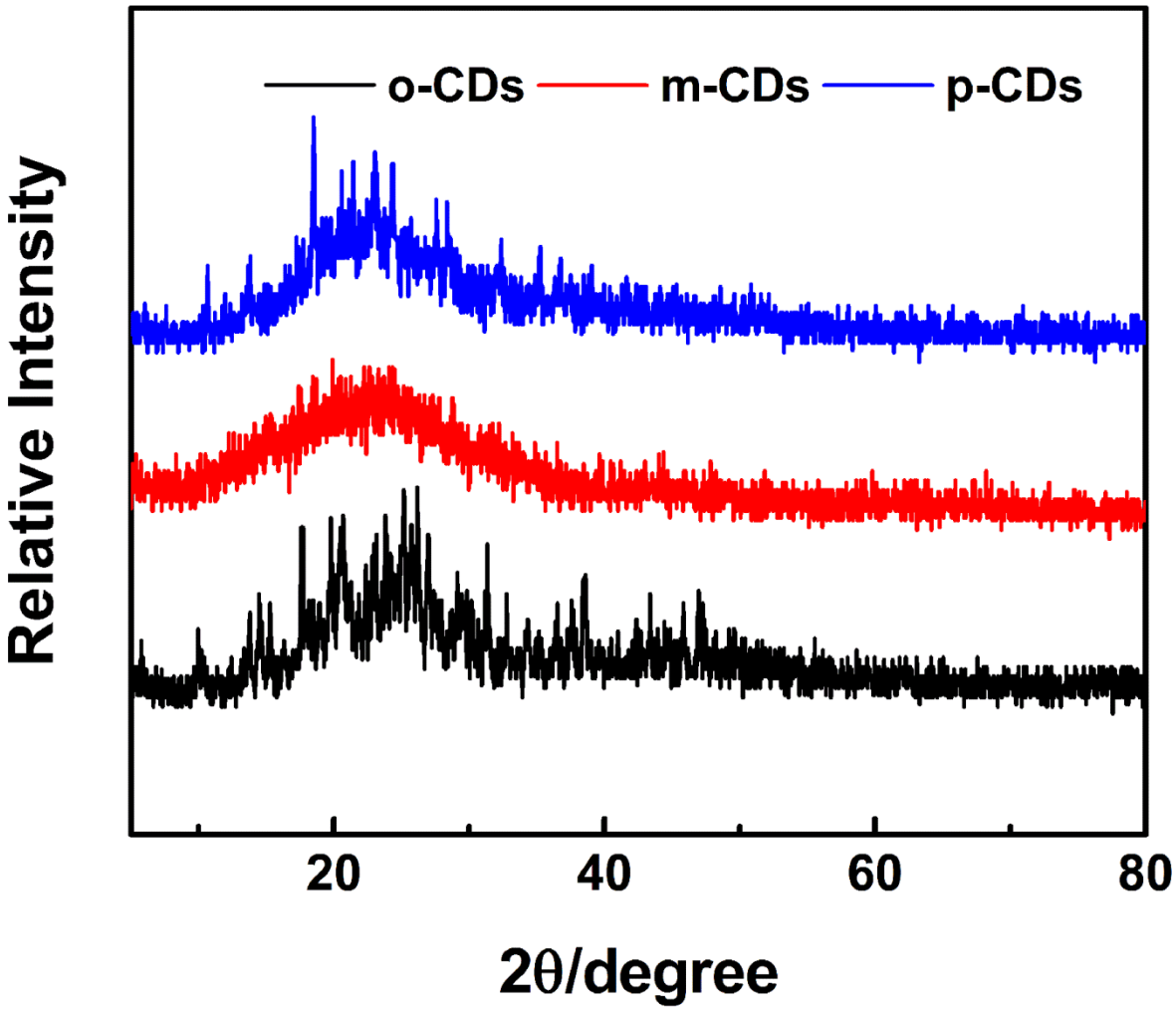

Figure S4. XRD pattern of *o*-CDs (black), *m*-CDs (red) and *p*-CDs (blue).

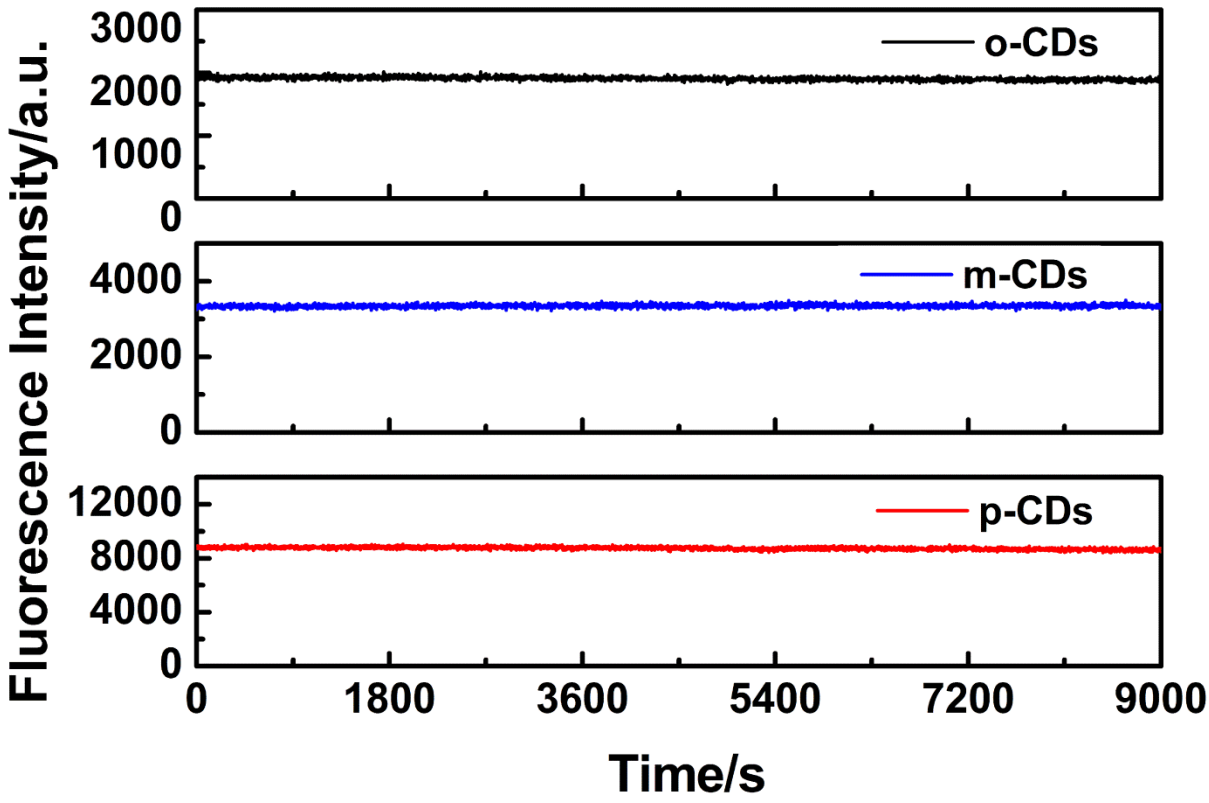

Figure S5. Effect of photoirradiation time on the fluorescence intensity of *o*-CDs (black), *m*-CDs (blue) and *p*-CDs (red).

Supplemental result and discussion

Measurement of fluorescence quantum yield

The quantum yield (QY) of carbon dots was determined by a comparative method. Quinine sulfate in 0.1 M H_2SO_4 (literature quantum yield 54% at 350 nm) was chosen as a standard to calculate the QY of the test samples which were dissolved in water or ethanol at different concentrations. All the absorbance values of the solution at the excitation wavelength were

measured with UV-Vis spectrophotometer. Photoluminescence emission spectra of all the sample solutions were recorded by HITACHI F-7000 fluorescence spectrometer at an excitation wavelength of 340 nm. The integrated fluorescence intensity is the area under the fluorescence curve in the wavelength range from 360 to 660 nm. A graph was plotted using the integrated fluorescence intensity against the absorbance and the trend lines were added for each curve with intercept at 0. The QY of the samples was calculated according to: [S1]

$$\Phi_{X=}{}^{\Phi_{ST}\left(\frac{F_X/A_X}{F_{ST}/A_{ST}}\right)\left(\frac{\eta_X}{\eta_{ST}}\right)^2}$$

Where the subscripts X and ST refer to the test sample and standard, respectively; Φ is the fluorescence quantum yield, F is the integrated fluorescence intensity, A is the absorbance, and η is the refractive index of the solvent.

The maximum excitation wavelengths of *o*-CDs, *m*-CDs, *p*-CDs and quinine sulfate are at *ca.* 330 nm, 330 nm, 350 nm and 350 nm, respectively. As the quantum yield of quinine bisulfate is almost independent (within 5%) on the wavelength excitation for 200~400 nm,[S2,S3] We choose 340 nm as the excitation wavelength and still take 0.54 as the Φ_{ST}.

In order to minimize the re-absorbance effect, absorbance in the 10 mm fluorescence cuvette were kept under 0.05 at the excitation wavelength (340 nm). The refractive index of 0.1 M H_2SO_4, H_2O and ethanol were 1.33, 1.33 and 1.36, respectively.[S4]

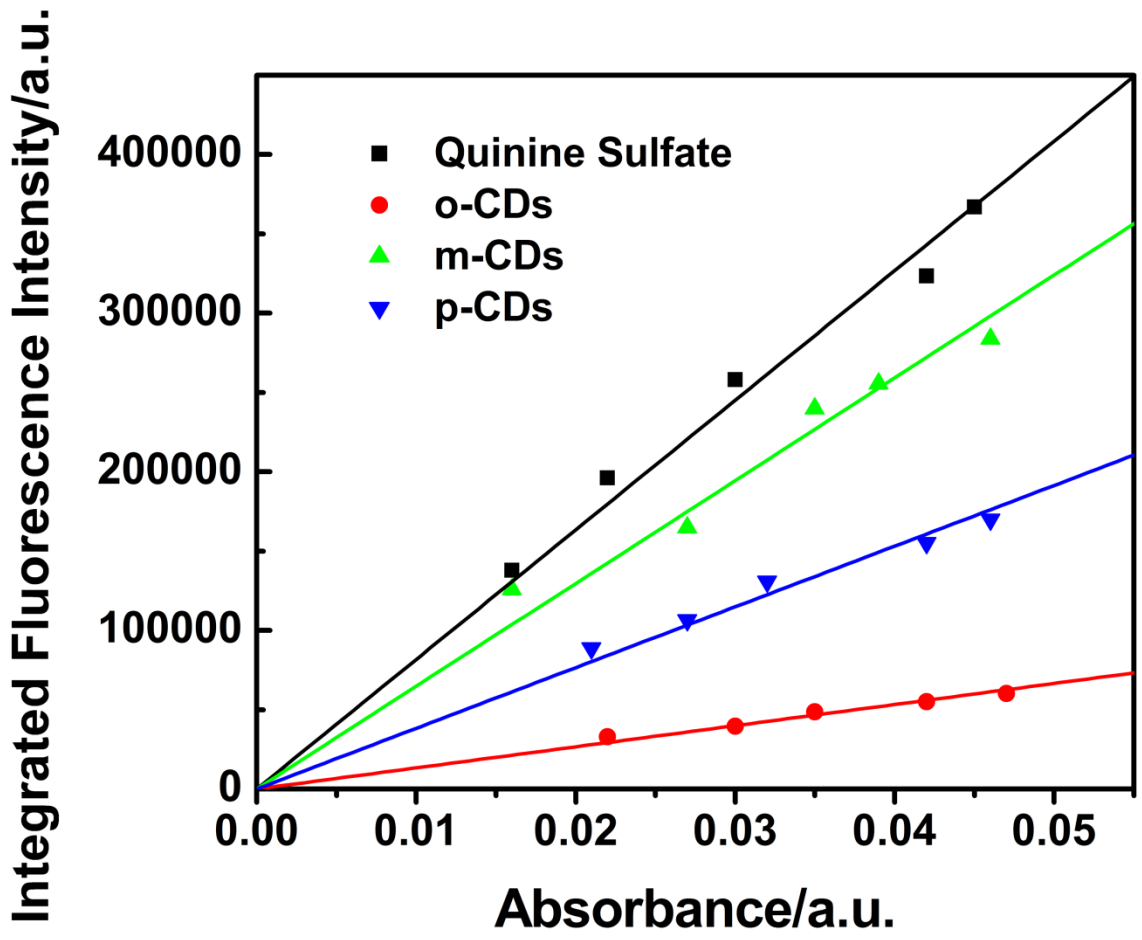

Figure S6. Plots and fitting line of integrated fluorescence intensity (excited at 340 nm) against absorbance values at 340 nm of sulfate quinine (square dots, black), *o*-CDs (round dots, red), *m*-CDs (upper triangle dots, green) and *p*-CDs (lower triangle dots, blue).

Table S4. The results of Quantum yields of CDs.

Sample	F/A	η	Quantum Yield (Φ)
Sulfate Quinine	8.16963×10^6	1.33	0.54 (known)
o-CDs	1.33139×10^6	1.36	0.092
m-CDs	6.48099×10^6	1.33	0.428

p-CDs	3.82771×10^{6}	1.36	0.265

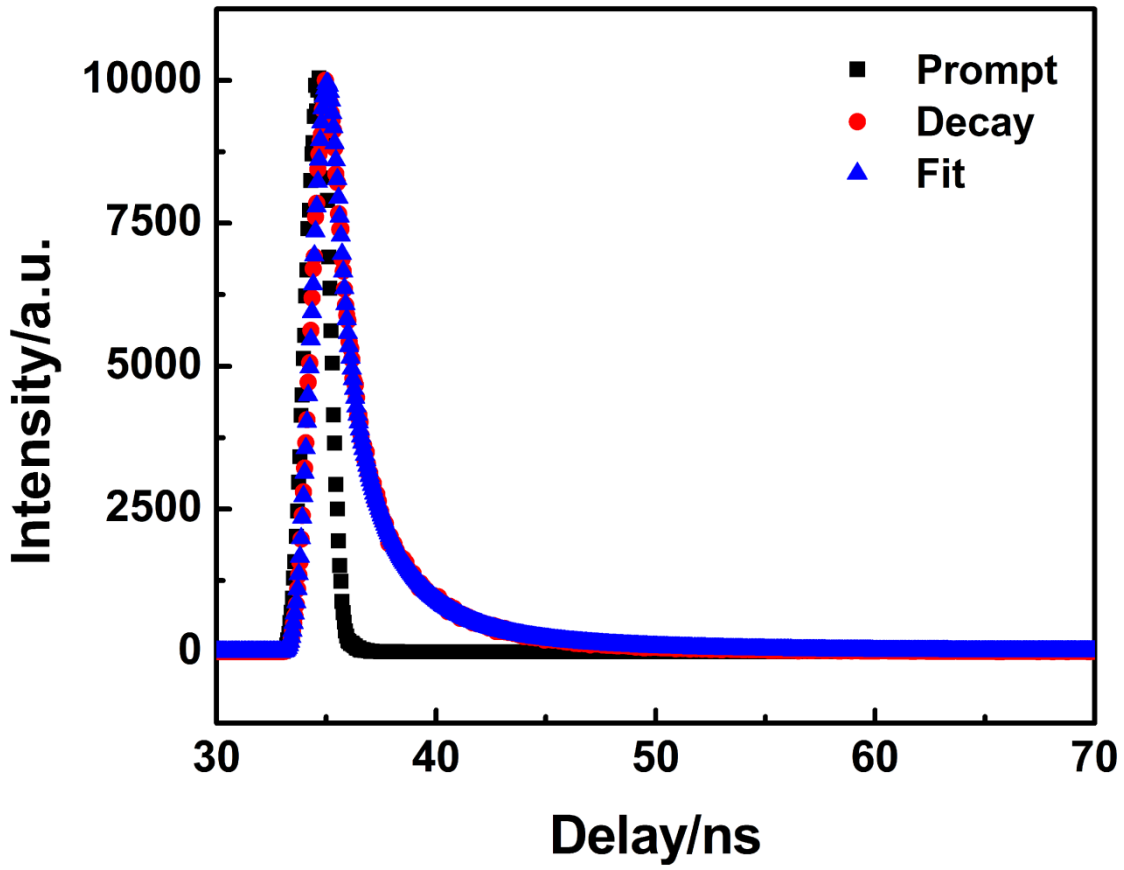

Figure S7. Time-resolved fluorescence decay of the *o*-CDs.

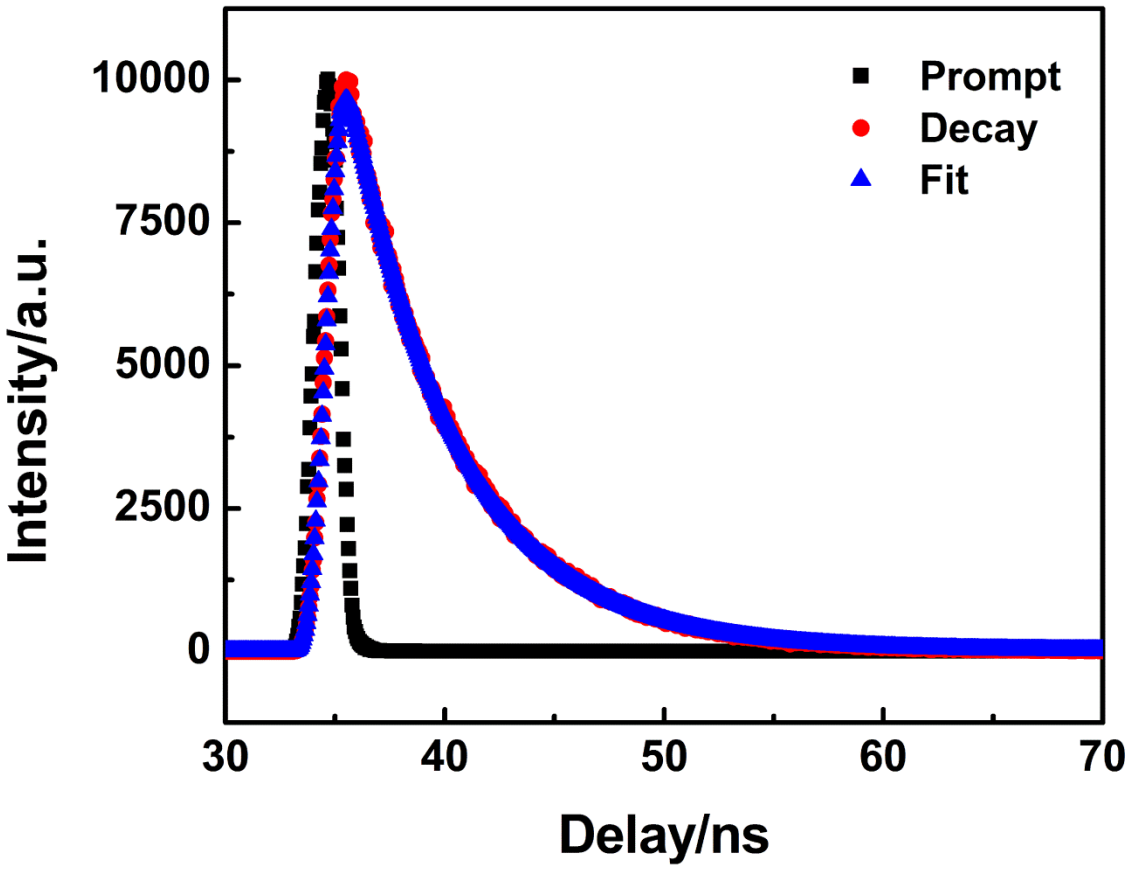

Figure S8. Time-resolved fluorescence decay of the *m*-CDs.

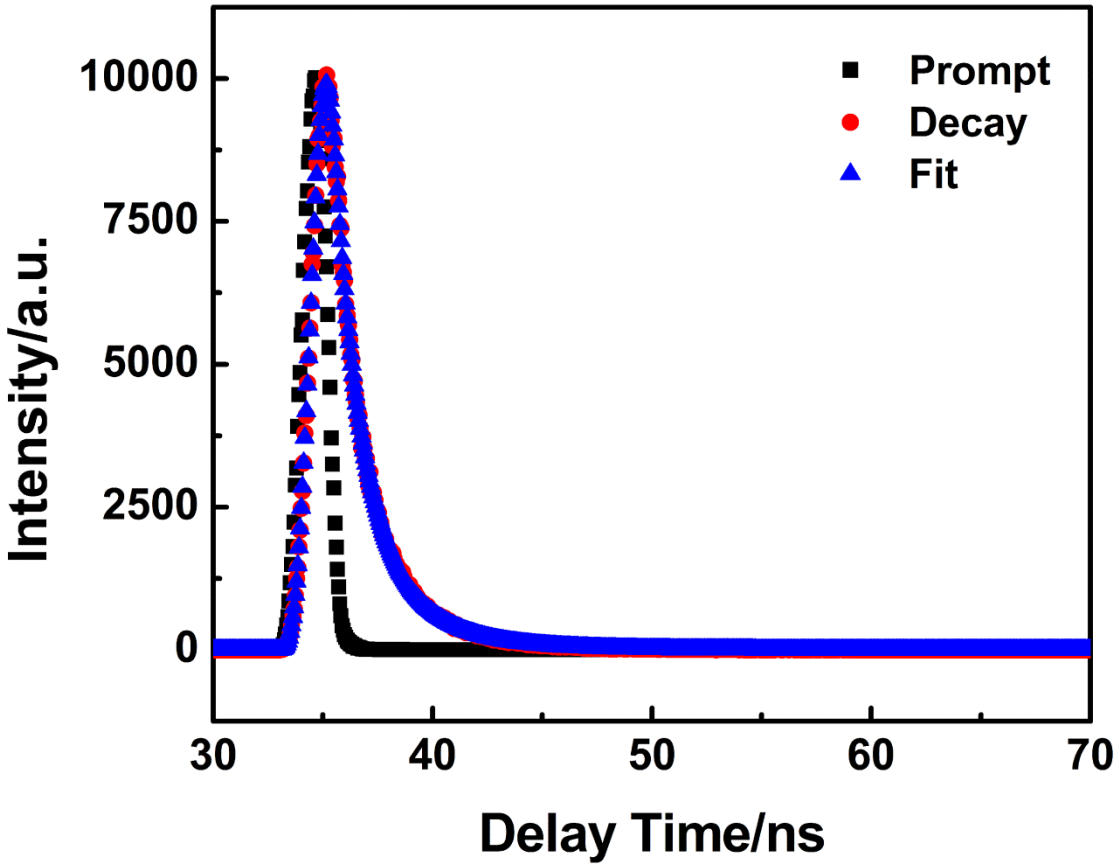

Figure S9. Time-resolved fluorescence decay of the *p*-CDs.

Table S5. Fluorescence lifetime of *m*-CDs (single-exponential fit of the fluorescence decay curve), *o*-CDs and *p*-CDs (three-exponential fit of the fluorescence decay curves).

samples	τ_1/ns(%)	τ_2/ns(%)	τ_3/ns(%)	$\tau_{average}$/ns
o-CDs	0.42 (27.09)	1.97 (51.15)	6.05 (21.76)	2.43
m-CDs	4.95 (100.00)	-	-	4.95
p-CDs	0.30 (13.53)	1.23 (49.48)	2.69 (36.99)	1.64

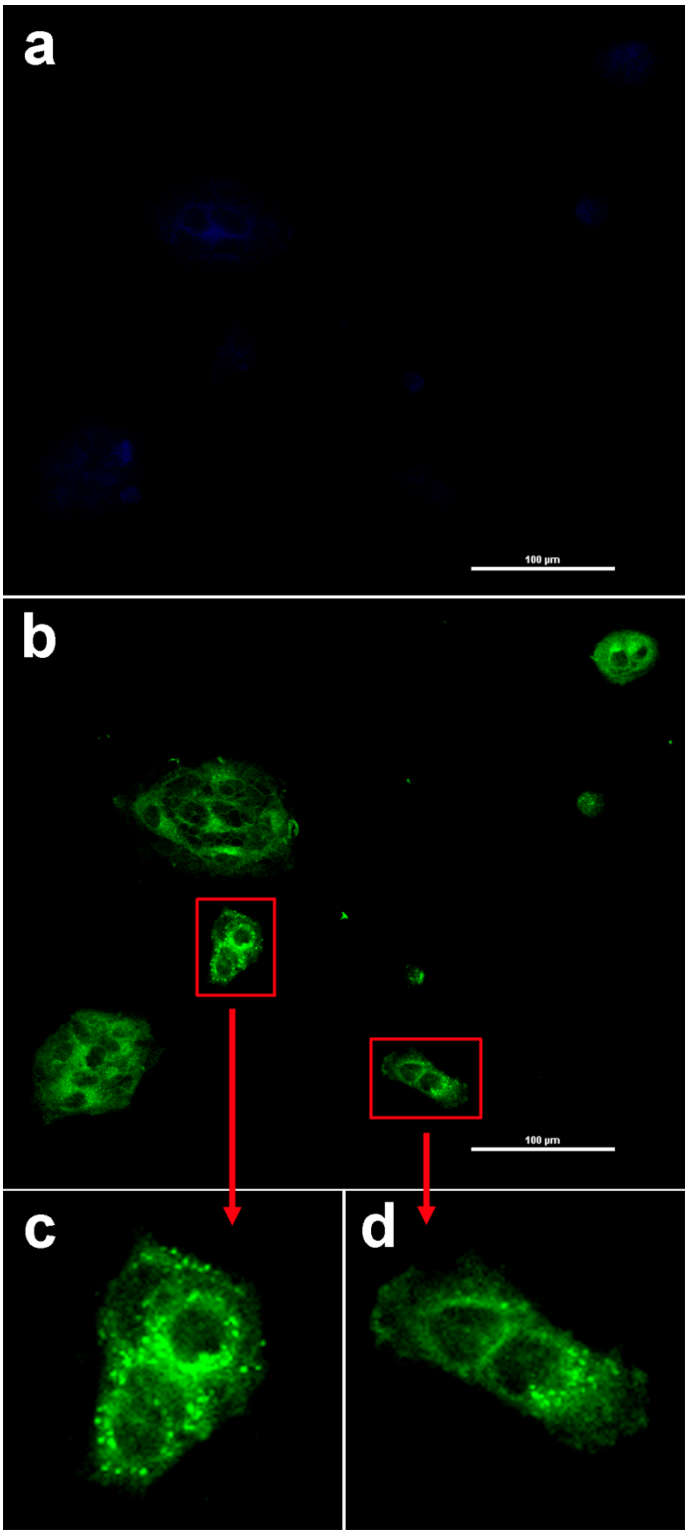

Figure S10. Confocal fluorescence imaging of L02 cells incubated with *p*-CDs (200 μg/mL) for 30 min excited with 405 nm (a) and 488 nm (b) laser, respectively. (c) and (d) are partial enlarged view

of (b).

References

[S1] Q. Zhao, Z. Zhang, B. Huang, J. Peng, M. Zhang and D. Pang, *Chem. Commun.*, 2008, **0**, 5116–5118.

[S2] J. E. Gill, *Photochem. Photobiol*., 1969, **9**, 313-322.

[S3] Y. Fang, S. Guo, D. Li, C. Zhu, W. Ren, S. Dong and E. Wang, *ACS Nano*, 2012, **6**, 400-409.

[S4] J. Zhou, C. Booker, R. Li, X. Zhou, Tsun-Kong Sham, X. Sun and Z. Ding, *J. AM. CHEM. SOC.*, 2007, **129,** 744-745.