Supporting Information

Carbon dots with tunable dual-emission: from the mechanism to specific imaging of endoplasmic reticulum polarity

Shuang E[a], *Quanxing Mao*[b], *Jianhua Wang*[a], *Xuwei Chen**[a]

[a]Department of Chemistry, College of Sciences, Northeastern University, Shenyang, China, 110819

[b]College of Chemistry, Liaoning University, Shenyang 110036, China

Corresponding author:

*E-mail: chenxuwei@mail.neu.edu.cn.

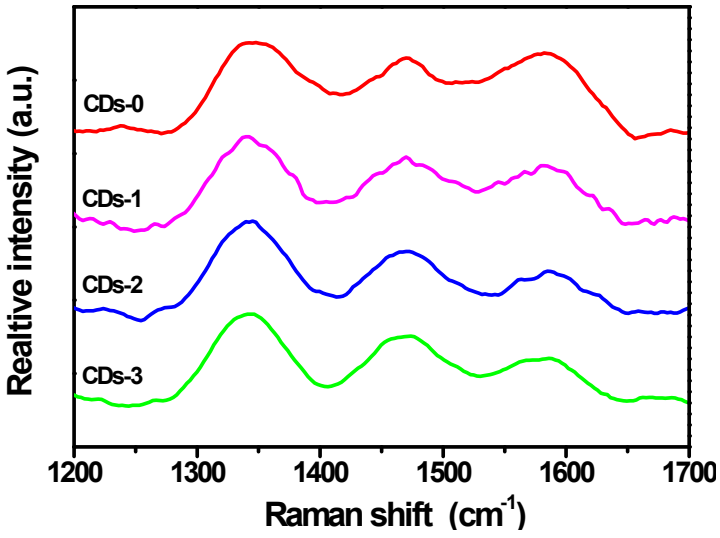

Fig. S1. Raman spectra of the four CDs products.

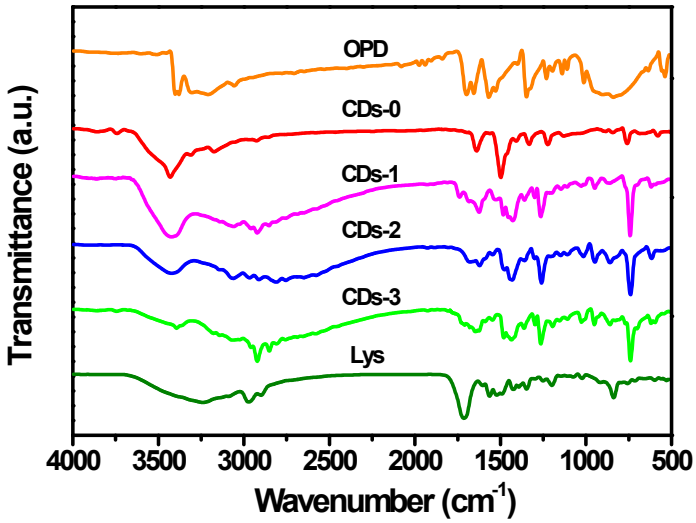

Fig. S2. FT-IR spectra of the four CDs products and precursors.

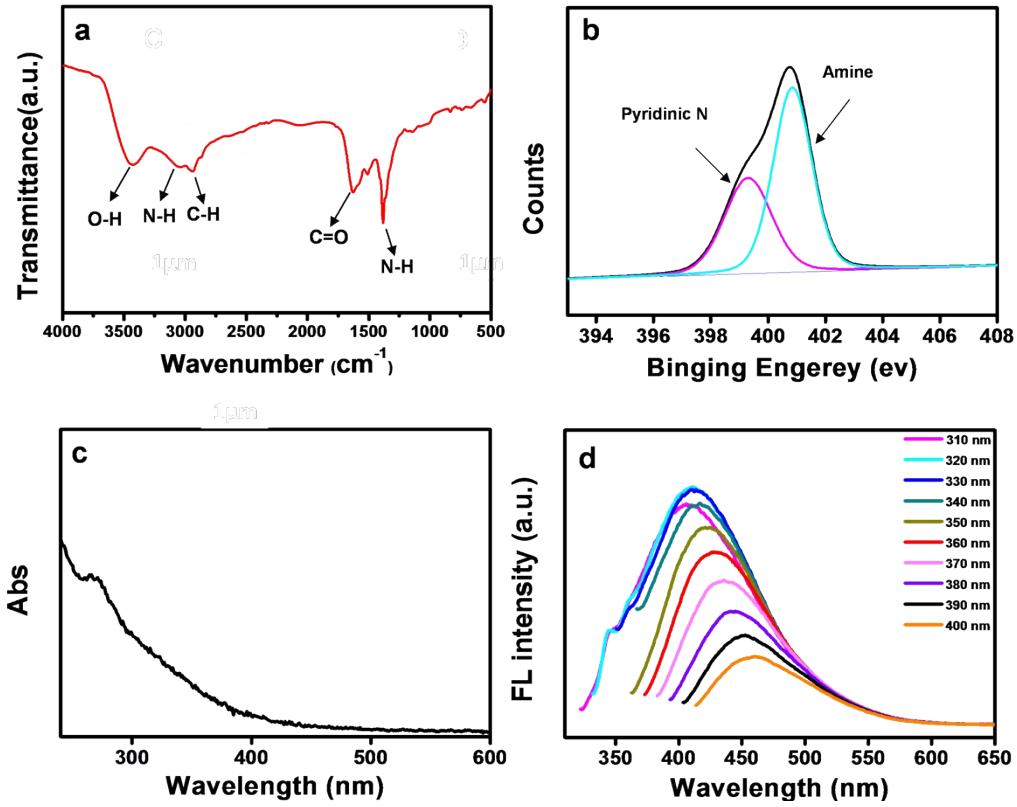

Fig. S3. FT-IR (a), XPS (b), UV spectra (c) and FL spectra (d) of LCDs.

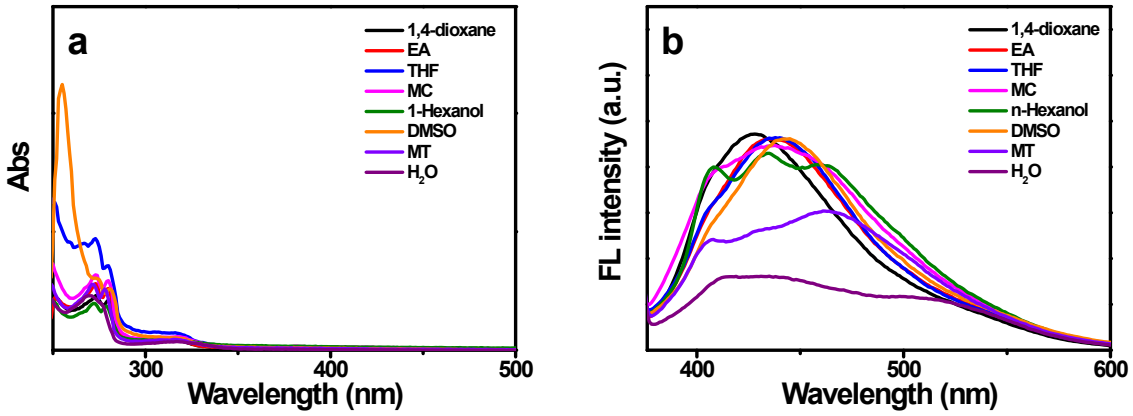

Fig. S4. The UV spectra of CDs-3 in different solvents (a). The fluorescence spectra of CDs-3 in different solvents (b). Ex=360 nm.

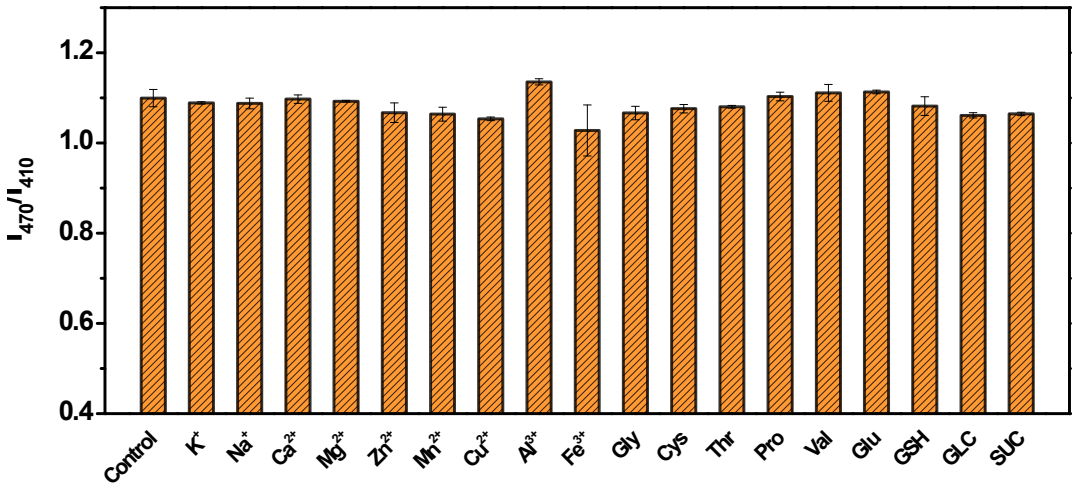

Fig. S5. Fluorescence ratio of I_{470}/I_{410} of CDs-3 in the presence of different interferences (0.01 mM for Al^{3+}, Cu^{2+} and Fe^{3+}, 0.05 mM for K^{+}, Na^{+}, Ca^{2+}, Mg^{2+}, Zn^{2+} and Mn^{2+}, 0.10 mM for Gly, Cys, Thr, Pro, Val, Glu, GSH, GLC and SUC).

Ex=360 nm. Volume fraction of water/1,4-dioxane =50%/50%.

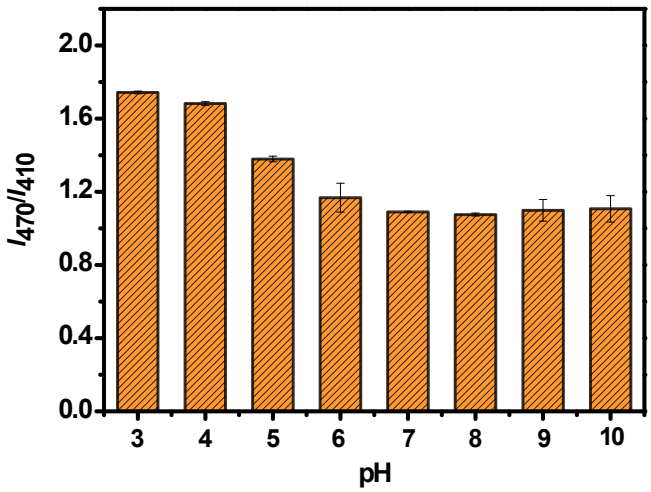

Fig. S6. Fluorescence ratio of I_{470}/I_{410} of CDs-3 at different pH values. Ex=360 nm. Volume fraction of water/1,4-dioxane =50%/50%.

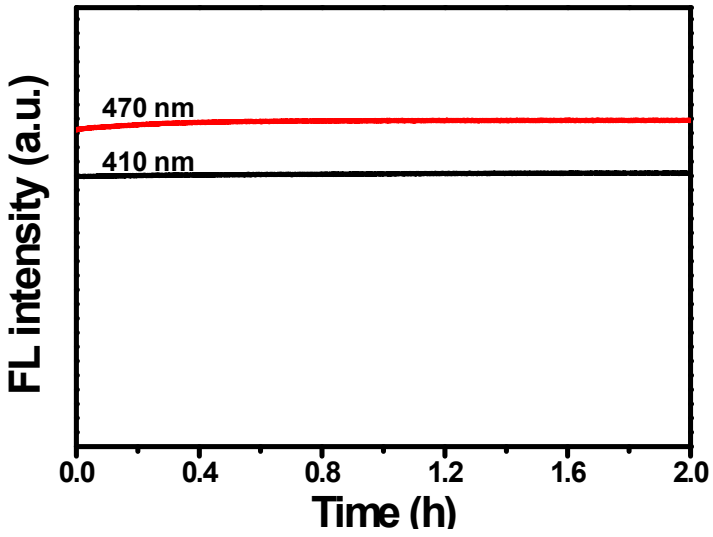

Fig. S7. Fluorescence intensity of CDs-3 under continuous irradiation of xenon lamp for 2 h. Ex=360 nm. Volume fraction of water/1,4-dioxane =50%/50%.

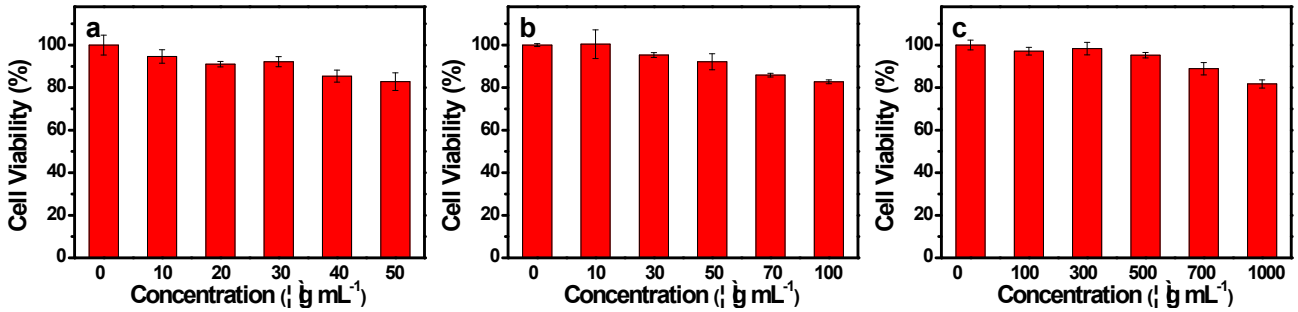

Fig. S8. Cytotoxicity of CDs-0 (a), CDs-3 (b) and LCDs (c).

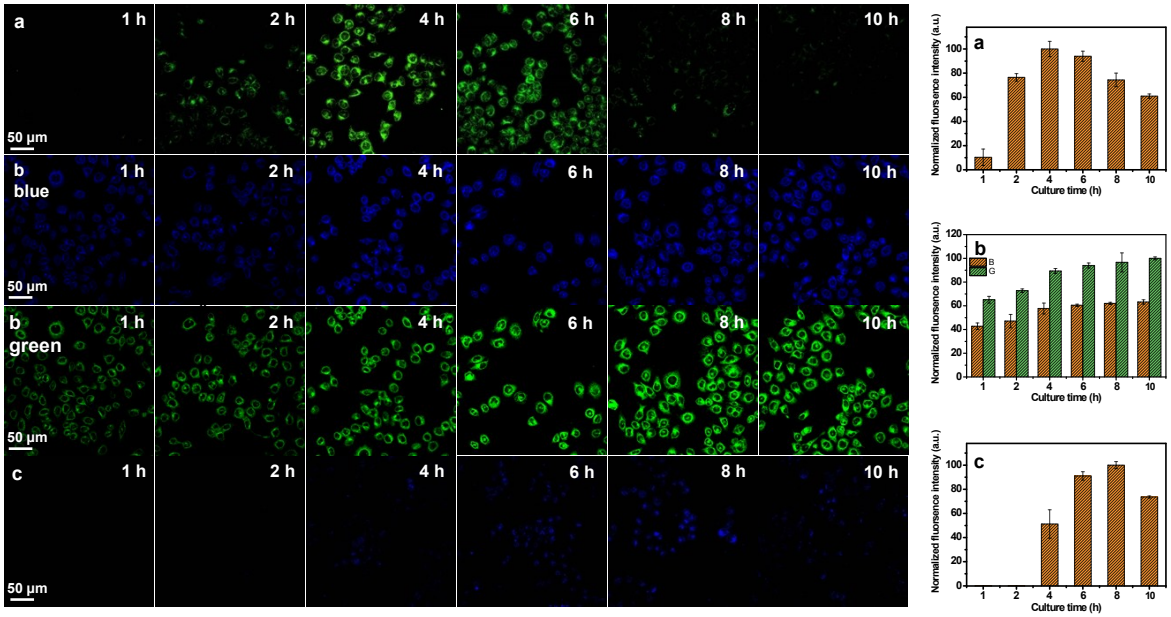

Fig. S9. CLSM images of MCF-7 cells incubated with 40 μg mL^{-1} CDs-0 (a), 40 μg mL^{-1} CDs-3 (b) and 500 μg mL^{-1} LCDs (c) at different culture time.

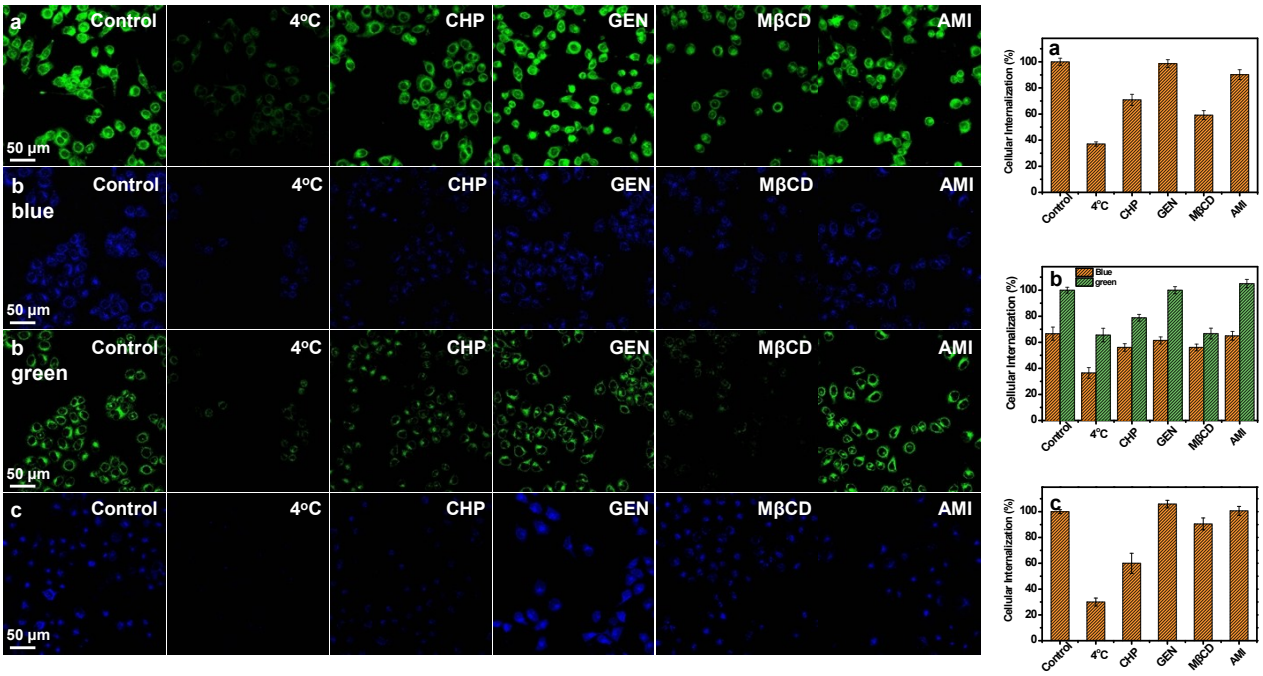

Fig. S10. CLSM images and cell internalization percentages of CDs-0 (a), CDs-3 (b) and LCDs (c) in the presence of different endocytosis inhibitors.

Table S1. XPS data analyses of C 1s spectra

Product	C=C/C-C	C-N/C-O	C=O	COOH
CDs-0	72.96%	21.67%	2.16%	3.21%
CDs-1	68.00%	27.14%	2.01%	2.85%
CDs-2	61.87%	28.31%	2.86%	6.95%
CDs-3	60.89%	34.92%	4.19%	0

Table S2. XPS data analyses of the N 1s spectra

Product	Pyridinic N	Amine	Pyrrolic N	Graphitic N
CDs-0	43.47%	13.04%	35.11%	8.38%
CDs-1	30.09%	16.56%	48.20%	5.25%
CDs-2	5.56%	88.88%	5.56%	0
CDs-3	30.42%	34.49%	35.09%	0

Table S3. Physical parameters of different solvents

Solvent	Dielectric constant (ε)[a]	Refractive index (n)	Orientation polarizability (Δf)[b]
1, 4-dioxane	2.21	1.42	0.021
Ethyl acetate	6.02	1.372	0.199
Tetrahydrofuran	7.50	1.407	0.209
Dichloromethane	10.42	1.444	0.221
1-Hexanol	13.03	1.418	0.243
Dimethyl sulfoxide	47.2	1.474	0.265
Methanol	33.6	1.326	0.310
Water	78.36	1.34	0.321

[a]Dielectric constant at 25 ^{o}C

[b] $\Delta f = \frac{\varepsilon - 1}{2\varepsilon + 1} - \frac{n^2 - 1}{2n^2 + 1}$

Table S4. Physical parameters of binary mixed solvents

Sample	Dioxane Percent (Volume Fraction	H_2O Percent (volume Fraction	ε_{mix} [a]	n^2_{mix} [b]	Δf [c]
1	90%	10%	9.825	1.994	0.228
2	80%	20%	17.444	1.972	0.262
3	70%	30%	25.055	1.950	0.277
4	60%	40%	32.670	1.928	0.286
5	50%	50%	40.285	1.906	0.293
6	40%	60%	47.900	1.884	0.299
7	30%	70%	55.515	1.862	0.304
8	20%	80%	63.130	1.839	0.309
9	10%	90%	70.745	1.818	0.313

[a] $\varepsilon_{mix} = f_a\varepsilon_a + f_b\varepsilon_b$

[b] $n_{mix} = f_a n_a^2 + f_b n_b^2$

[c] $\Delta f = \frac{\varepsilon_{mix} - 1}{2\varepsilon_{mix} + 1} - \frac{n_{mix}^2 - 1}{2n_{mix}^2 + 1}$

Table S5. The correlation coefficient of CDs-0, CDs-3 and LCDs with different organelle probe

Sample / Probe	CDs-0		CDs-3		LCDs	
	PCC[a]	OLC[b]	PCC	OLC	PCC	OLC
Lyso-Tracker Red	0.52	0.56	0.33	0.39	0.84	0.86
MitoRed	0.34	0.39	0.53	0.63	0.36	0.41
ER-Tracker Red	0.57	0.61	0.85	0.91	0.57	0.62
Golgi-Tracker Red	0.55	0.58	0.29	0.39	0.29	0.32

[a]PCC: Pearson's correlation coefficient

[b]OLC: Overlap coefficient