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ADVANCED OPTICAL MATERIALS

Supporting Information

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Origin of Anisotropic Photoluminescence in Heteroatom-Doped Carbon Nanodots

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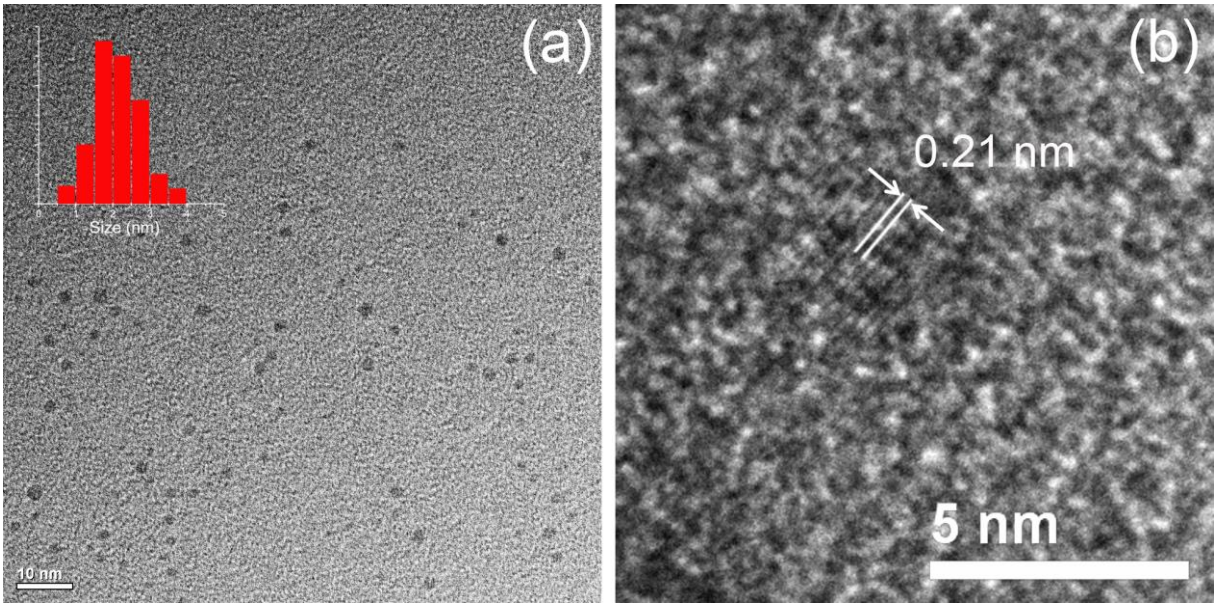

Figure S1. (a) TEM image of CDots. Inset: Size distribution. (B) HR-TEM image of CDots.

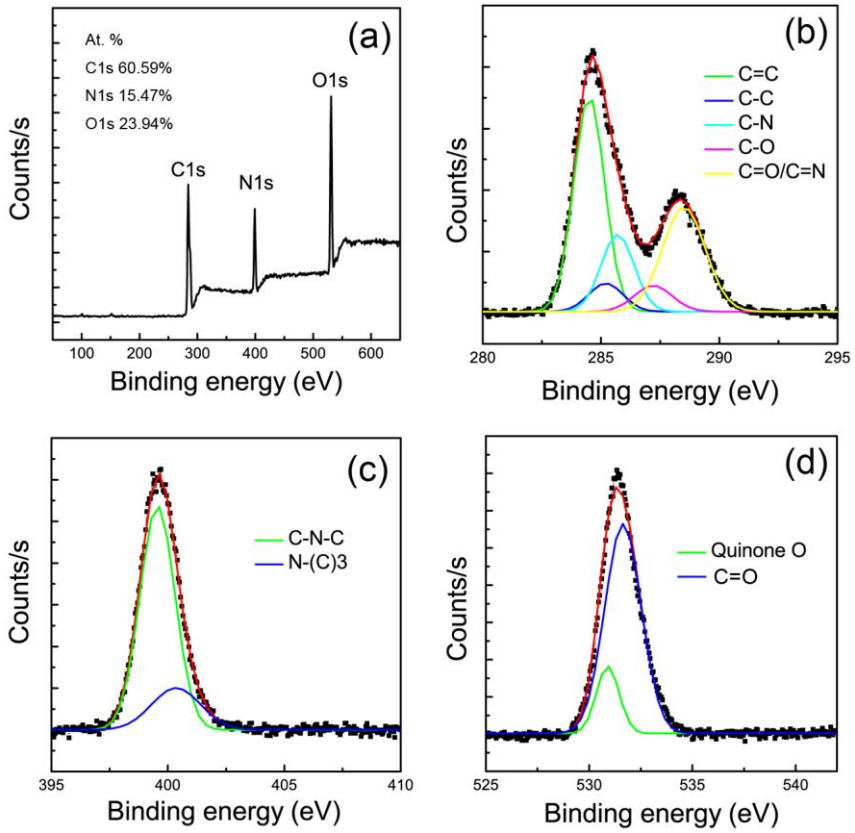

Figure S2. (a) Full survey XPS of CDots in dry state. XPS C1s (b), N1s (c), and O1s (d) analyses of CDots in dry date.

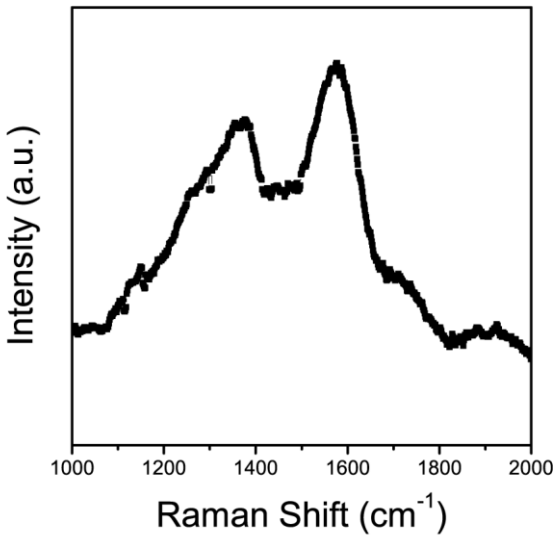

Figure S3. Raman spectrum of CDots

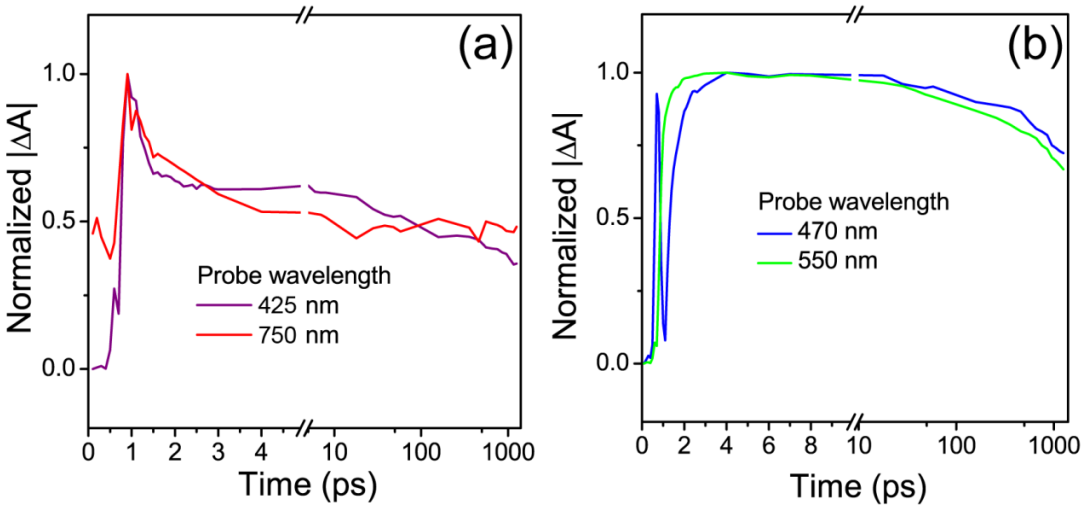

Figure S4. Normalized TA kinetic traces of CDots in water at different probe wavelengths. Probe wavelengths were (a) 425 nm and 750 nm, (b) 470 nm and 550 nm.

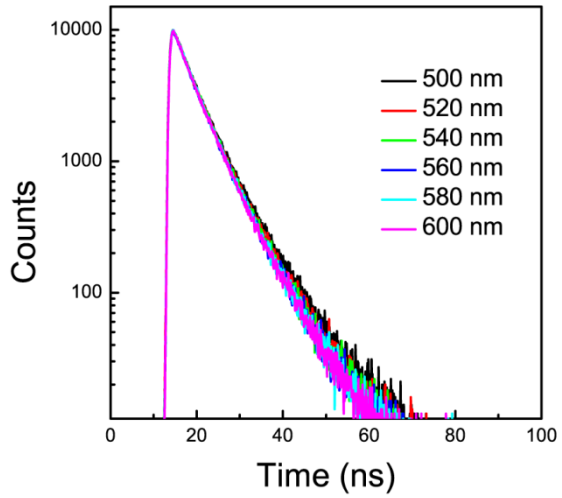

Figure S5. PL decay curves of CDots in water monitored at different wavelengths. The fitted decay time constants are 5.5 ns, 5.5 ns, 5.4 ns, 5.4 ns, 5.4 ns, and 5.3 ns, respectively for 500 nm, 520 nm, 540 nm, 560 nm, 580 nm, and 600 nm.

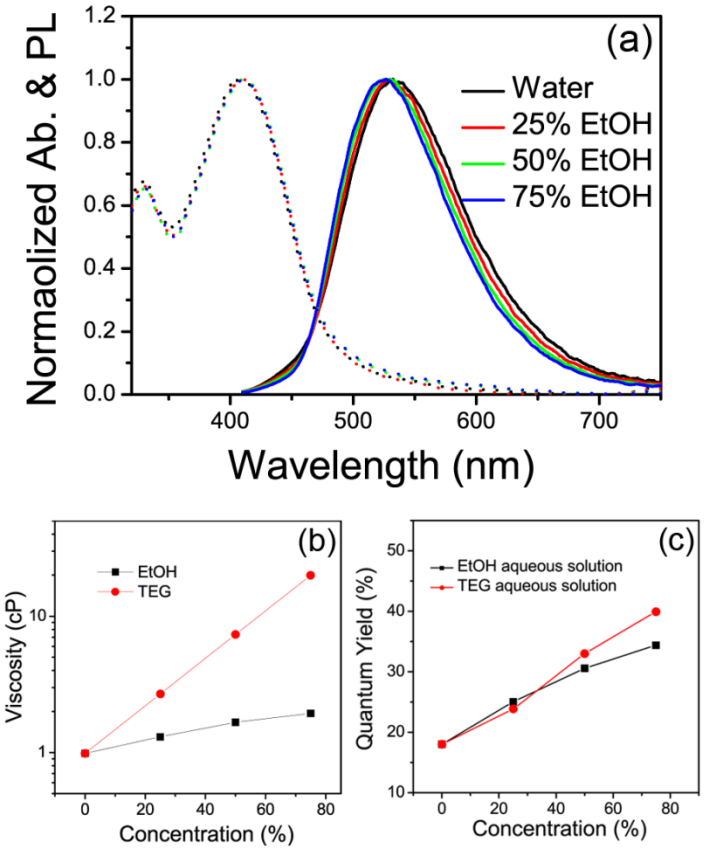

Figure S6. (a) Absorption (dotted lines) and PL spectra (solid lines) of CDots dissolved in water, 25%, 50% and 75% ethanol aqueous solutions. (b) Estimated viscosities of ethanol and TEG aqueous solutions by Ref. 1 and 2. (c) PL quantum yields of CDots in ethanol and TEG aqueous solutions with different concentration.

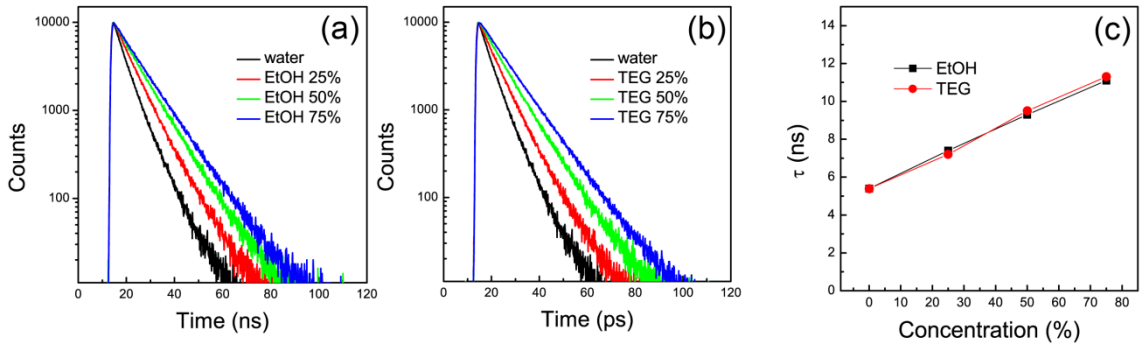

Figure S7. PL decay curves of CDots in mixed aqueous solutions with different concentration of (a) EtOH and (b) TEG. (c) The fitted PL lifetime constants of CDots in mixed aqueous solutions with different concentration of EtOH and TEG.

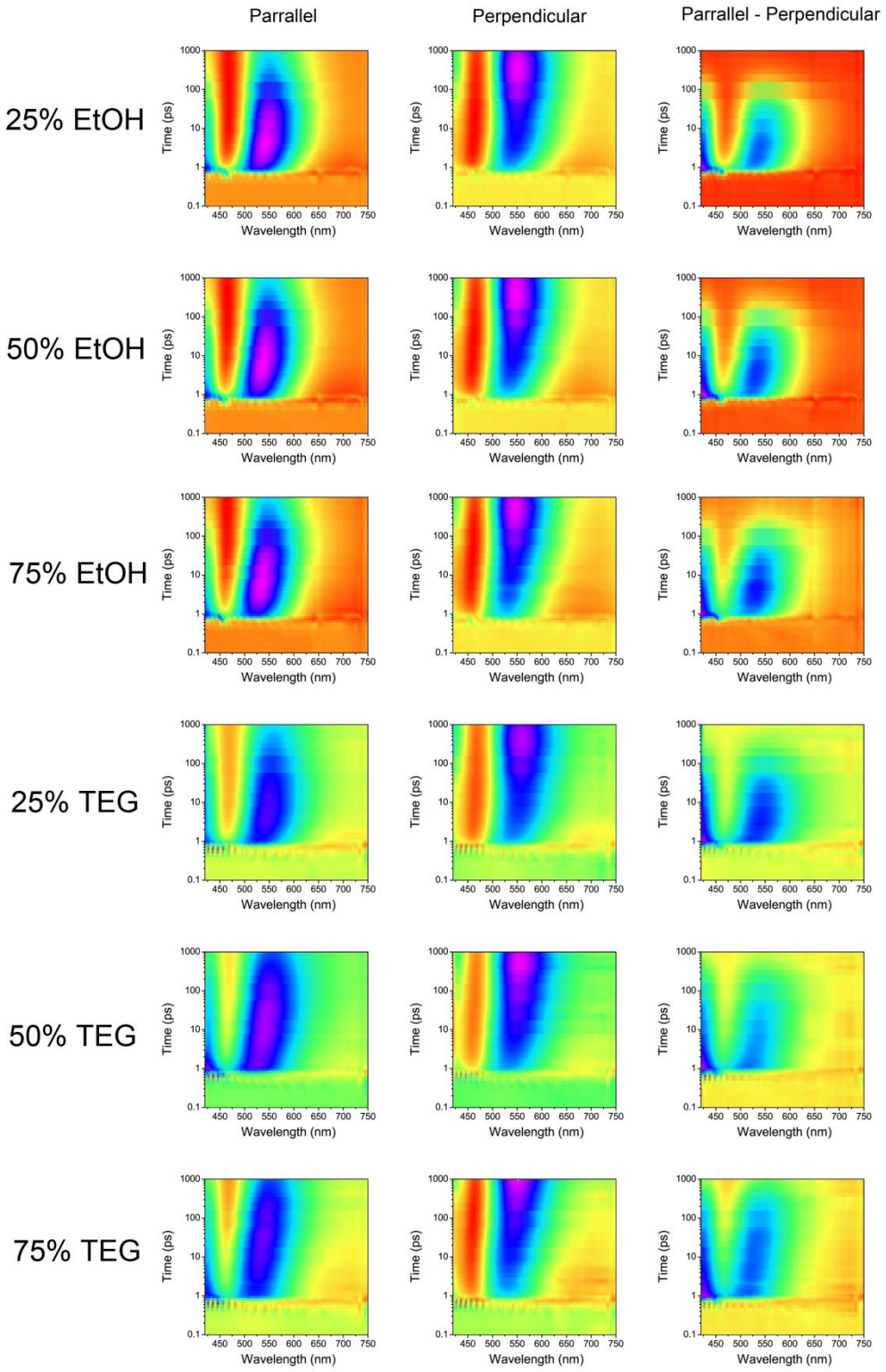

Figure S8. Top viewed TA data of CDots in mixed aqueous solutions with different concentration of EtOH or TEG under different polarization configurations. The difference spectrum between parallel and perpendicular TA spectra, $\Delta A_{\parallel}(t) - \Delta A_{\perp}(t)$.

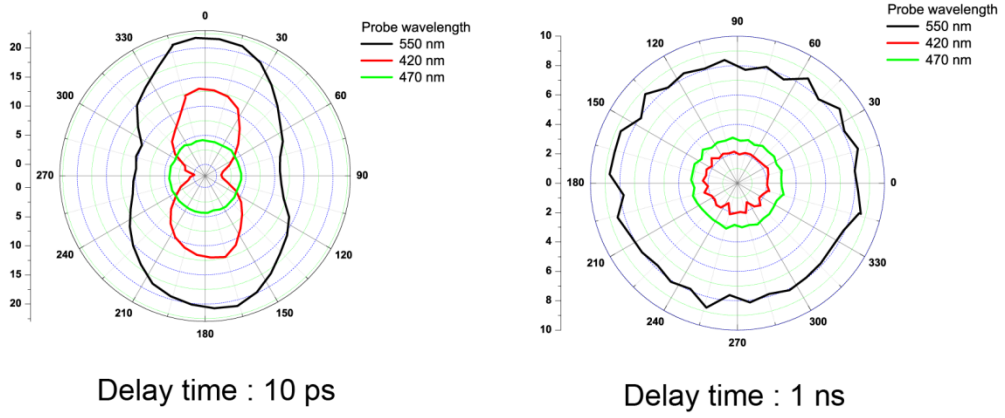

Figure S9. TA signals of CDots aqueous solution probed at 550 nm (black), 420 nm (red) and 470 nm (green) vs. included angle of polarizations between pump and probe beams at delay times of 10 ps (left) and 1 ns (right), respectively, plotted in polar coordinates.

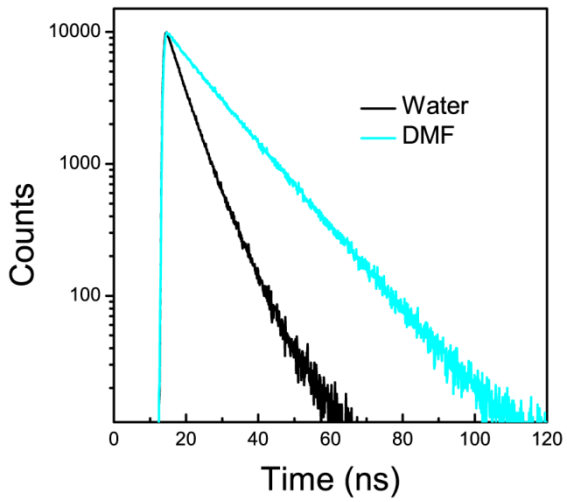

Figure S10. PL decay curves of CDots in water and DMF, monitored at 540 nm and 520 nm, respectively. Excitation wavelength is 405 nm.

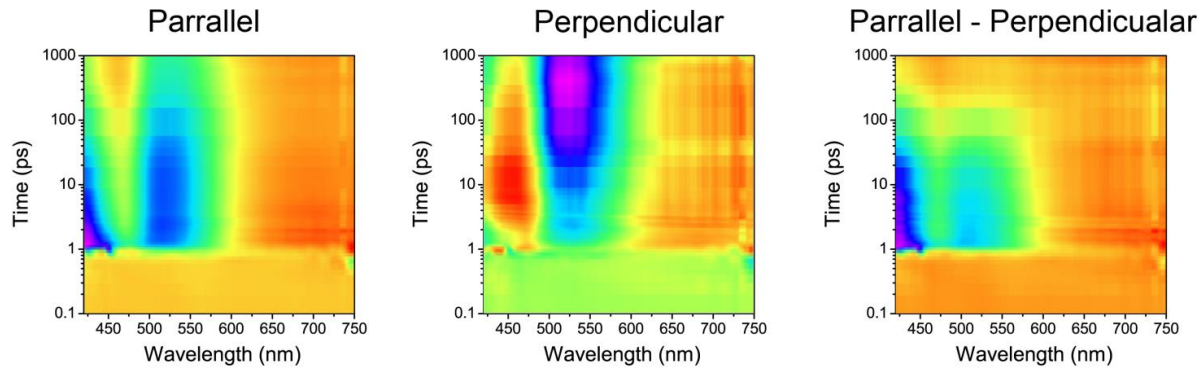

Figure S11. Top viewed TA data of CDots in DMF under different polarization configurations. The difference spectrum between parallel and perpendicular TA spectra, $\Delta A_{\parallel}(t) - \Delta A_{\perp}(t)$.

Table S1. The fitted solvation relaxation times for CDots in different solutions.

Solutions	Viscosity (cP)	A_1	τ_1 (ps)	A_2	τ_2 (ps)	$\langle\tau\rangle$ (ps)
Water	1.0	0.37 ± 0.03	0.23 ± 0.03	0.63 ± 0.03	1.29 ± 0.06	0.90
25% EtOH	1.3	0.43 ± 0.02	0.49 ± 0.04	0.57 ± 0.02	4.70 ± 0.28	2.90
50% EtOH	1.7	0.50 ± 0.02	1.29 ± 0.08	0.50 ± 0.02	17.95 ± 1.33	9.62
75% EtOH	1.9	0.37 ± 0.02	0.97 ± 0.08	0.63 ± 0.01	18.94 ± 1.06	12.34
25% TEG	2.7	0.40 ± 0.03	0.37 ± 0.06	0.60 ± 0.03	4.84 ± 0.49	3.05
50% TEG	7.3	0.45 ± 0.02	1.34 ± 0.16	0.55 ± 0.02	34.91 ± 3.66	19.75
75% TEG	20.0	0.56 ± 0.03	7.17 ± 0.78	0.44 ± 0.02	179.09 ±30.71	83.58

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