

Supplementary data

Achieving full-color emission in coal-based humic acid derived carbon dots through intradot aggregation

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Table S1. The synthesis of CPDs using different solvent and gas atmosphere.

Conditions	DMF		H ₂ O		C ₂ H ₅ OH	
	O ₂	N ₂	O ₂	N ₂	O ₂	N ₂
Residue mass /mg	0	0	17	19	15	18
QY /%	8.9	5.9	6.7	4.3	9.1	6.0

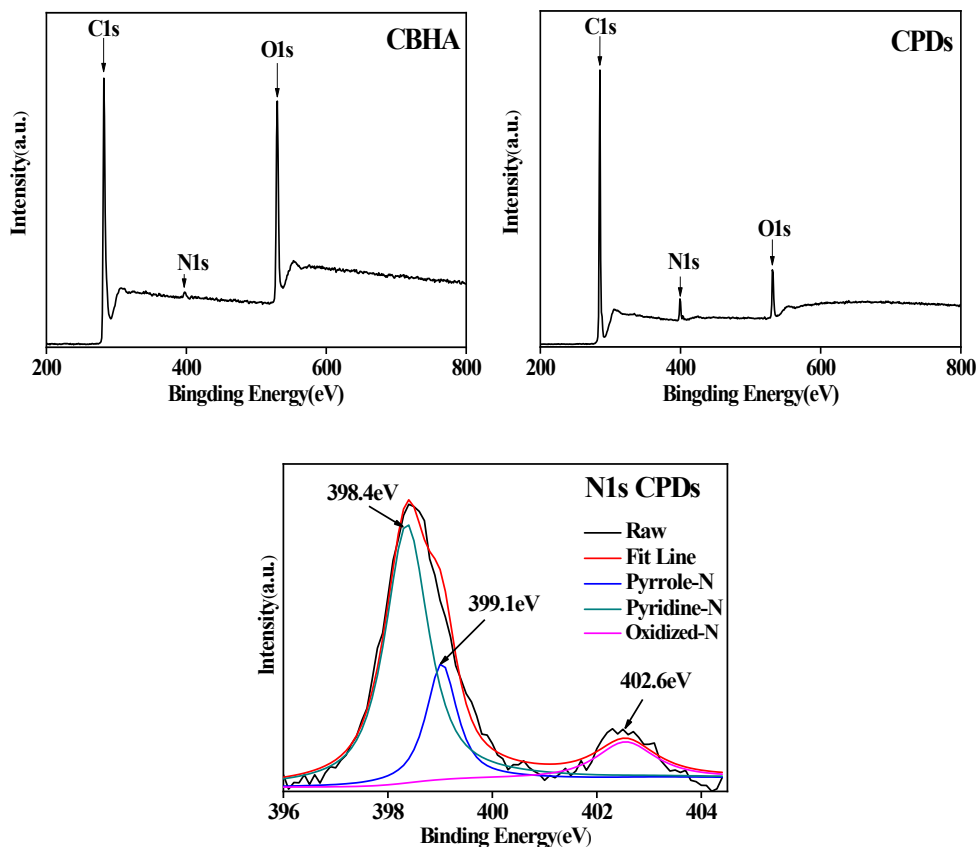


Figure S1. XPS survey spectra of CBHA and CPDs, and N1s spectrum of CPDs.

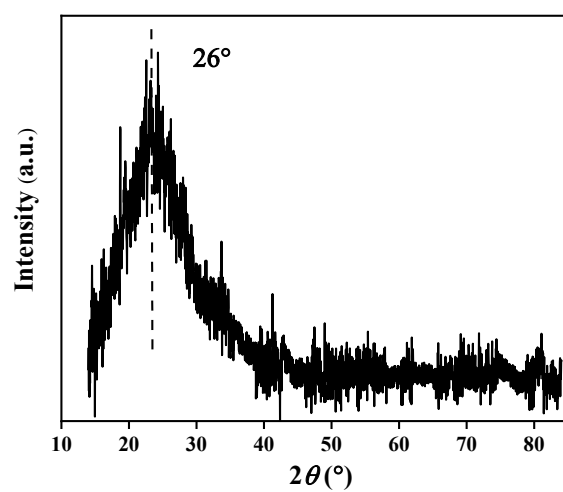


Figure S2. XRD pattern for the obtained CPDs

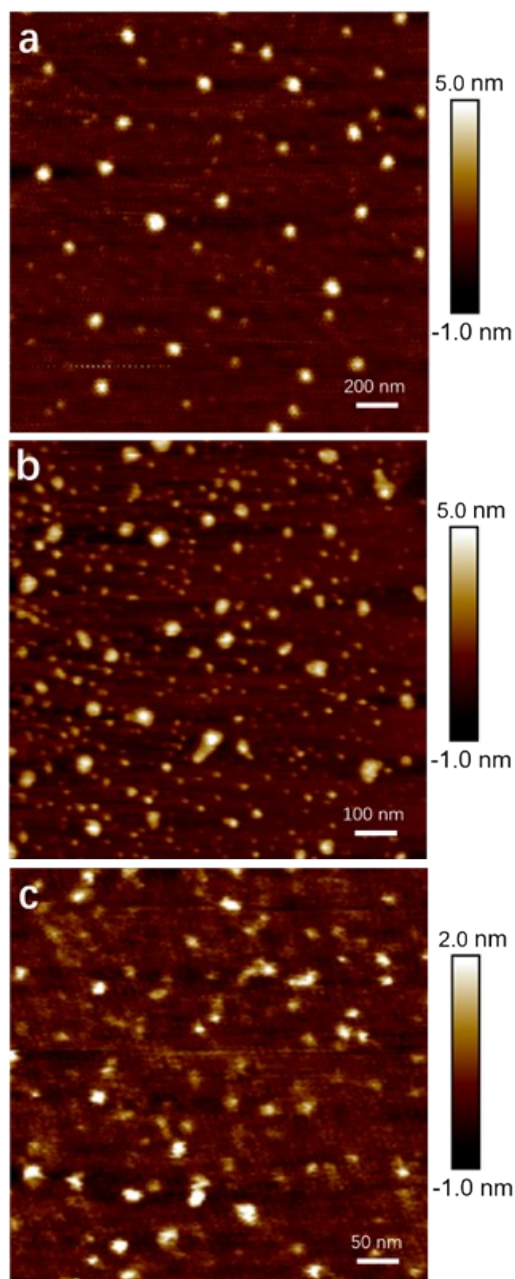


Figure S3. AFM images of CPDs obtained at different concentrations: (a) 2.5 mg/mL, (b) 1.25 mg/mL, (c) 0.625 mg/mL.

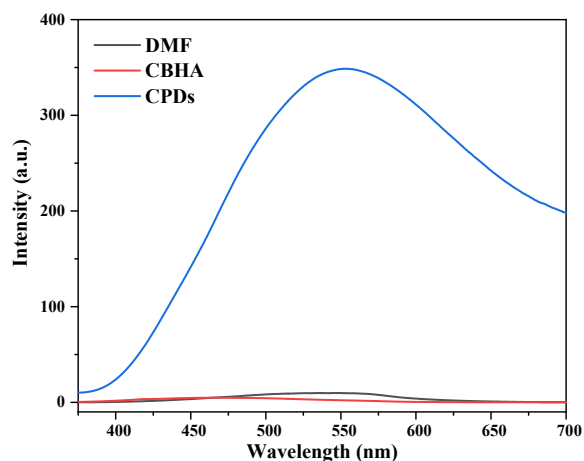


Figure S4. Fluorescence spectra of DMF, CBHA and CPDs solution (1.5 mg/ML).

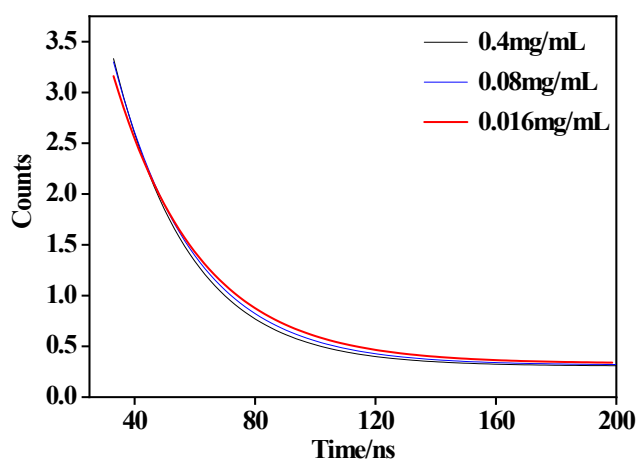


Figure S5. Fluorescence decay curves of the CPDs at different concentrations.

Table S2. The lifetime fitting of the CPDs.†

Concentration mg/mL	τ_1 /ns	τ_2 /ns	τ_3 /ns	τ_{average} /ns	P ₁ /%	P ₂ /%	P ₃ /%
0.4	1.06	3.9	11.04	5.49	19.78	50.15	30.09
0.08	0.78	3.91	12.03	5.77	15.01	56.31	28.68
0.016	0.84	4.02	12.45	6.13	14.91	54.41	30.68

† Excitation: 340 nm, Emission: 460 nm.