Electronic Supplementary Information

Room-temperature Phosphorescence in Coal-based Humic Acid-derived Carbon Dots

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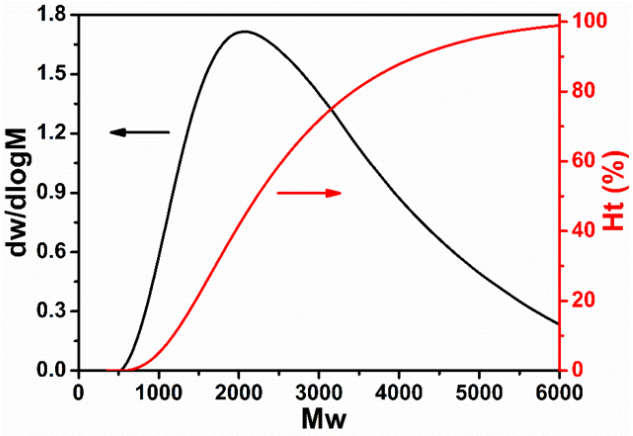

Fig. S1. The molecular weight distribution curve (*black line*) and mass integral molecular weight distribution curve (*red line*) of CBHA.

Table S1 Statistical results of molecular weight of CBHA

Mp	Mn	Mw	Mz	Mz+1	Mv	PDI
1441	1209	1550	1931	2311	1497	1.28

PDI: Polymer dispersity index.

Table S2 The phosphor lifetime of the selected samples

Samples	τ_1(ms)	τ_2(ms)	τ_3(ms)	B_1	B_2	B_3	$\tau_{average}$(ms)
HACDs/BA-100	16.28	141.58	630.69	378.39	36.36	11.74	293.83
HACDs/BA-160	16.42	146.63	824.53	4507.96	781.55	173.92	410.38
HACDs/BA-180	17.54	178.06	877.43	4847.31	1105.63	440.96	562.25
HACDs/BA-210	13.58	128.80	795.65	4636.15	866.29	226.00	446.70
HACDs/BA-400	13.73	138.75	808.89	5074.73	857.18	198.16	421.67

Table S3 Phosphor lifetime of the selected samples

Concentration ($mg \cdot g^{-1}$)	τ_1(ms)	τ_2(ms)	τ_3(ms)	B_1	B_2	B_3	$\tau_{average}$(ms)
0	18.09	131.14	630.51	285.44	56.56	84.39	333.71
0.05	12.98	126.80	782.55	3660.77	684.86	165.89	428.56
0.15	13.69	135.65	814.84	2866.24	542.39	166.97	487.70
0.25	17.54	178.06	877.43	4847.31	1105.63	440.96	562.25
0.35	14.98	143.42	815.76	4395.65	784.47	206.03	445.18

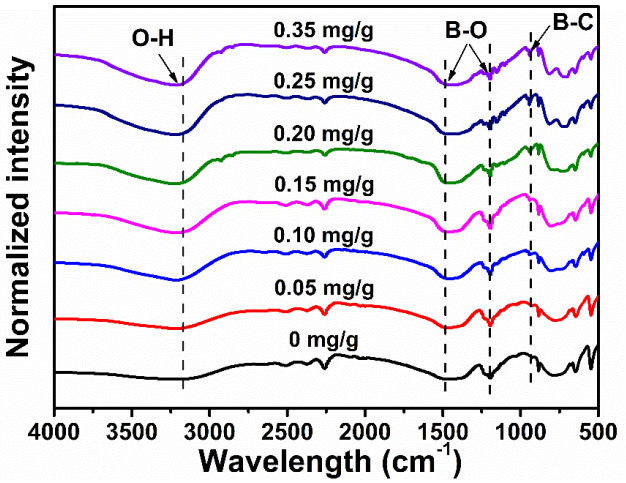

Fig. S2. FTIR spectra of HACDs/BA-180 at different HACDs concentrations.

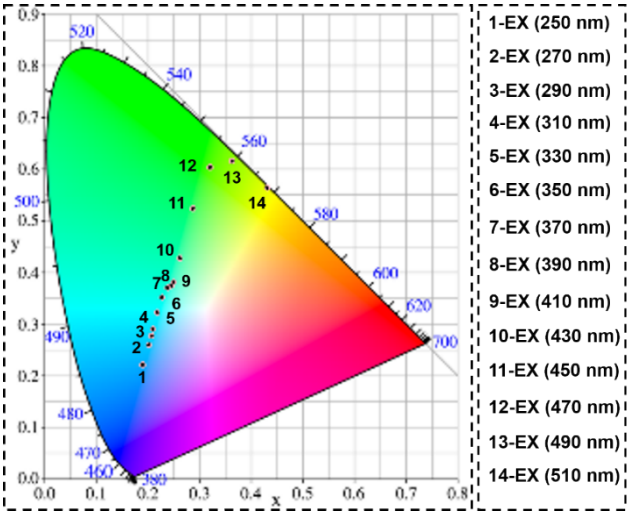

Fig. S3. CIE coordinates of HACDs/BA-180 under different excitation wavelengths.

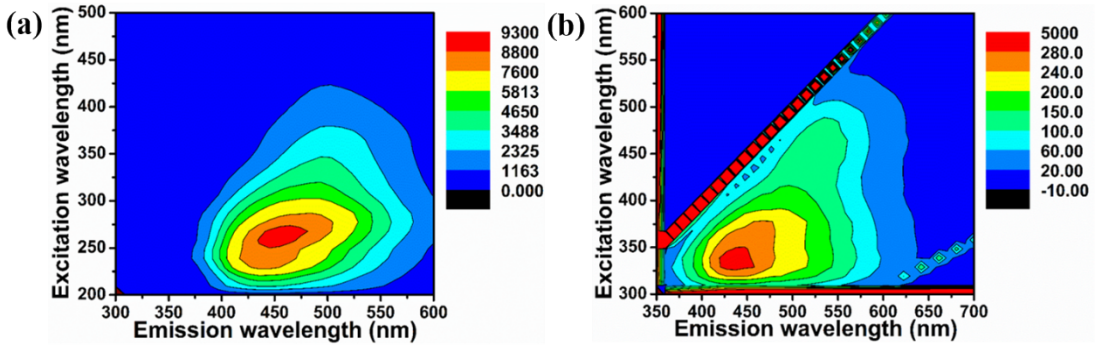

Fig. S4. (a) 3D RTP scan of HACDs/BA-180 and (b) 3D FL scan of HACDs/BA-180 aqueous solution.

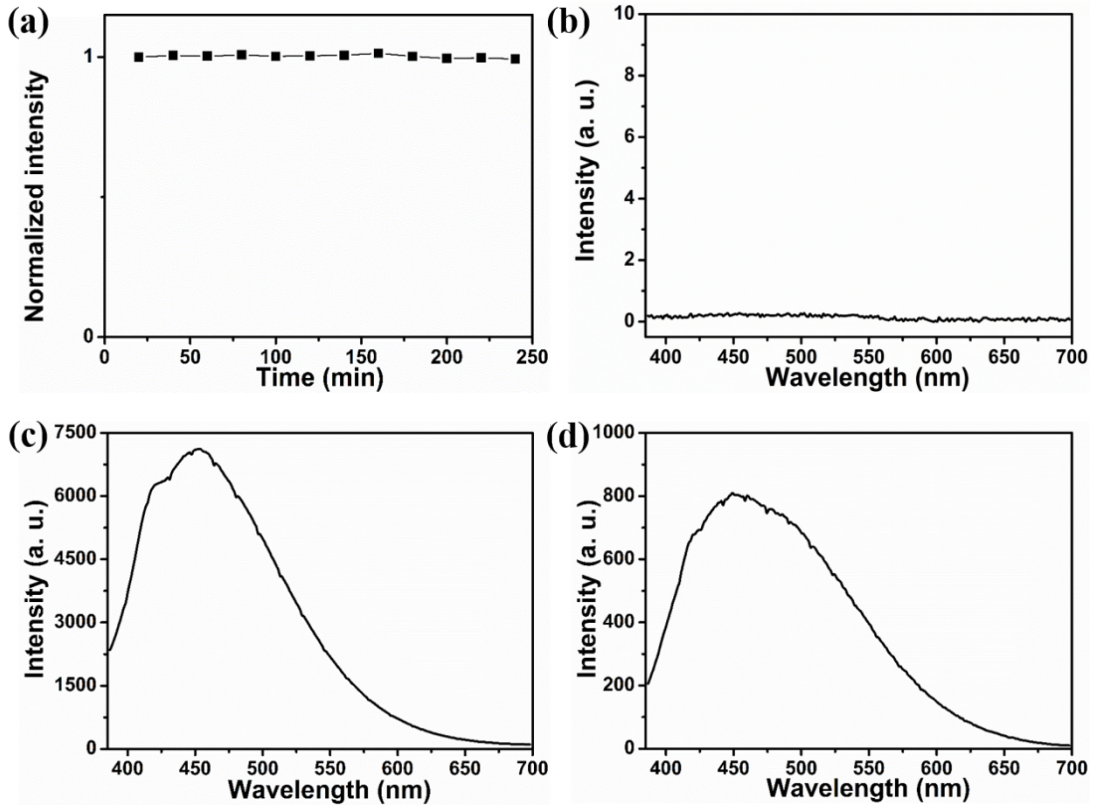

Fig. S5. (a) The RTP stability of HACDs/BA-180. (b) RTP spectra of HACDs/BA-180 in aqueous solution. (c) FL spectra of HACDs/BA-180 in aqueous solution. (d) FL spectra of HACDs in aqueous solution. (Excited at 365 nm)

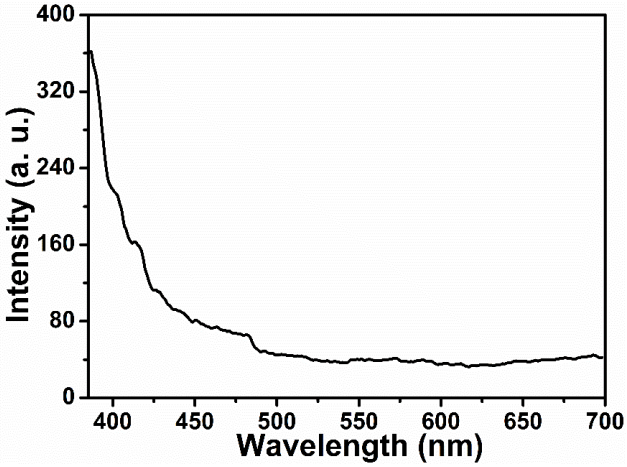

Fig. S6. FL spectra of BA-180 in aqueous solution excited at 365 nm.

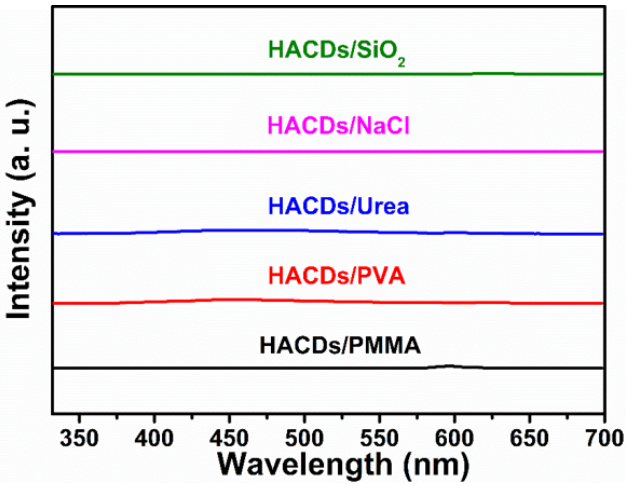

Fig. S7. RTP spectra of HACDs dispersed in different matrices.

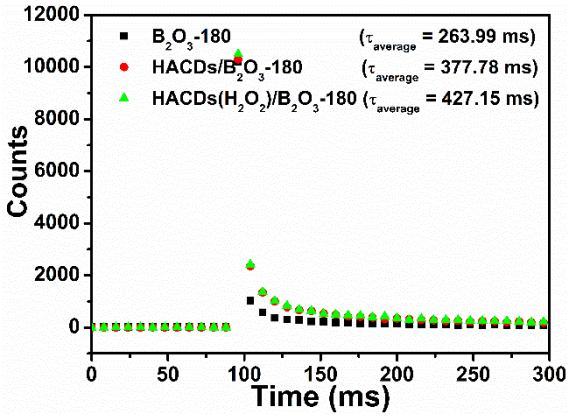

Fig. S8. RTP lifetimes of B_2O_3-180, HACDs/B_2O_3-180, HACDs(H_2O_2)/B_2O_3-180.

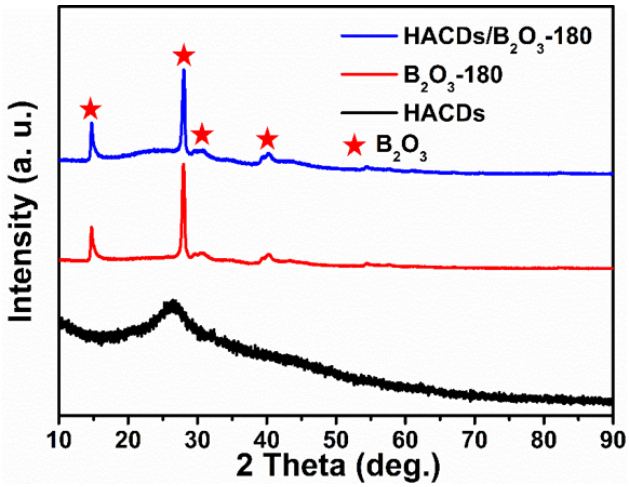

Fig. S9. XRD patterns of HACDs/B_2O_3-180 (*blue*), B_2O_3-180 (*red*), and HACDs (*black*).

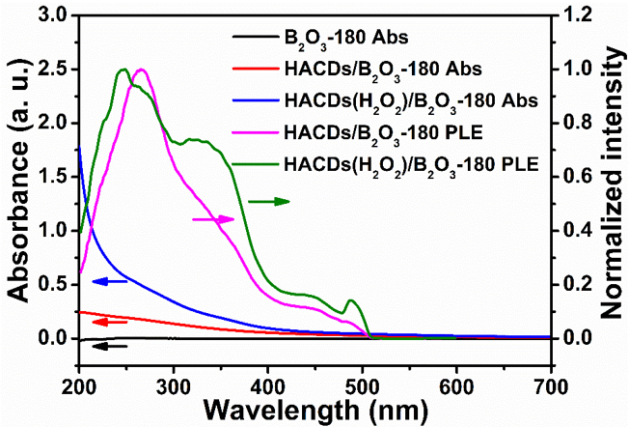

Fig. S10. UV-Vis spectra (*black, red,* and *blue line*) and PLE spectra (*pink* and *green line*) of different selected samples.

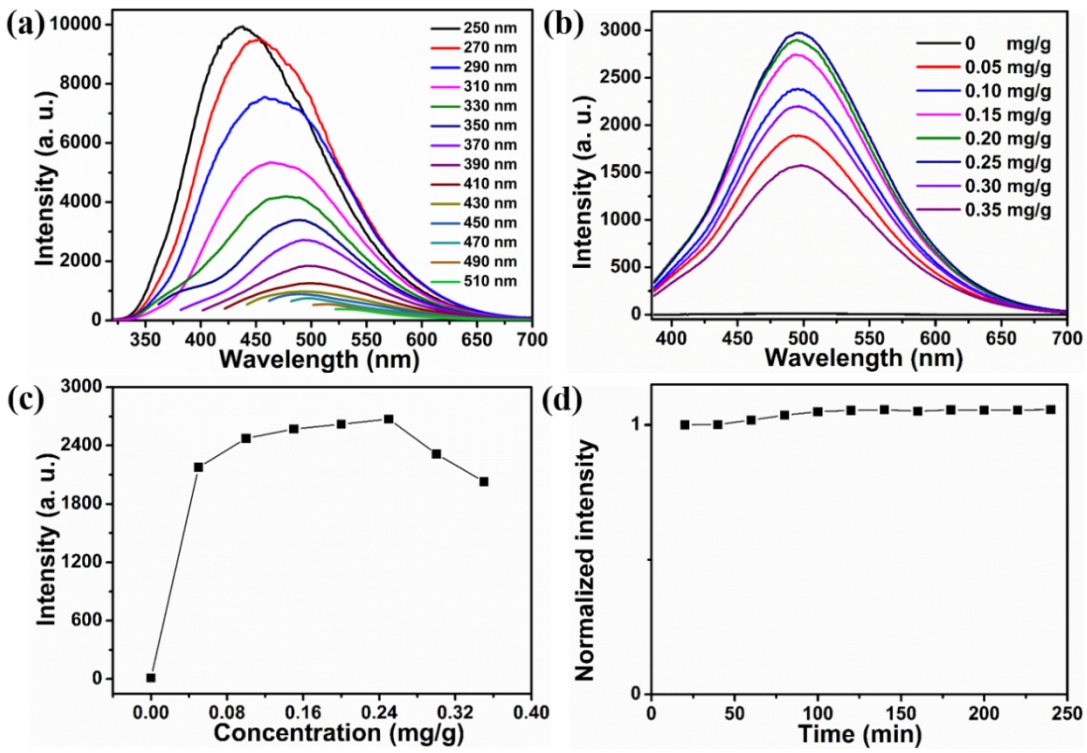

Fig. S11. (a) RTP spectra of HACDs/B_2O_3-180 at different excitation wavelengths. (b) RTP spectra, (c) RTP intensity of HACDs/B_2O_3-180 at different HACDs concentrations. (d) The RTP stability of HACDs/B_2O_3-180.

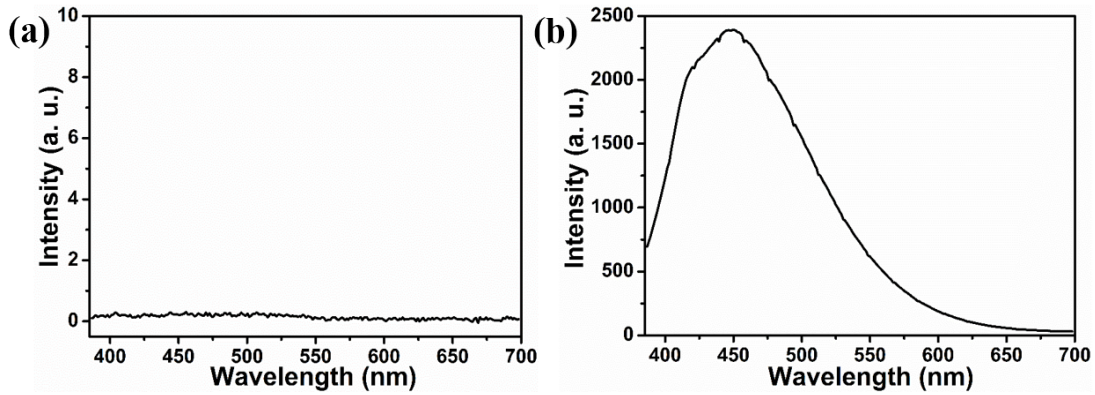

Fig. S12. (a) RTP spectra and (b) FL spectra of HACDs/B_2O_3-180 in aqueous solution excited at 365 nm.

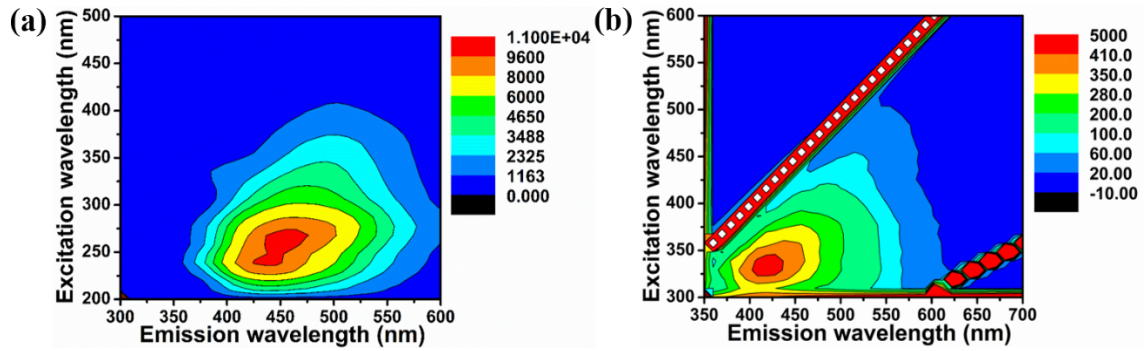

Fig. S13. (a) 3D RTP and (b) 3D FL scan of B_2O_3-180 aqueous solution.

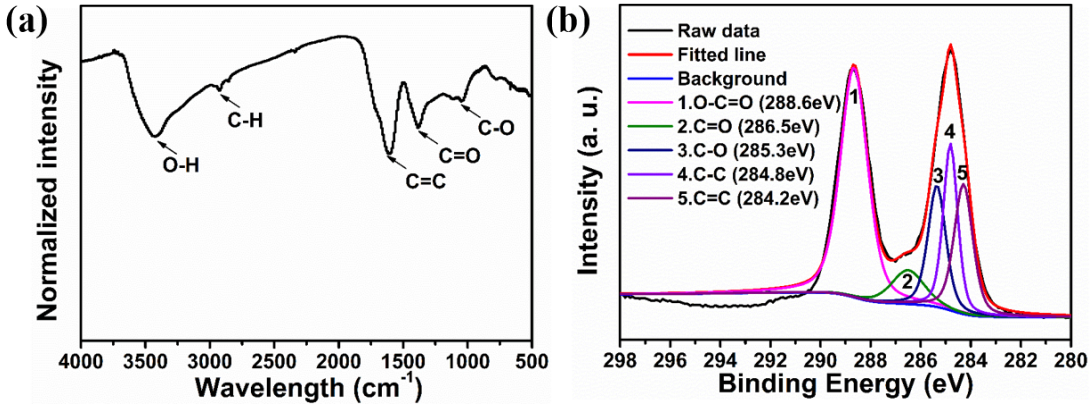

Fig. S14. (a) FTIR spectrum and (b) XPS high-resolution C1s spectra of HACDs(H_2O_2).

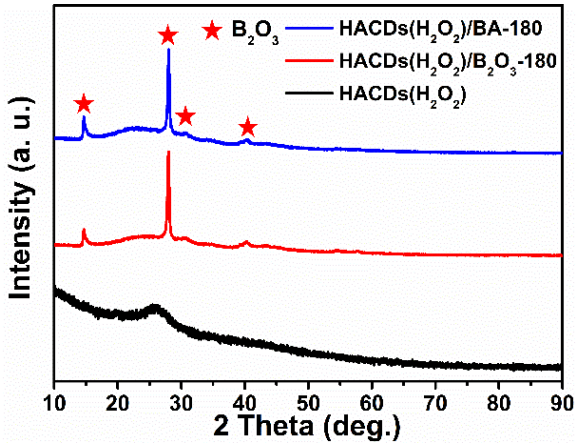

Fig. S15. XRD patterns of the selected samples.