

Figure S1. TEM and HRTEM images of PACDs2~4. Inset, the particle size distributions of PACDs2 (a), PACDs3 (b) and PACDs4 (c).

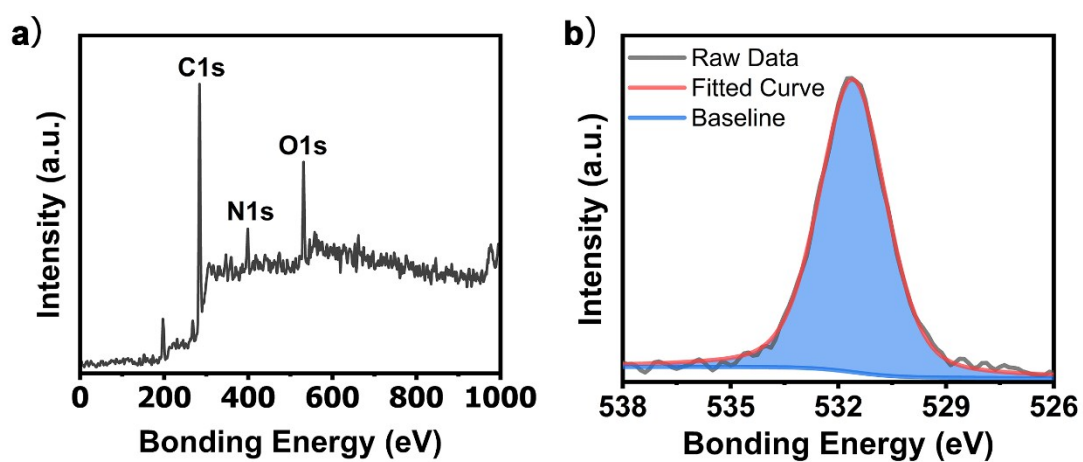


Figure S2. a) XPS survey spectrum of PACDs1. b) High resolution XPS spectra and fitting results of O 1s of PACDs1.

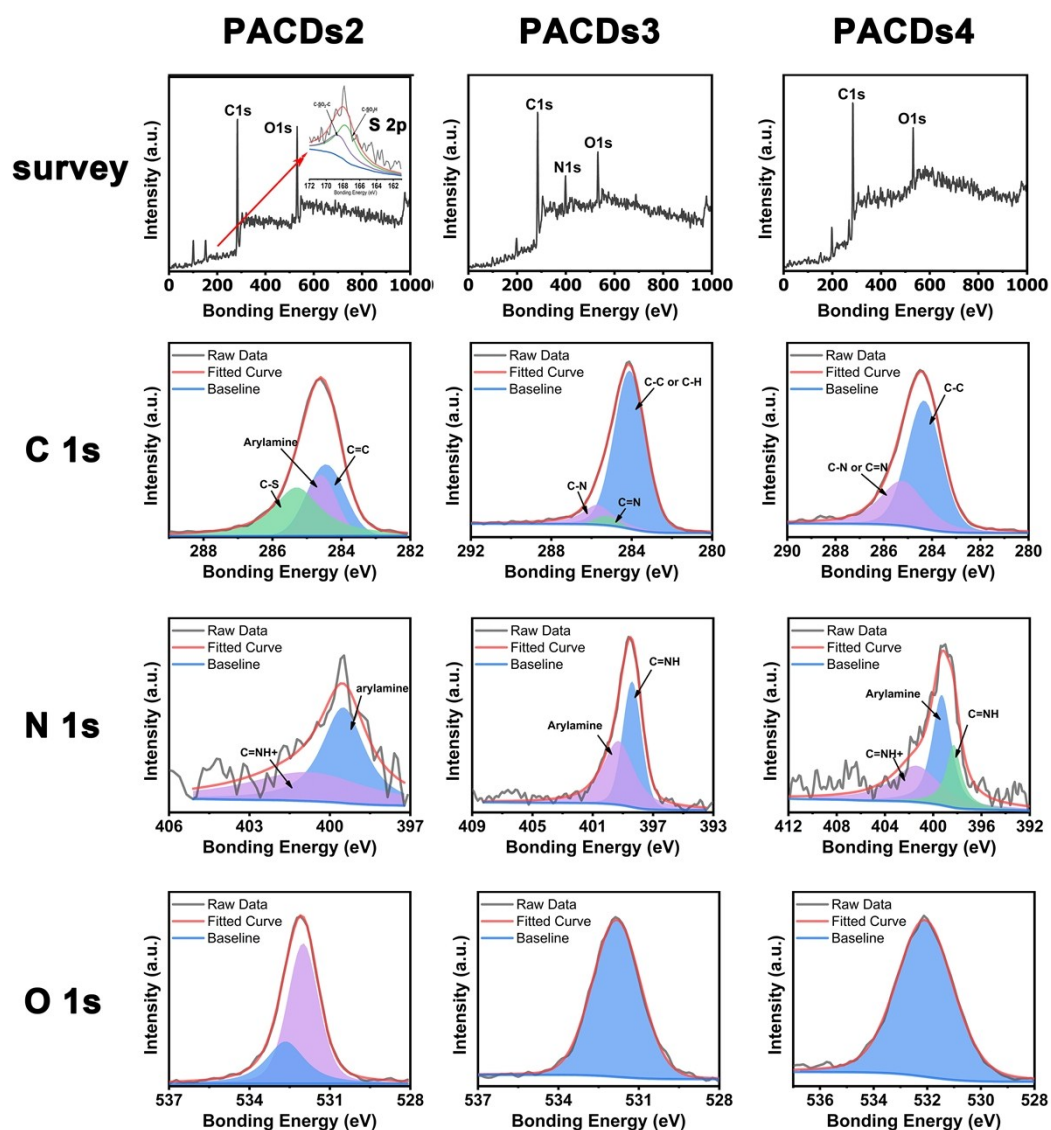


Figure S3. a) XPS survey spectrum and high resolution XPS spectra and fitting results of C 1s, N 1s S 2p (inset) and O 1s (d) of PACDs2~4.

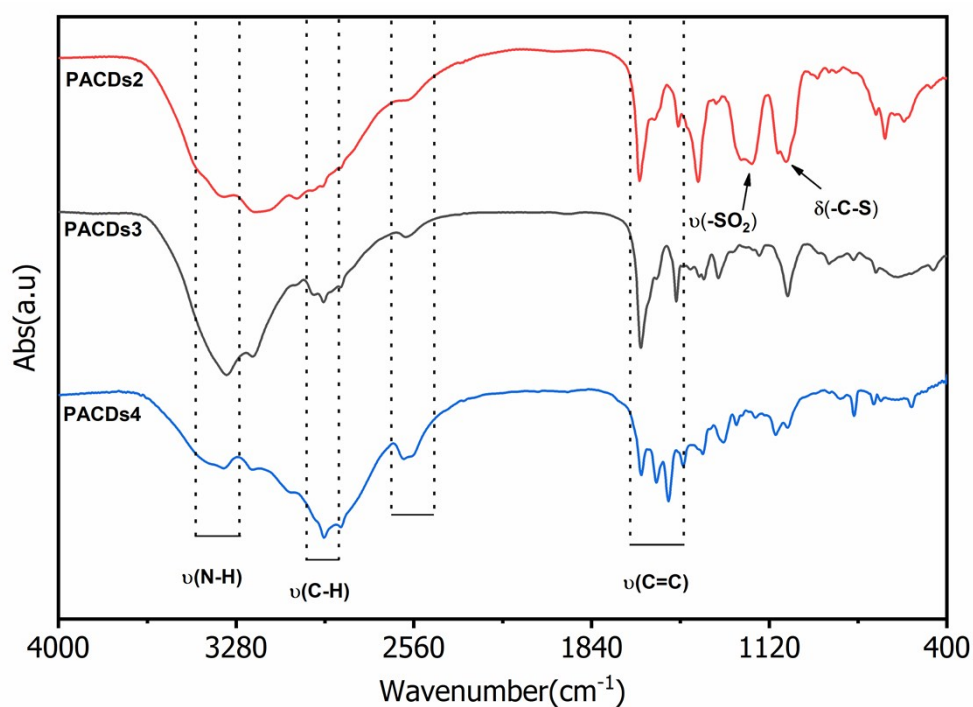


Figure S4. FT-IR spectra of PACDs2 , PACDs3 and PACDs4.

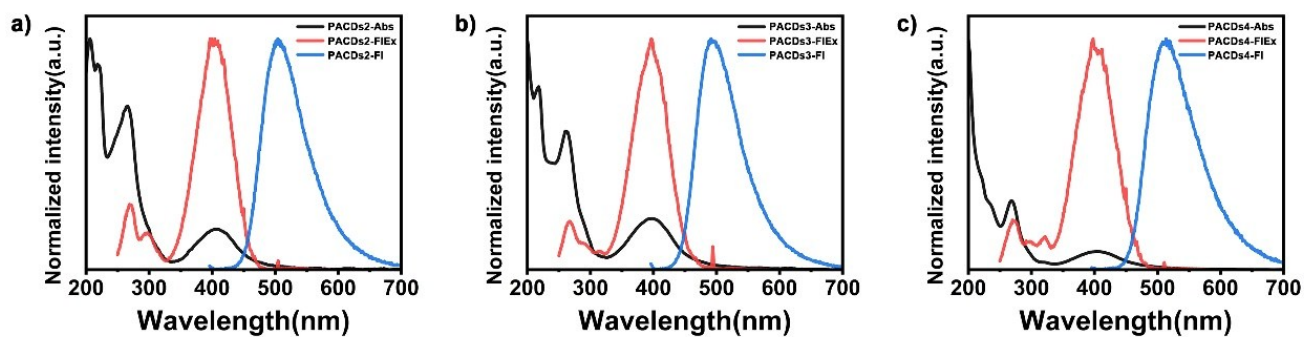


Figure S5. a-d) The nomalized UV/Vis absorbance (black line), FL excitation (red line) and emission (Ex= 395 nm) spectra of PACDs2 (a), PACDs3 (b) and PACDs4 (c) in water.

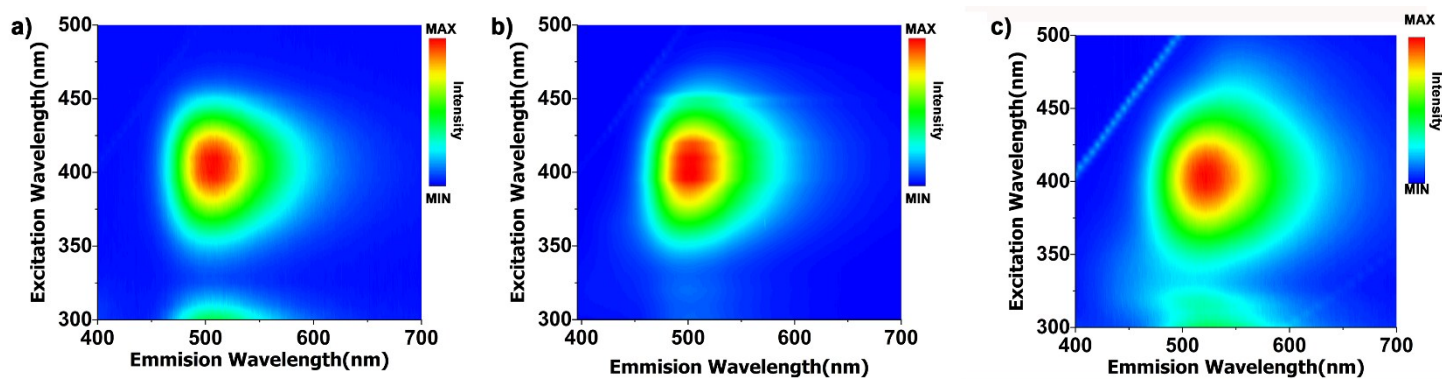


Figure S6. a-c) 3D-PL contour maps of PACDs2 (a), PACDs3 (b) and PACDs4 (c) in water.

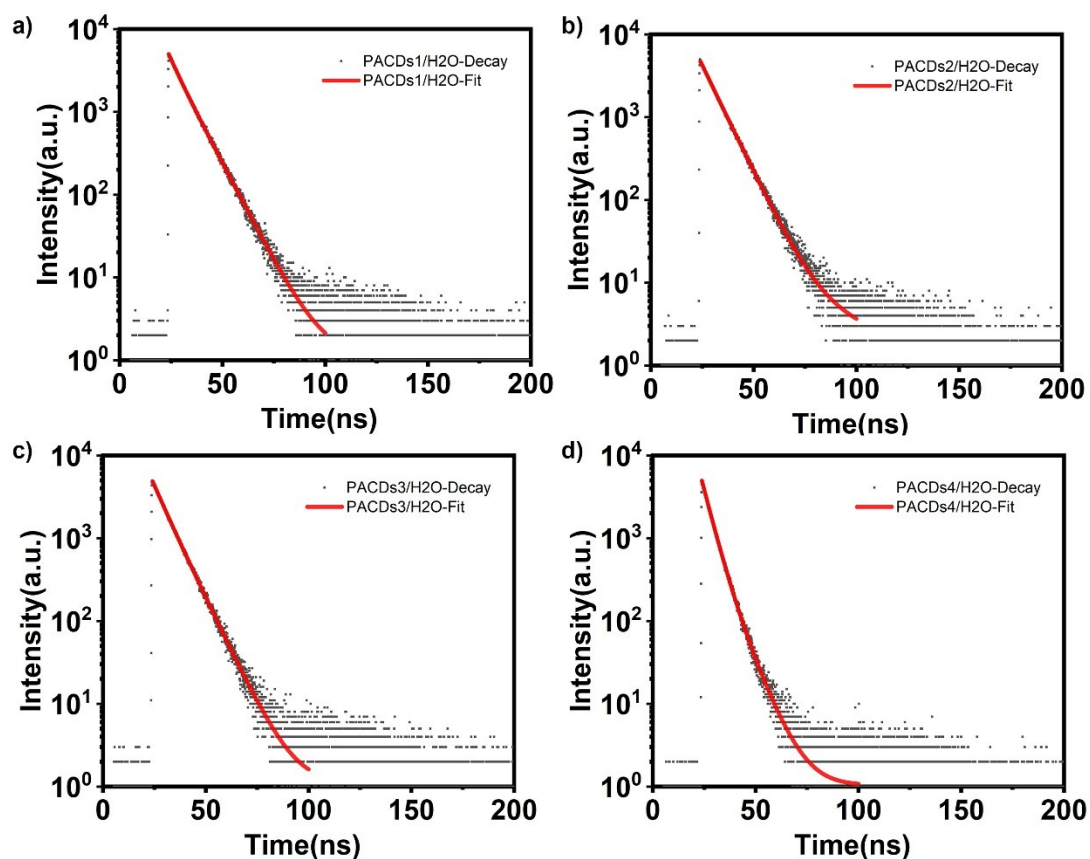


Figure S7. Fluorescence decay spectrum and fitting curve of PACDs in H₂O: a) PACDs1, b) PACDs2, c) PACDs 3, d) PACDs4.

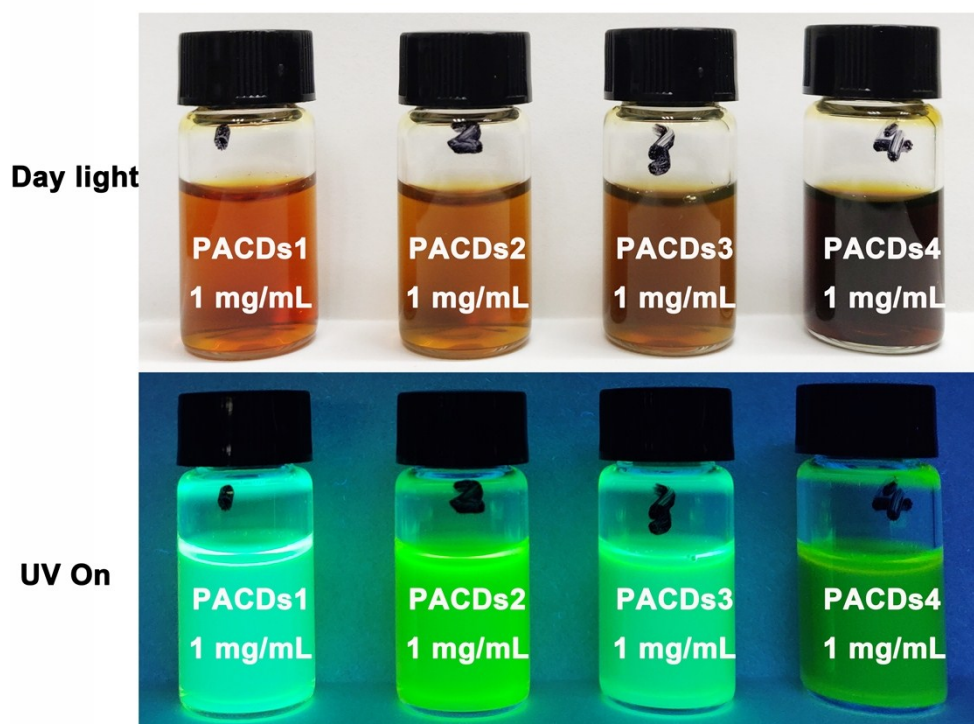


Figure S8. Photograph of PACDs (1 mg/mL) in water after 180 days of storage at room temperature.

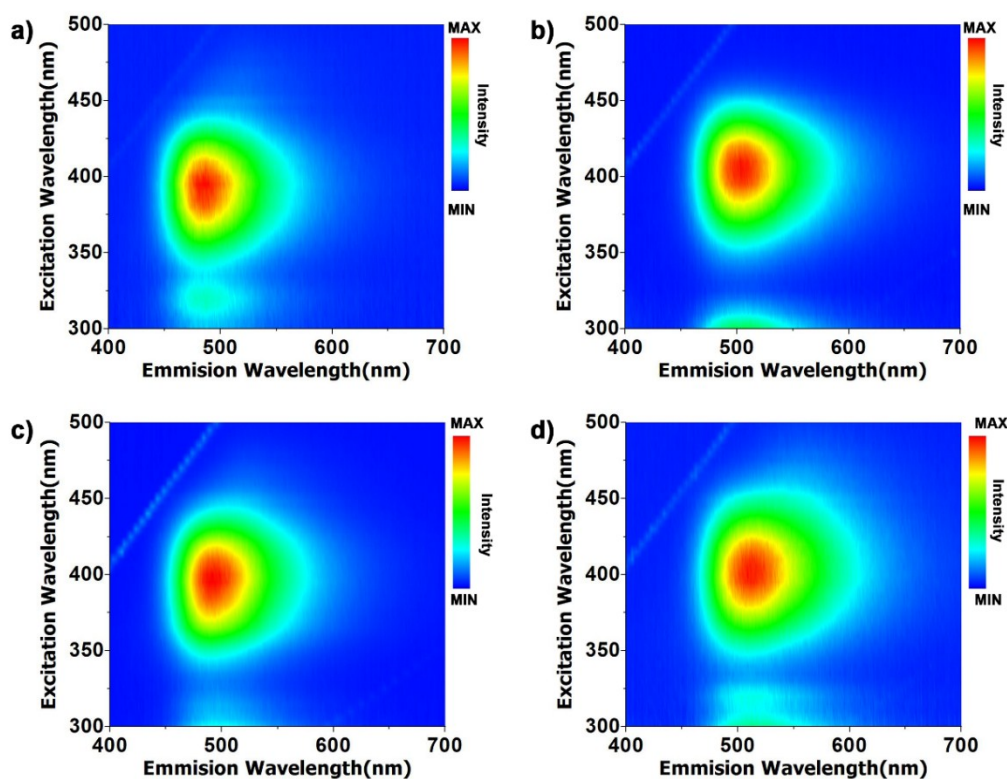


Figure S9. 3D-PL contour maps of PACDs in water after 180 days of storage at room temperature. a) PACDs1, b) PACDs2, c) PACDs3, d) PACDs4.

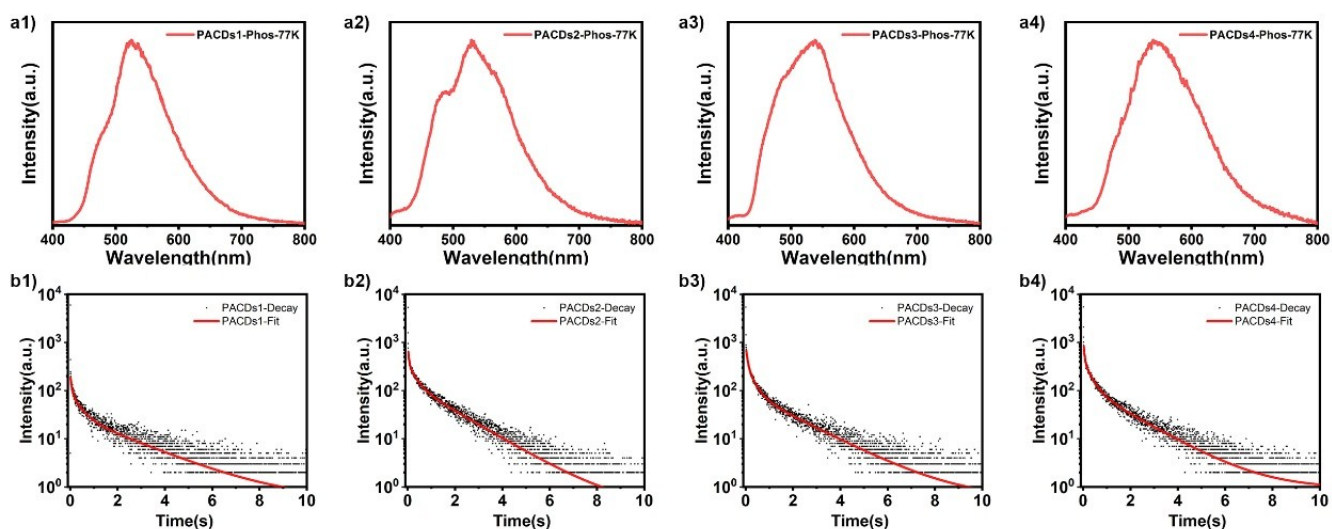


Figure S10. RTP emission (Ex=365 nm) spectra of PACDs in mixed solvent (water: DMSO = 1:1) at 77K. a1) PACDs1, a2) PACDs2, a3) PACDs3, a4) PACDs4.

Phosphorescence decay spectrum and fitting curve (red line) of PACDs in mixed solvent (water: DMSO = 1:1) at 77K. b1) PACDs1, b2) PACDs2, b3) PACDs3, b4) PACDs4.

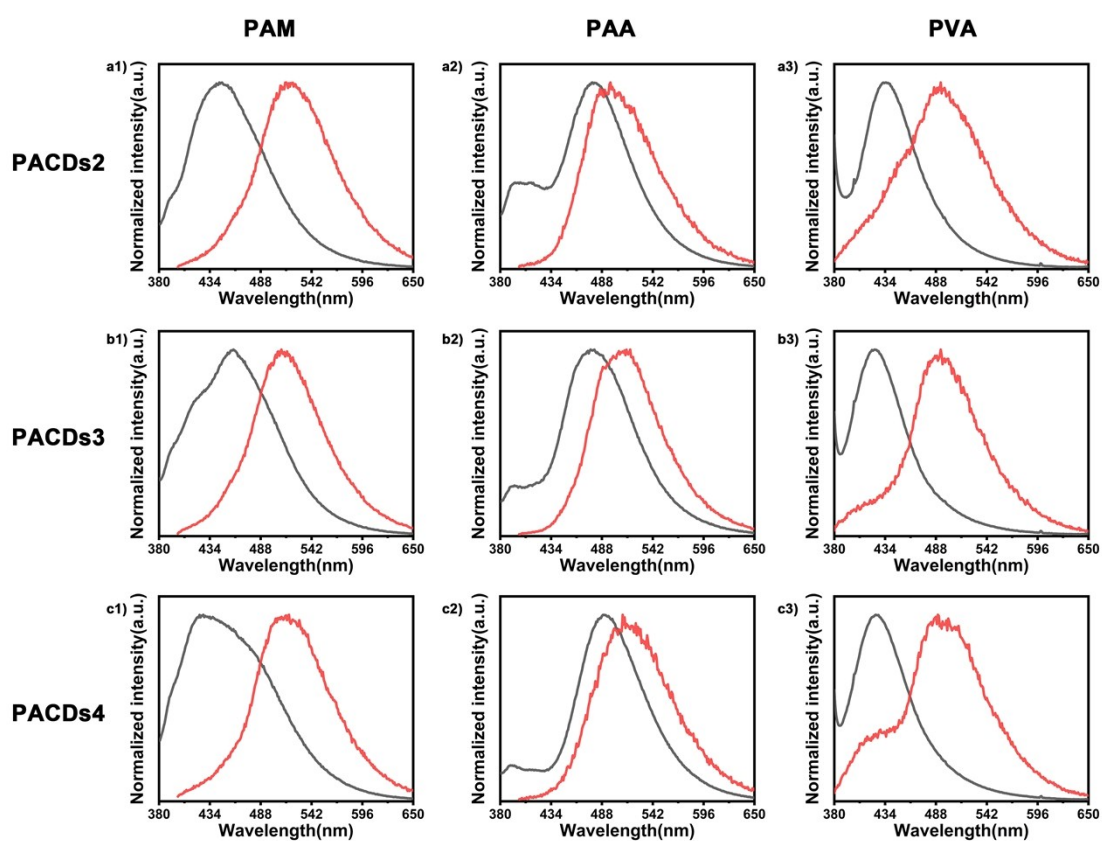


Figure S911 . FL emission (black line, Ex=365 nm), RTP emission (red line, Ex=365 nm) spectra of PACDs2/PAM (a1), PACDs2/PAA (a2), PACDs2/PVA (a3), PACDs3/PAM (B1), PACDs3/PAA (b2), PACDs3/PVA (b3) and PACDs4/PAM (c1), PACDs4/PAA (c2), PACDs4/PVA (c3).

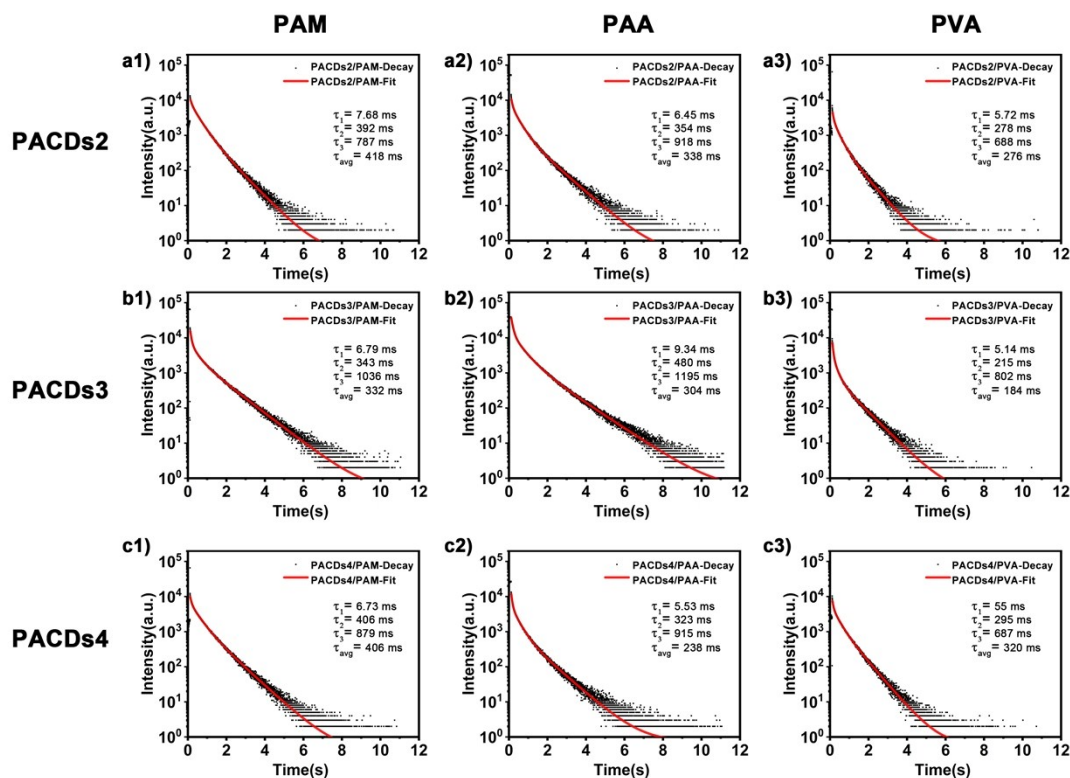


Figure S12. Phosphorescence decay spectrum and fitting curve (red line) of PACDs2/PAM (a1), PACDs2/PAA (a2), PACDs2/PVA (a3), PACDs3/PAM (b1), PACDs3/PAA (b2), PACDs3/PVA (b3), and PACDs4/PAM (c1), PACDs4/PAA (c2), PACDs4/PVA (c3).

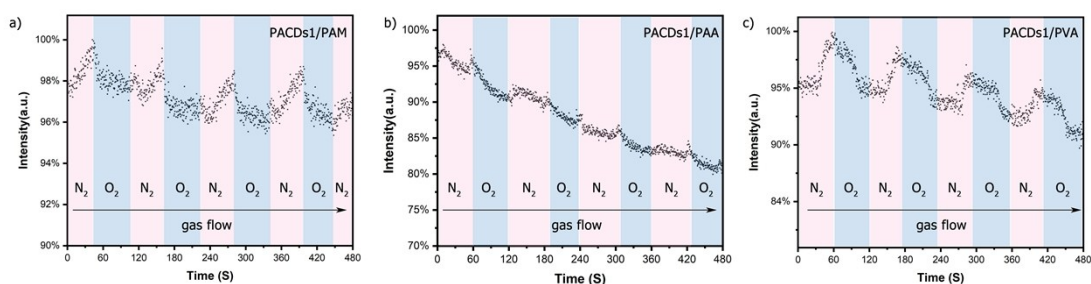


Figure S13. RTP kinetic Scan of PACDs/polymer in the case of nitrogen and oxygen alternating access. The PACDs/polymer powder was put in a capped cuvette. At first, only N_2 was allowed to circulate, then was oxygen. a) PACDs1/PAM, b) PACDs1/PAA, c) PACDs1/PVA.

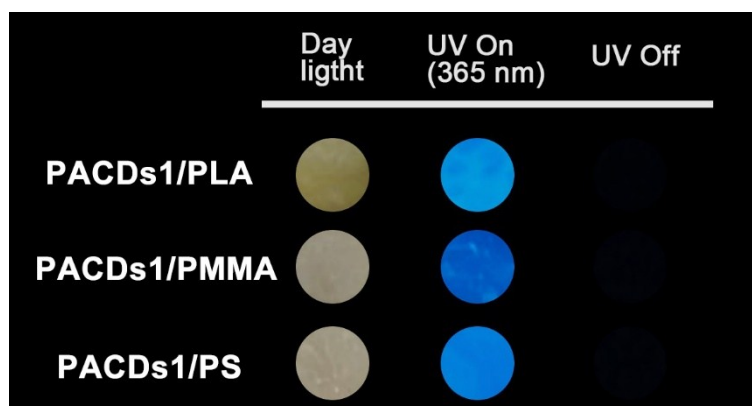


Figure S14. Luminescence photographs of series of composites under 365 nm UV irradiation and after removal of 365 nm ultraviolet lamp.

Table S1. Summarized fluorescence lifetime of PACDs aqueous solution.

PACDs	τ_1/ns	τ_2/ns	B1/%	B2/%	$\tau_{\text{avg}}/\text{ns}$	CHISQ
PACDs1	4.38	9.14	16.0%	84.0%	8.36	1.062
PACDs2	6.15	8.41	1.9%	98.1%	8.55	1.067
PACDs3	5.44	8.51	14.8%	85.2%	7.85	1.057
PACDs4	4.20	7.81	75.8%	24.2%	4.73	0.911

Table S2. Summarized phosphorescence lifetime of PACDs in mixed solvent (water : DMSO = 1:1) at 77K.

PACDs	FL emission/n m	Phos emission /nm	$\Delta E_{\text{st}}/\text{eV}$	τ_1/ms	τ_2/ms	τ_3/ms	B1/%	B2/%	B3/%	$\tau_{\text{avg}}/\text{ms}$	CHISQ
PACDs1	456	529	0.37	54.71	359.07	2132.63	5.86	23.93	70.21	1586.428	1.213
PACDs2	465	530	0.32	40.81	298.87	1511.35	4.68	21.77	73.54	1178.461	1.182
PACDs3	459	541	0.41	63.34	293.51	1742.15	9.12	28.98	61.9	1169.253	1.172
PACDs4	492	544	0.24	40.65	300.88	1545.27	6.74	31.21	62.05	1055.473	1.263

Table S3. Summarized RTP lifetime of PACDs/polymer.

RTP composite	τ_1/ms	B1/%	τ_2/ms	B2/%	τ_3/ms	B3/%	$\tau_{\text{avg}}/\text{ms}$	CHISQ
PACDs1/PAM	103	4.47	583	34.11	1030	61.42	652	0.994
PACDs1/PAA	103	5.81	572	43.95	1257	50.24	578	1.106
PACDs1/PVA	6.72	10.55	315	32.87	925	56.59	315	1.001

PACDs2/PAM	7.68	3.95	392	51.25	787	44.80	418	0.994
PACDs2/PAA	6.45	6.86	354	50.56	918	42.58	338	1.029
PACDs2/PVA	5.72	7.30	278	46.75	688	45.95	276	1.014
PACDs3/PAM	6.79	11.11	343	26.73	1036	62.16	332	1.051
PACDs3/PAA	9.34	19.52	480	42.21	1195	38.26	304	1.087
PACDs3/PVA	5.14	16.46	215	35.35	802	48.18	184	0.977
PACDs4/PAM	6.73	5.65	406	41.37	879	52.99	406	0.998
PACDs4/PAA	5.53	12.67	323	47.04	915	40.28	238	1.137
PACDs4/PVA	55	6.15	295	32.98	687	60.87	320	0.998

Table S4. Summarized phosphorescence lifetime of PACDs/polymer in both dry and wet state.

PACDs/polymer	τ_{avg}/ms	CHISQ	PACDs/polymer	τ_{avg}/ms	CHISQ	PACDs/polymer	τ_{avg}/ms	CHISQ
PACDs1/PAM-Dry	674.40	1.08	PACDs1/PAA-Dry	506.41	1.10	PACDs1/PVA-Dry	391.67	1.11
PACDs1/PAM-Wet	96.73	1.02	PACDs1/PAA-Wet	34.75	0.90	PACDs1/PVA-Wet	49.40	0.91
PACDs2/PAM-Dry	413.20	1.07	PACDs2/PAA-Dry	322.61	1.20	PACDs2/PVA-Dry	299.41	1.13
PACDs2/PAM-Wet	74.95	1.04	PACDs2/PAA-Wet	61.49	0.90	PACDs2/PVA-Wet	43.35	0.92
PACDs3/PAM-Dry	355.48	1.08	PACDs3/PAA-Dry	308.37	1.14	PACDs3/PVA-Dry	227.45	1.02
PACDs3/PAM-Wet	159.91	1.05	PACDs3/PAA-Wet	33.61	1.05	PACDs3/PVA-Wet	44.42	0.92
PACDs4/PAM-Dry	422.02	0.99	PACDs4/PAA-Dry	224.40	0.95	PACDs4/PVA-Dry	312.82	1.00
PACDs4/PAM-Wet	1.72	1.32	PACDs4/PAA-Wet	174.70	1.01	PACDs4/PVA-Wet	49.40	0.91