

Electronic Supplementary Information

One-pot Synthesis and Control of Aqueous Soluble and Organic Soluble Carbon Dots from Designable Waterborne Polyurethane Emulsion

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Table S1 The required mole numbers of the soft segment, IPDI and DMPA for different WPU samples

Sample	Soft segment	Weight content of the soft segment	IPDI(mol)	DMPA(mol)
1	0.0100 mol PTMG1K	55%	0.0300	0.0100
2	0.0050 mol PTMG2K	55%	0.0281	0.0131
3	0.0100 mol PEG1K	55%	0.0300	0.0100
4	0.0100 mol PCDL1K	55%	0.0300	0.0100
5	0.0082mol PTMG1K	45%	0.0344	0.0162
6	0.0118mol PTMG1K	65%	0.0256	0.0038

Table S2 Elemental analysis results of the WPU, PTMG1K-ACDs and PTMG1K-OCDs

Sample	C(%)	H(%)	N(%)	O(%,calculated)
WPU	63.30	9.76	4.74	22.20
PTMG1K-ACDs	53.34	10.35	7.71	28.60
PTMG1K-OCDs	58.77	9.87	0.85	30.51

Table S3 Quantum yield (QY) calculation of the ACDs and OCDs at 360nm

Sample	Intergrated emission intensity (I)	UV Absorbance	Refractive index of solvent (n)	Quantum yield (Q)
Quinine sulfate	120647590	0.0112	1.333(default)	0.54
PTMG1K-ACDs	114803140	0.0230	1.333	0.250
PTMG1K-OCDs	46037435	0.0543	1.4458	0.050
PTMG2K-ACDs	94335897	0.0245	1.333	0.193
PTMG2K-OCDs	15207746	0.0198	1.4458	0.045
PEG1K-ACDs	287668376	0.0843	1.333	0.171
PCDL1K-ACDs	275088109	0.0765	1.333	0.180

Table S4. Fluorescence lifetime calculation of PTMG1K-ACDs, PTMG1K-OCDs, PTMG2K-ACDs, PTMG2K-OCDs, PEG1K-ACDs and PCDL1K-ACDs.

Sample	B ₁	B ₂	τ_1	τ_2	$\tau(\text{ns})$
PTMG1K-ACDs	0.025	0.031	2.73	8.89	6.14
PTMG1K-OCDs	0.073	0.0034	1.35	8.68	1.68
PTMG2K-ACDs	0.042	0.015	2.75	10.30	4.74
PTMG2K-OCDs	0.074	0.0087	1.06	6.00	1.58
PEG1K-ACDs	0.023	0.037	1.92	5.59	4.18
PCDL1K-ACDs	0.042	0.019	1.79	9.60	4.22

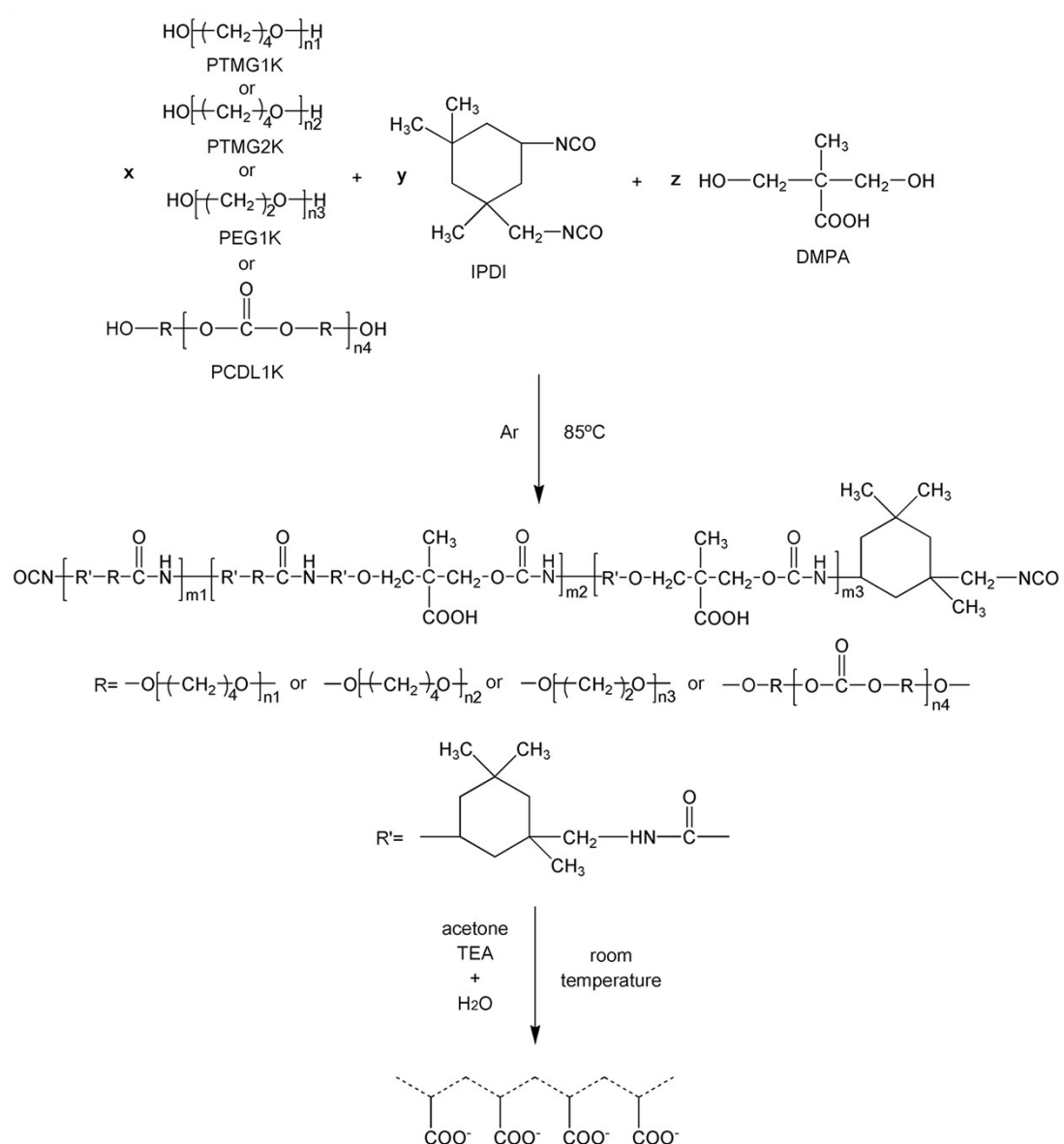


Fig. S1 A schematic illustration of the synthetic procedure of the WPU.

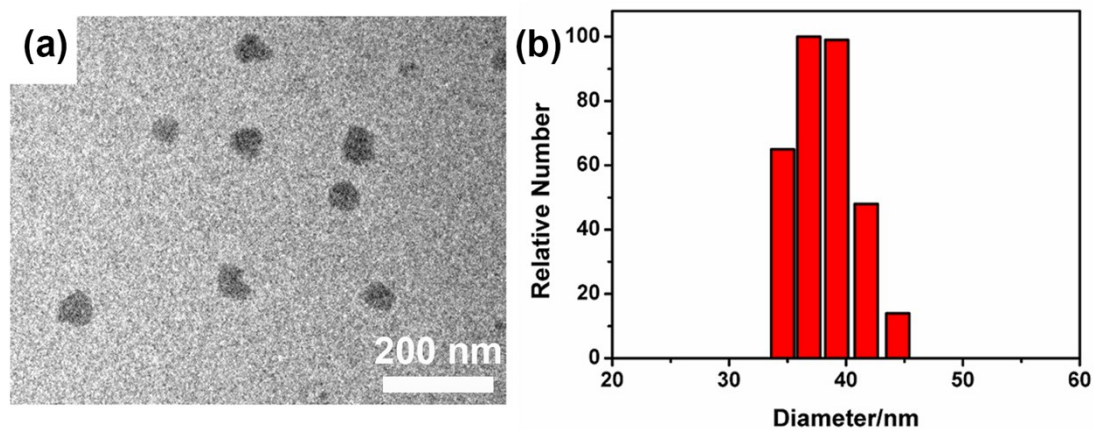


Fig. S2 The TEM image (a) and the size distribution histograms (b) of WPU with PTMG1K as the soft segments.

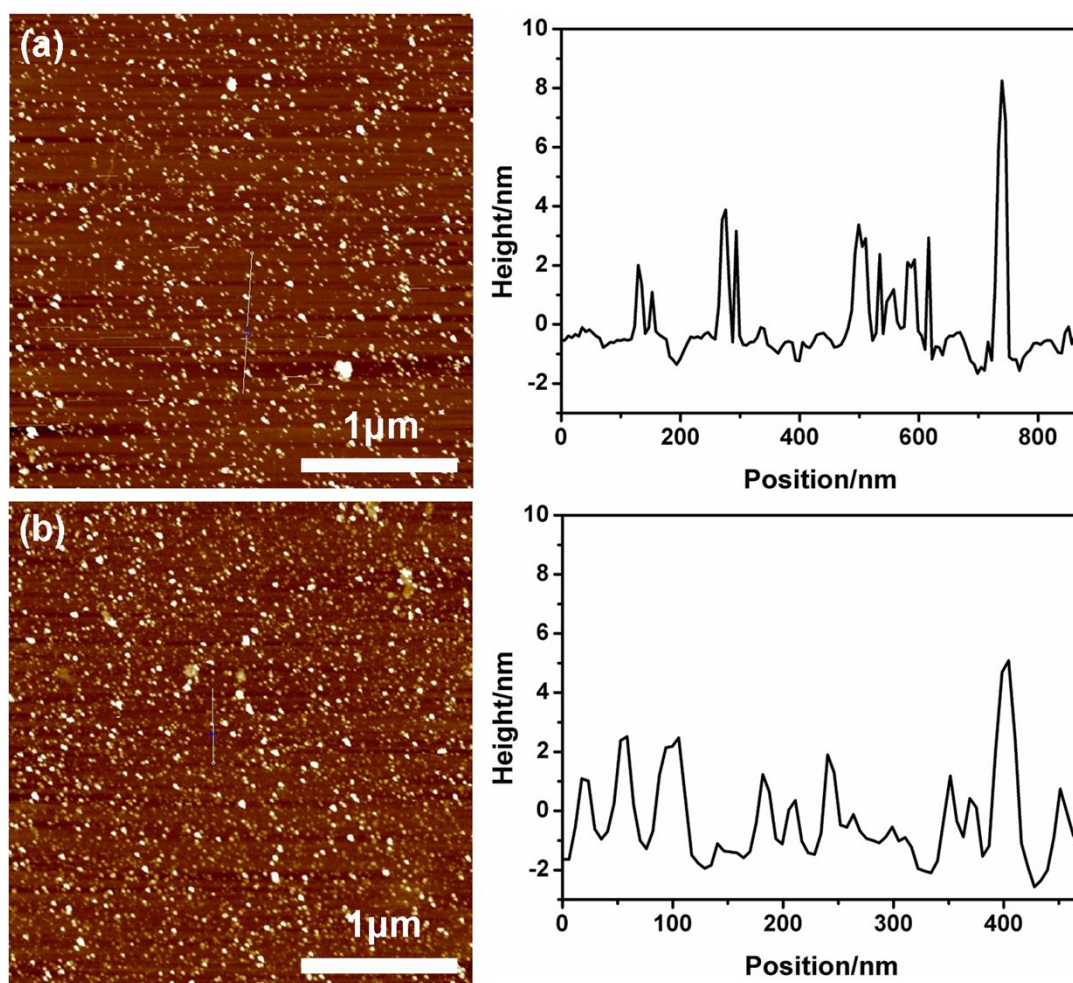


Fig. S3 AFM images of PTMG1K-ACDs (a) and PTMG1K-OCDs (b).

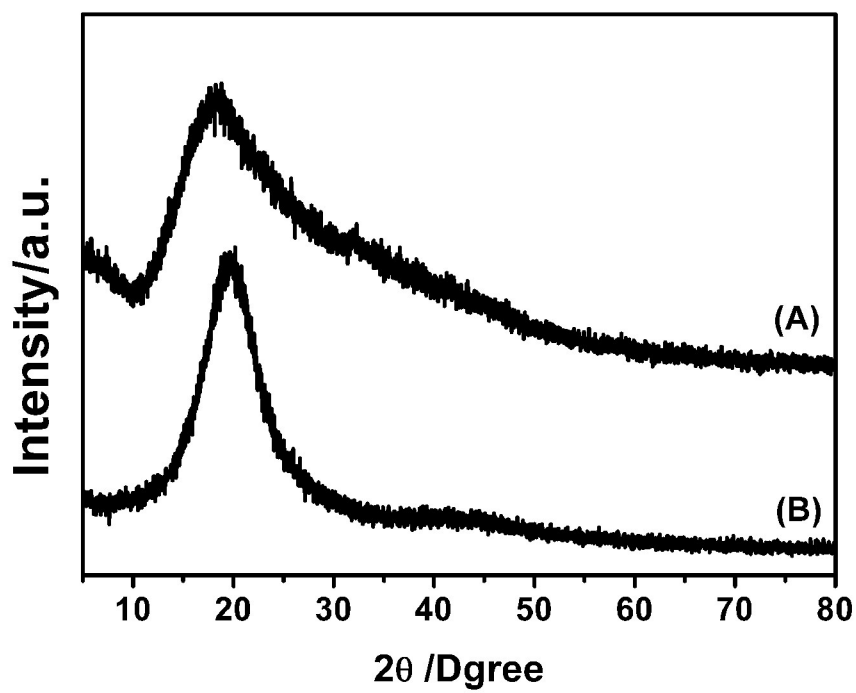


Fig. S4 XRD pattern of PTMG1K-ACDs (A) and PTMG1K-OCDs (B).

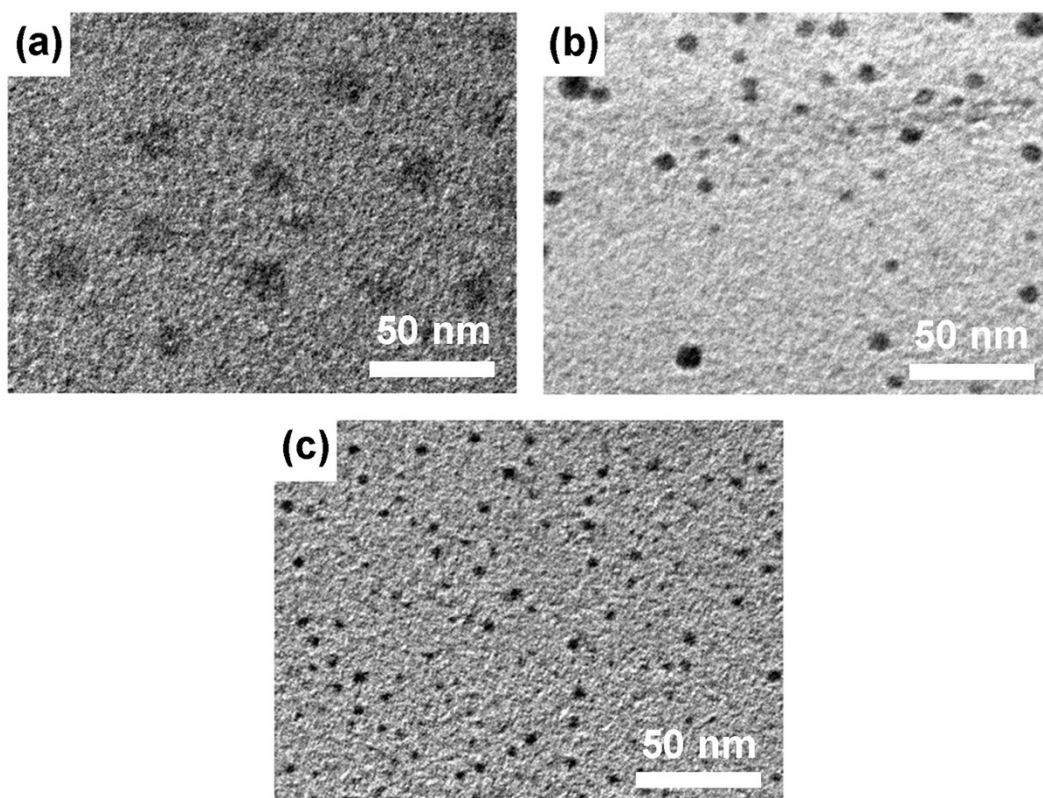


Fig. S5 TEM images of samples from WPU with different reaction temperatures. (a): 120 °C, (b): 160 °C, (c):240 °C.

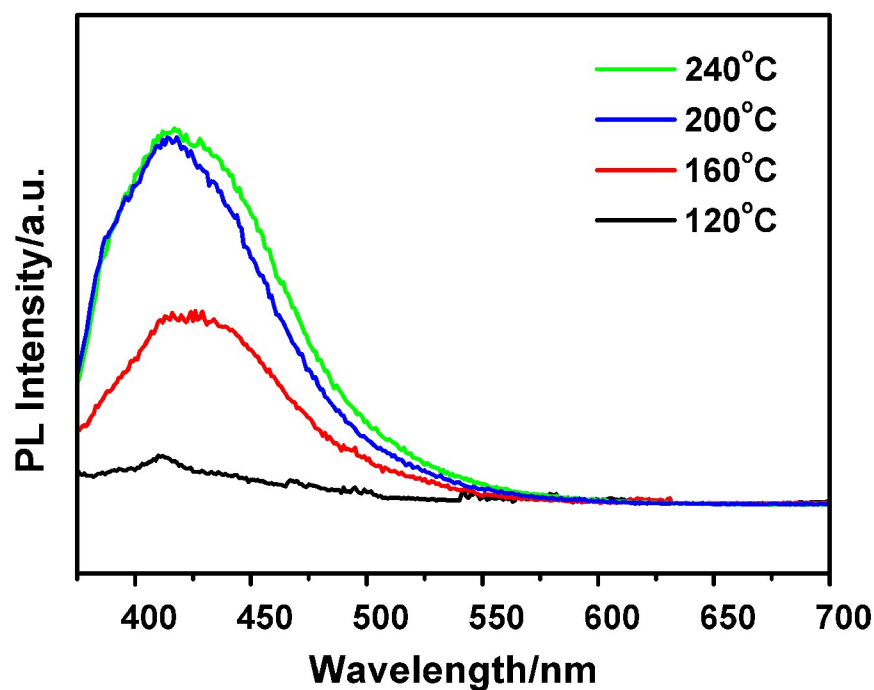


Fig. S6 Emission spectra of samples from WPU with different reaction temperatures under 360 nm excitation.

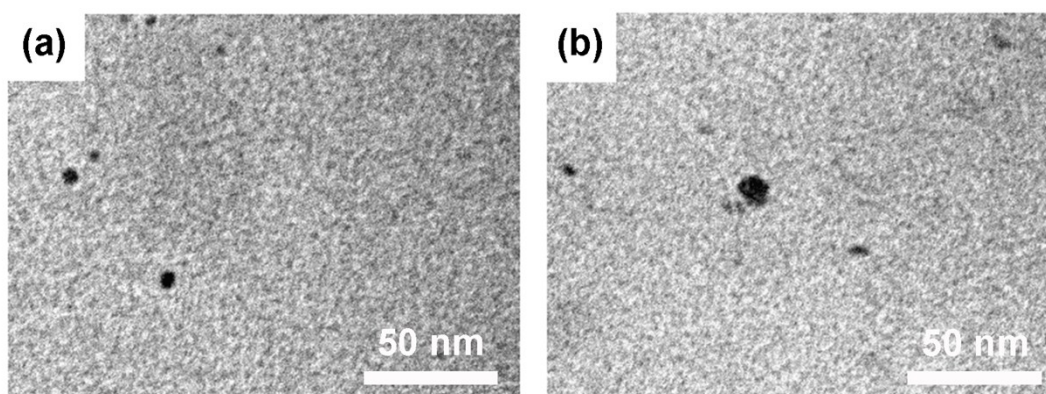


Fig. S7 TEM images of CDs from pure PTMG1K (a) or IPDI (b) after hydrothermal treatment at 200 °C.

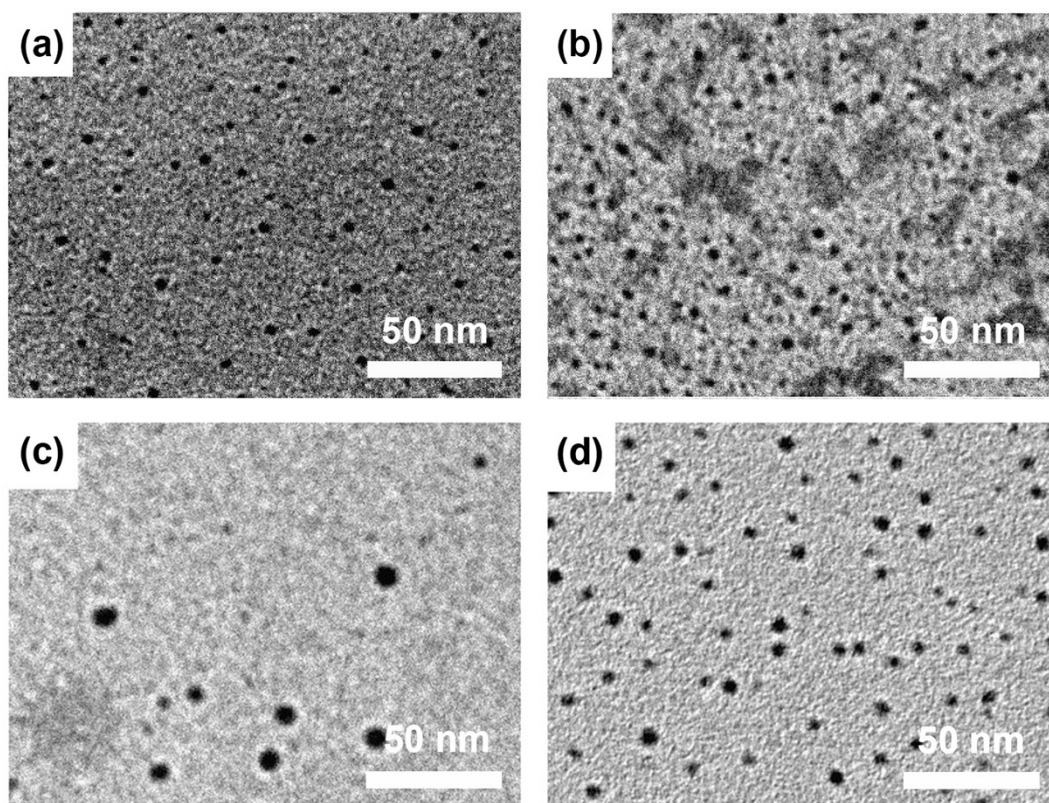


Fig. S8 TEM images of PTMG2K-ACDs (a), PTMG2K-OCDs (b), PEG1K-ACDs (c) and PCDL1K-ACDs (d).

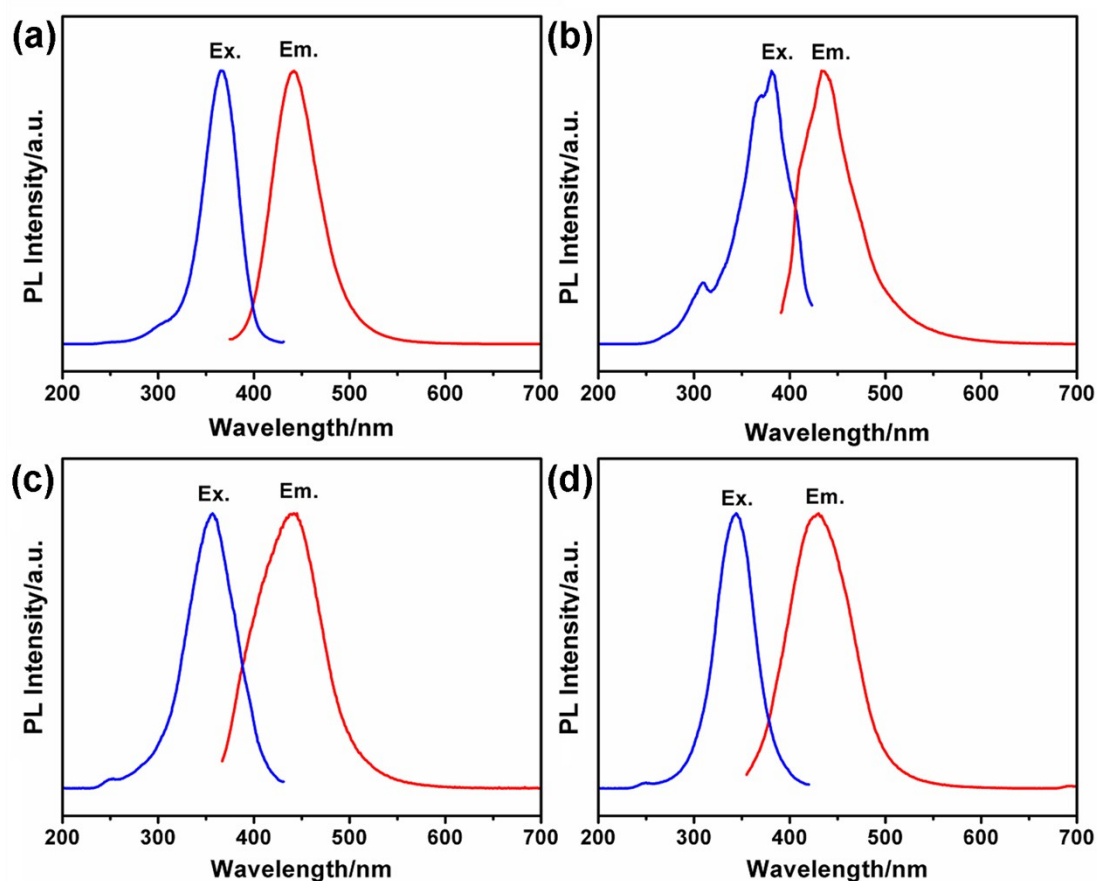


Fig. S9 Maximum excitation & emission spectra of PTMG2K-ACDs (a), PTMG2K-OCDs (b), PEG1K-ACDs (c) and PCDL1K-ACDs (d).

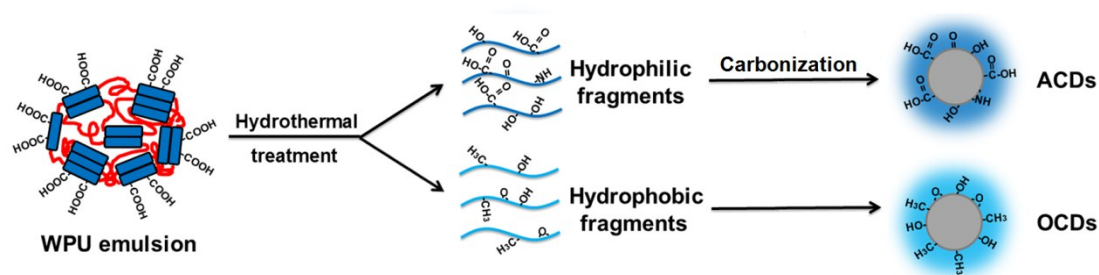


Fig. S10 The schematic illustration about the formation mechanism of CDs with different solubility from WPU emulsion.

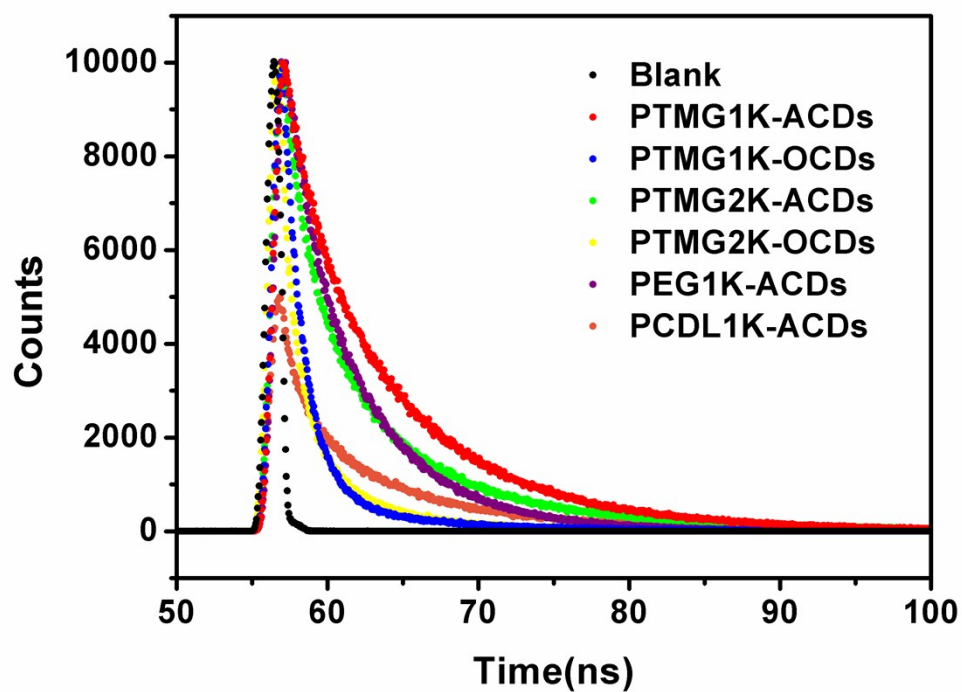


Fig. S11 Time-resolved fluorescence decay of PTMG1K-ACDs, PTMG1K-OCDs, PTMG2K-ACDs, PTMG2K-OCDs, PEG1K-ACDs and PCDL1K-ACDs. The black line was the instrument response function.

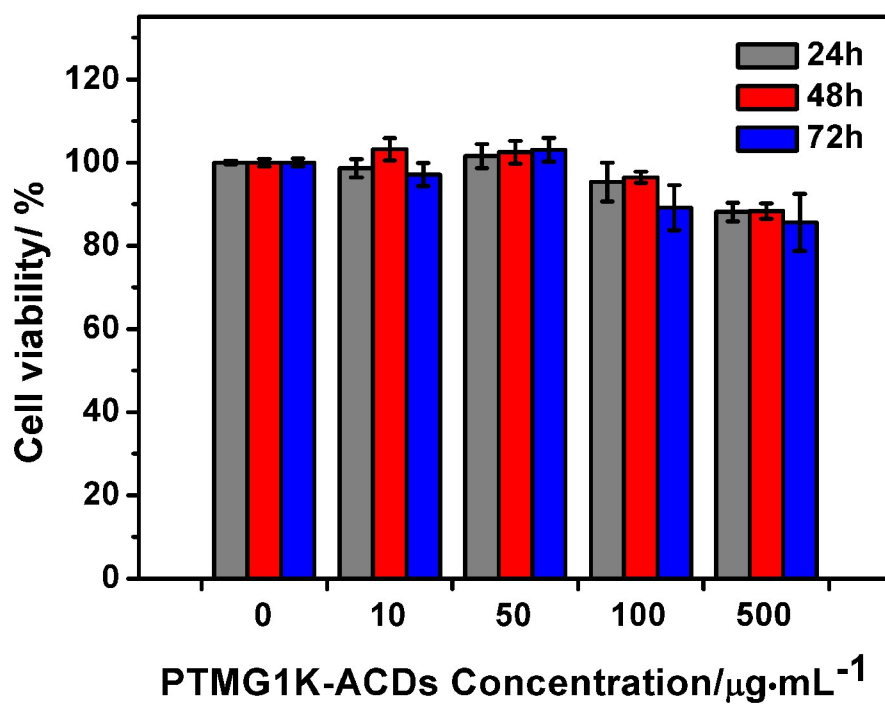


Fig. S12 Cytotoxicity test of MCF-7 cells with different concentration of PTMG1K-ACDs after 24 h, 48 h and 72 h incubation.

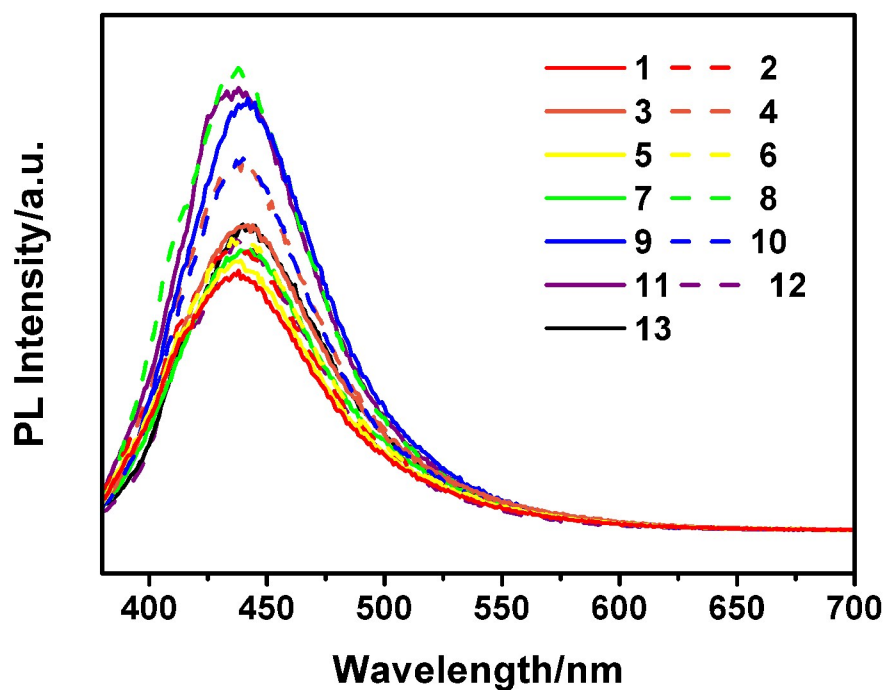


Fig. S13 Emission spectra of PTMG1K-OCDs in different organic solvents at 365 nm excitation. 1: n-hexane, 2: toluene, 3: chloroform, 4: dichloromethane, 5: aether, 6: ethyl acetate, 7: THF, 8: acetone, 9: alcohol, 10: methanol, 11: DMAc, 12: DMF, 13: DMSO.

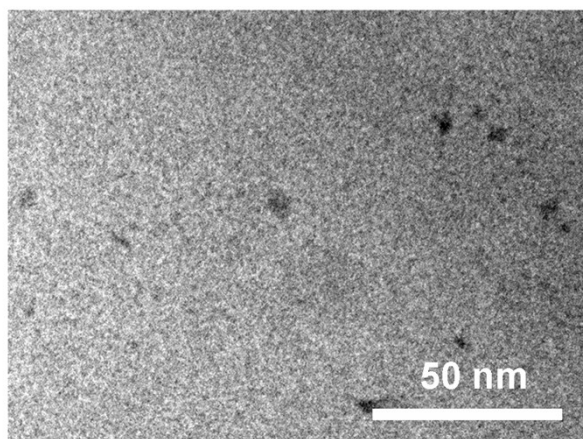


Fig. S14 The TEM image of the PMMA film with 3.0 wt% PTMG1K-OCDs.

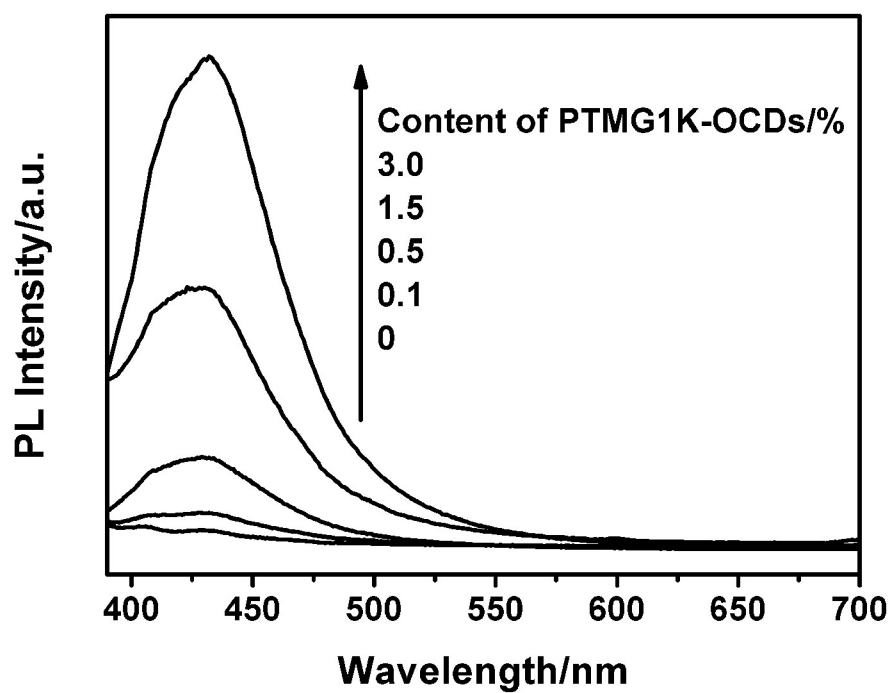


Fig. S15 Emission spectra of the PMMA films with various content of PTMG1K-OCDs under 365 nm excitation.

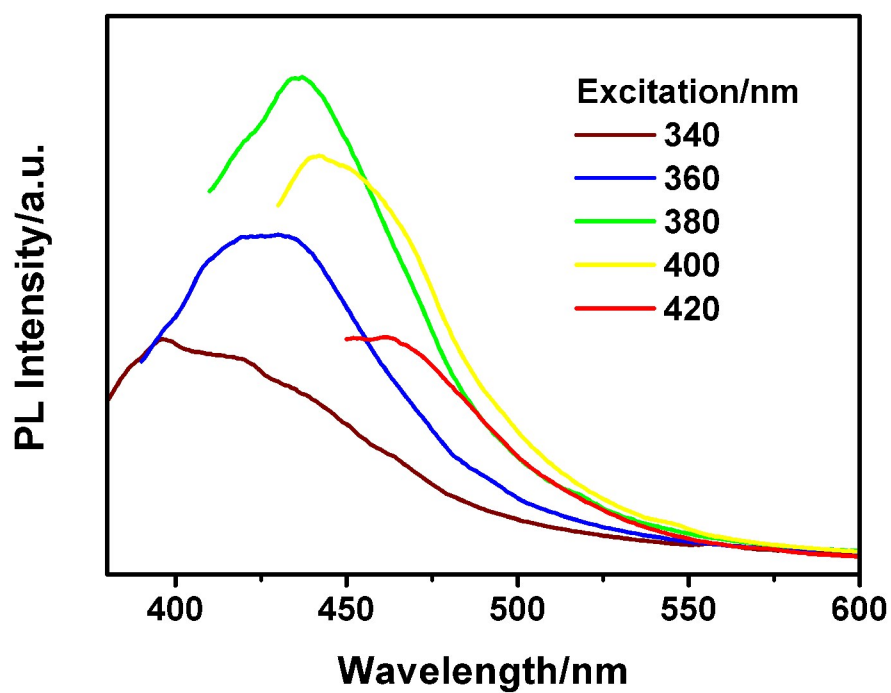


Fig. S16 Emission spectra of the PMMA films with 3.0 wt% PTMG1K-OCDs at different excitation wavelengths.