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## Supplementary Materials for

### Regulating the absorption spectrum of polydopamine

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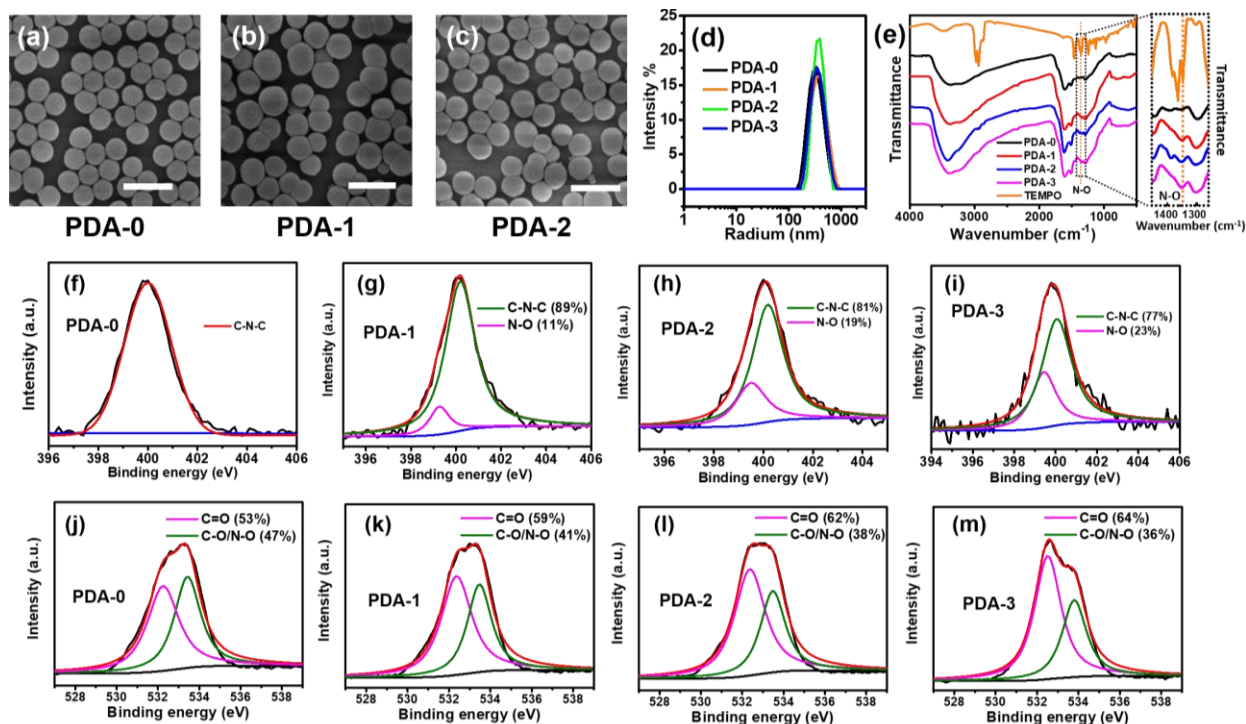
#### The PDF file includes:

Fig. S1 to S8  
Table S1  
Legend for movie S1

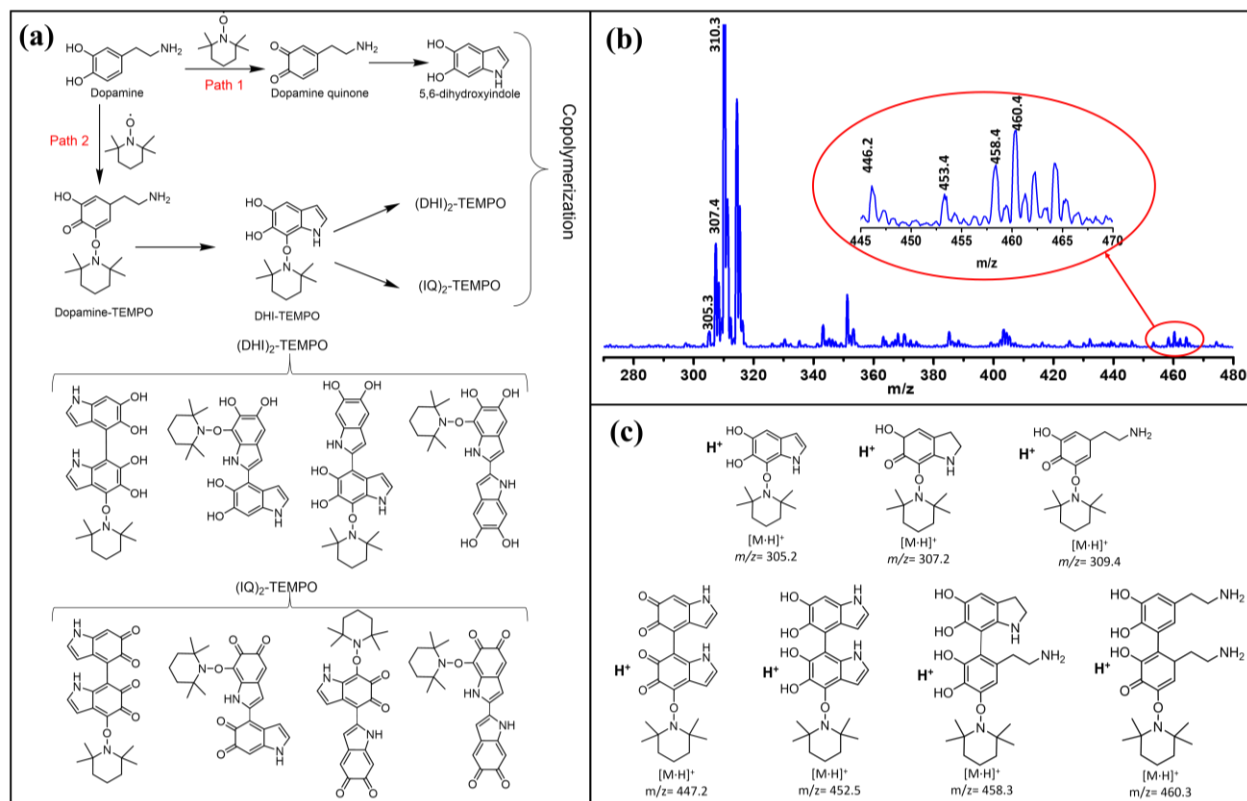
#### Other Supplementary Material for this manuscript includes the following:

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Movie S1

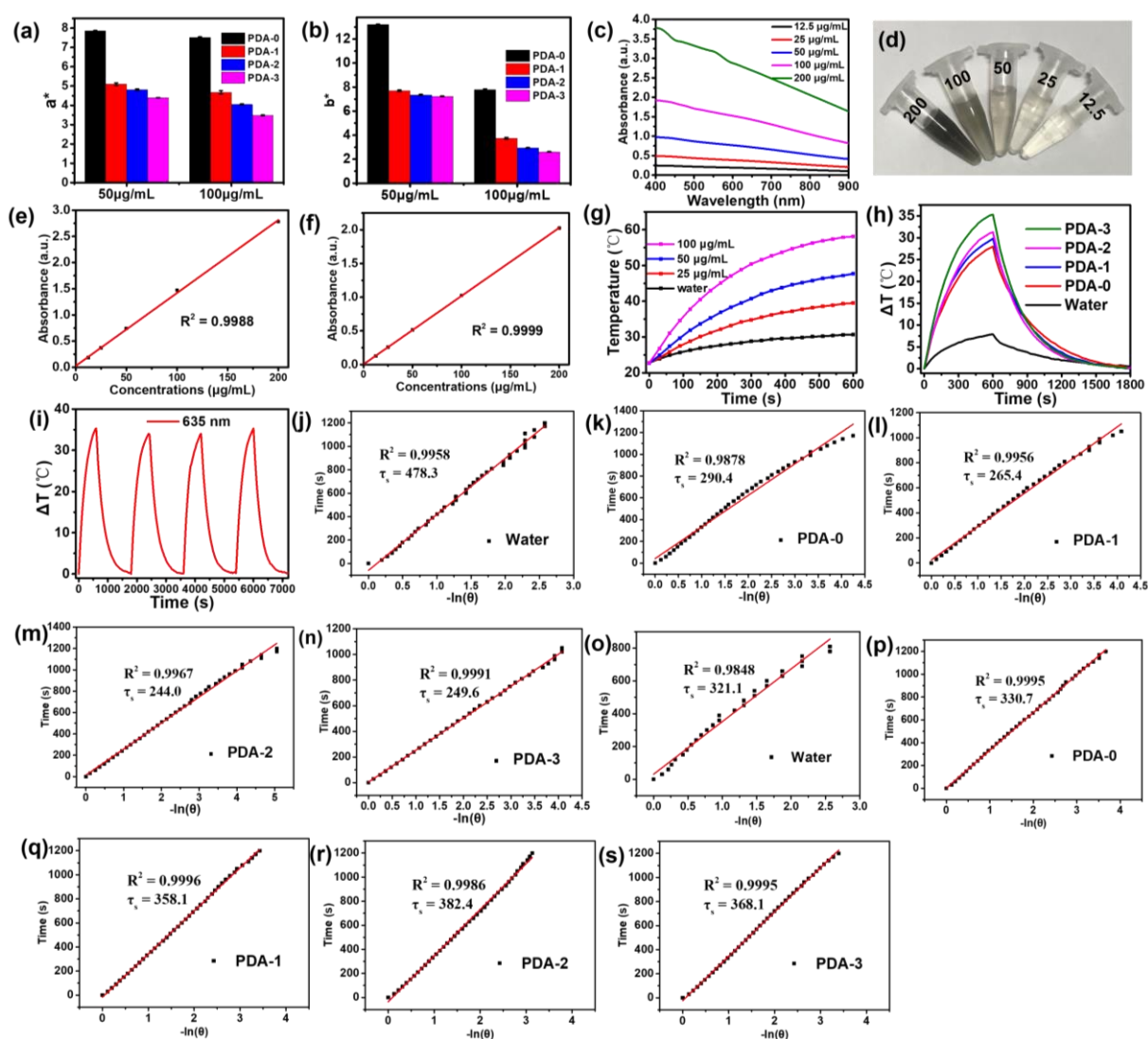


**Fig. S1. Characterization of PDA-*i* (*i*=0-3).** (a-c) SEM images of PDA-*i* (*i*=0-2) (Scale bar: 500 nm). (d) Hydrodynamic size of PDA NPs determined by DLS. (e) FTIR spectra of PDA-*i* (*i*=0-3) and TEMPO. (f-i) N 1s peaks in XPS spectra of PDA-*i* (*i*=0-3). (j-m) O 1s peaks in XPS spectra of PDA-*i* (*i*=0-3).

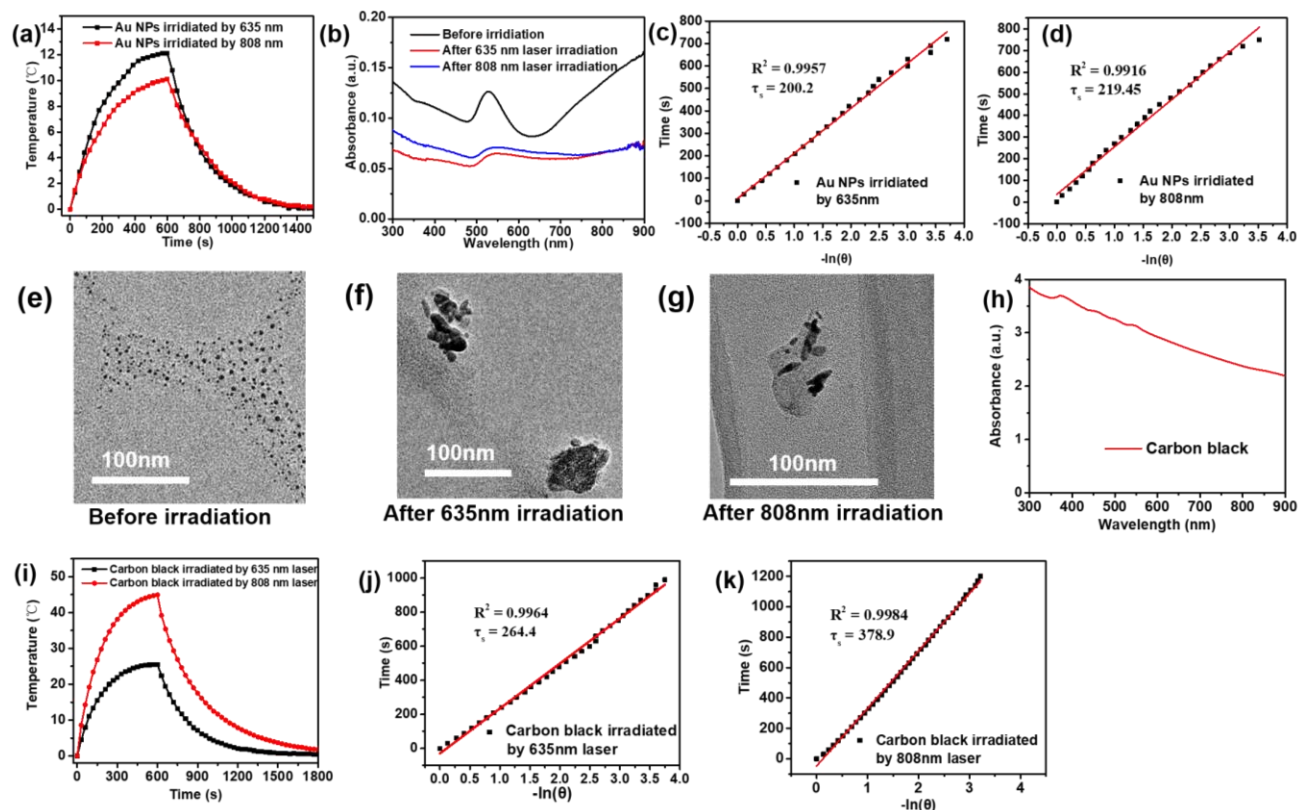


**Fig. S2. Proposed reaction pathways and intermediates formation during the polymerization of dopamine and TEMPO.** (a) Proposed reaction pathways and mechanism during the polymerization of dopamine and TEMPO. (b) ESI-MS spectrum of the crude product

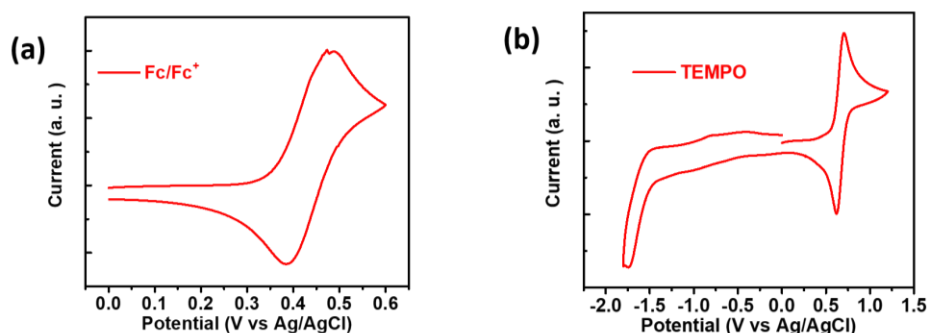
solution after 5 min reaction; (c) Proposed intermediate molecular structures assigned to main peaks in (b).



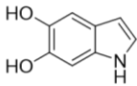
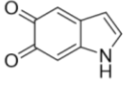
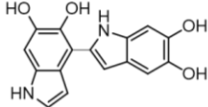
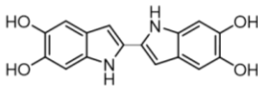
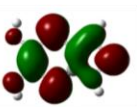
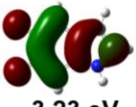
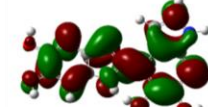
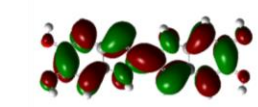
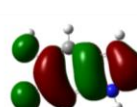
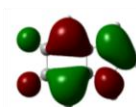
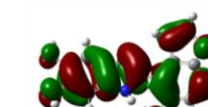
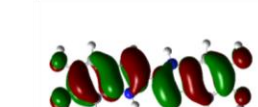
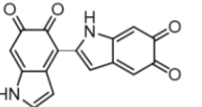
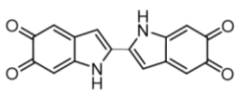
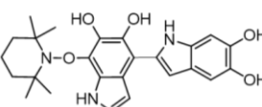
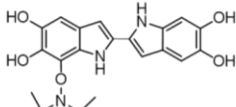
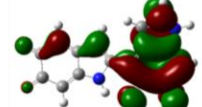
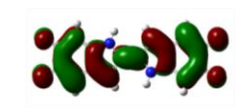
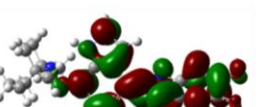
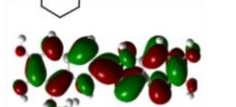
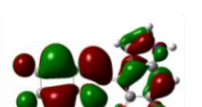
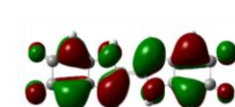

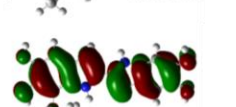
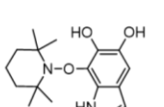
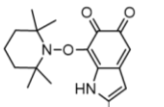
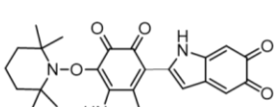
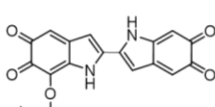
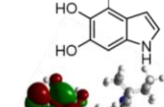
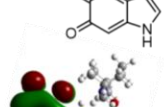

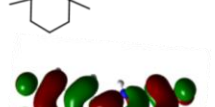
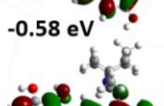
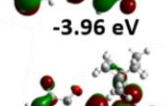
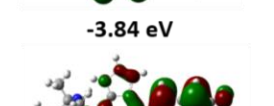
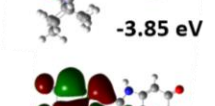
**Fig. S3.** Light absorption and photothermal behaviors of PDA-*i* (*i*=0-3). CIELAB color variable of different PDA aqueous solutions: (a)  $a^*$ , (b)  $b^*$ , in Figure 3a. (c) UV-vis absorbance spectra of PDA-3 with different concentrations. (d) Photograph of PDA-3 dispersion in water with different concentrations. A linear relationship for the optical absorbance at (e) 635 nm and (f) 808 nm as a function of the concentration of PDA-3. (g) Temperature elevations of PDA-3 with different concentrations under 635 nm laser irradiation. (h) The photothermal response curves of PDA-*i* (*i*=0-3) aqueous solutions (100 µg/mL) for 600 s with 635 nm laser irradiation and then the laser was shut off. (i) Temperature curves of PDA-3 (100 µg/mL) under four on/off cycles under and 635 nm laser irradiation. The light intensity of 635 nm laser was 1.8 W cm<sup>-2</sup>. (j-n) Linear time data versus  $-\ln(\theta)$  obtained from the cooling period of water and PDA-*i* (*i*=0-3) aqueous solutions in Fig. 2E. (o-s) Linear time data versus  $-\ln(\theta)$  obtained from the cooling period of water and PDA-*i* (*i*=0-3) aqueous solutions in fig. S3h. Photo credit Yuan Zou, Sichuan University.



**Fig. S4. Photothermal behaviors of Au NPs and carbon black.** (a) Temperature elevation of Au NPs aqueous solutions (100  $\mu\text{g}/\text{mL}$ ) under 635 nm and 808 nm laser irradiation. (b) UV-vis spectra of Au NPs before irradiation and after 635 nm and 808 nm laser irradiation. (c-d) Linear time data versus  $-\ln\theta$  obtained from the cooling period of Au NPs aqueous solutions in (a). TEM images of Au NPs (e) before and after (f) 635 nm and (g) 808 nm laser irradiation. (h) UV-vis spectra of carbon black aqueous solution (100  $\mu\text{g}/\text{mL}$ ). (i) Temperature elevation of carbon black aqueous solution (100  $\mu\text{g}/\text{mL}$ ) under 635 nm and 808 nm laser irradiation. (j-k) Linear time data versus  $-\ln\theta$  obtained from the cooling period of carbon black aqueous solutions in (i).

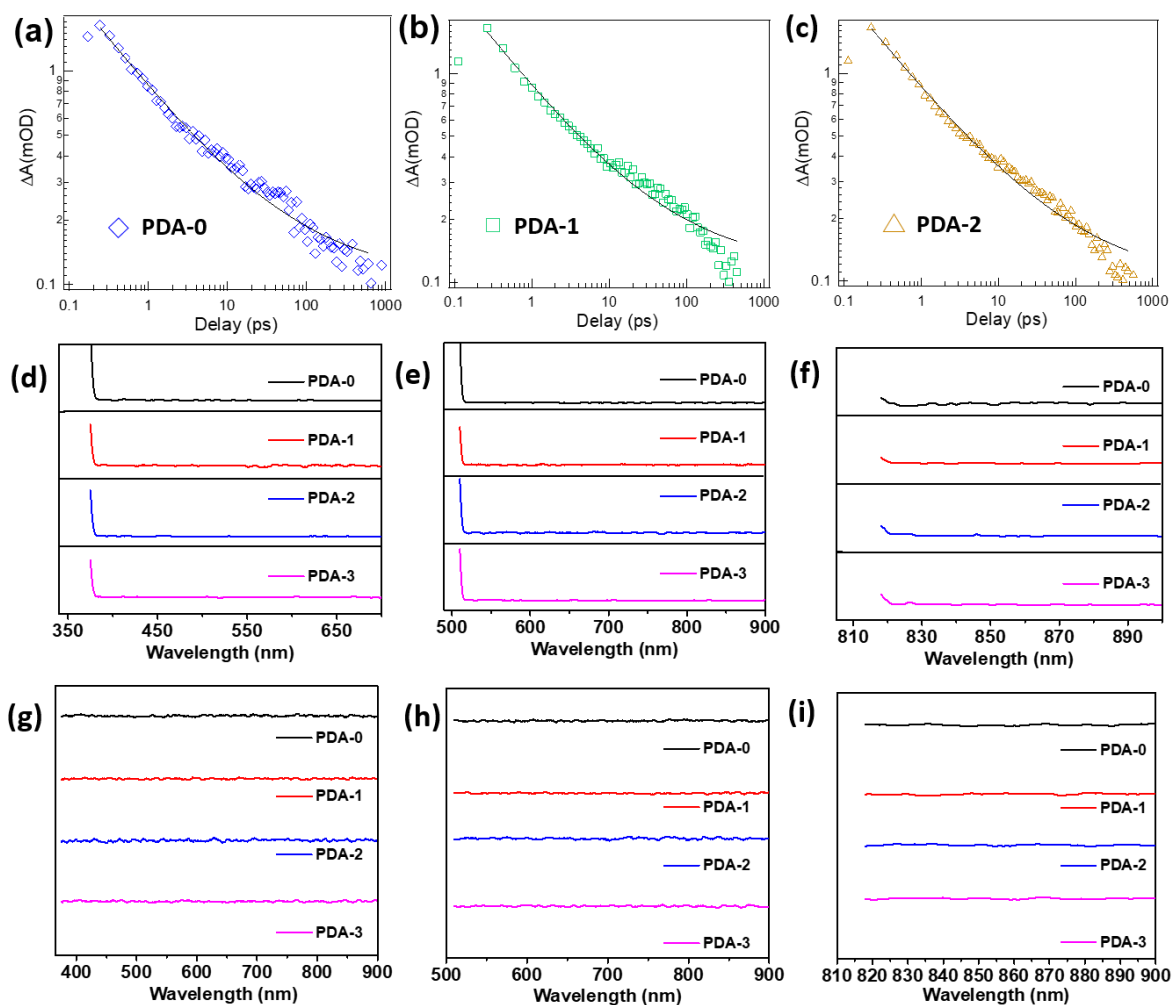


**Fig. S5. Cyclic voltammograms of ferrocene/ferrocenium ( $\text{Fc}/\text{Fc}^+$ ) couple and TEMPO.**

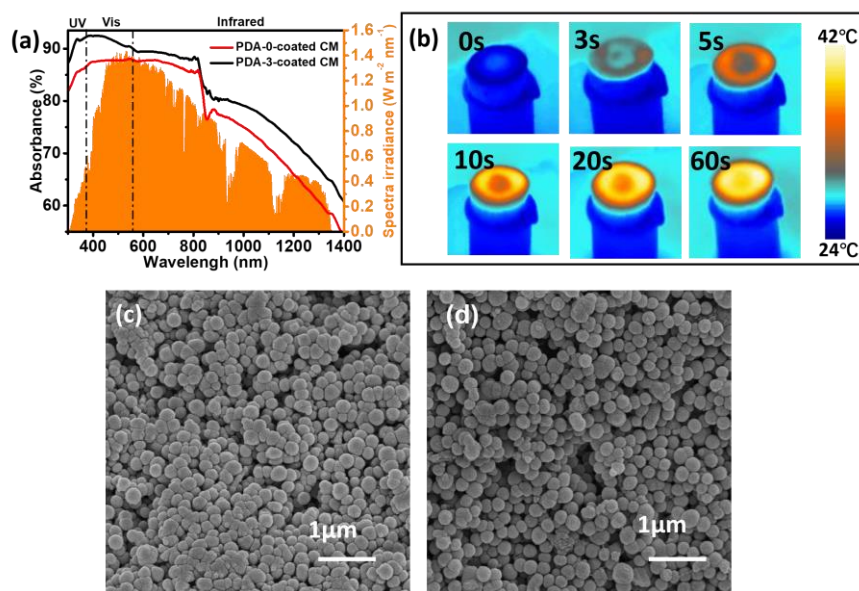
<b>(a)</b>	<b>Molecule structure</b>				
	<b>LUMO</b>	 -0.05 eV	 -3.23 eV	 -0.69 eV	 -0.79 eV
	<b>HOMO</b>	 -5.00 eV	 -5.81 eV	 -4.76 eV	 -4.59 eV
	<b>Bandgap</b>	4.95 eV	2.58 eV	4.07 eV	3.80 eV
<b>(b)</b>	<b>Molecule structure</b>				
	<b>LUMO</b>	 -4.15 eV	 -4.10 eV	 -0.43 eV	 -0.65 eV
	<b>HOMO</b>	 -5.52 eV	 -6.26 eV	 -4.53 eV	 -4.47 eV
	<b>Bandgap</b>	1.37 eV	2.16 eV	4.10 eV	3.82 eV
<b>(c)</b>	<b>Molecule structure</b>				
	<b>LUMO</b>	 -0.58 eV	 -3.96 eV	 -3.84 eV	 -3.85 eV
	<b>HOMO</b>	 -4.33 eV	 -4.98 eV	 -5.05 eV	 -5.65 eV
	<b>Bandgap</b>	3.75 eV	1.02 eV	1.21 eV	1.80 eV

**Fig. S6.** Chemical structures of possible moieties within PDA microstructure and theoretical calculated frontier molecular orbital using DFT calculations at the B3LYP/6-31 G(d, p) level.





**Fig. S7. Absorption property of PDA-i (i=0-3).** (a-c) EIA kinetic traces of PDA-i (i=0-2). Fluorescence spectra of PDA-i (i=0-3) aqueous solutions under the illumination of (d) 365 nm, (e) 500 nm and (f) 808 nm. Phosphorescence spectra of PDA-i (i=0-3) aqueous solutions under the illumination of (g) 365 nm, (h) 500 nm and (i) 808 nm.



**Fig. S8. Water desalination performance of PDA-3-coated CM.** (a) UV-Vis-NIR diffuse reflection spectra of the PDA-0-coated CM and PDA-3-coated CM in the main region of solar energy between 250 nm to 1400 nm. (b) IR images showing the temperature elevation of PDA-3-coated CM under 1 sun at various time points. The SEM image of PDA coated film before (c) and after (d) washing (after 30 cycles).

**Table S1.** Evaporation rate of various water evaporators under 1 sun illumination.

Evaporator		Evaporation rate ( $\text{kg m}^{-2} \text{h}^{-1}$ )	Ref	Years
	PDA-coated wood	1.38	(37)	2017
	PDA-filled BNC	1.13	(38)	2017
PDA-based evaporators	PDA-coated PVDF membrane	~0.65	(39)	2018
	PDA-functionalized sponge	1.18	(40)	2019
	PDA-coated PU sponge	0.83	(41)	2017
<b>PDA-3-coated CM</b>		<b>1.53</b>	<b>This work</b>	

**Movie S1.** Water steam was generated quickly on the top of PDA-3-coated CM under 4 sun illumination.