Supporting Information

**Polymer-coated daikon-based sunlight absorbers for highly efficient interface solar steam generation**

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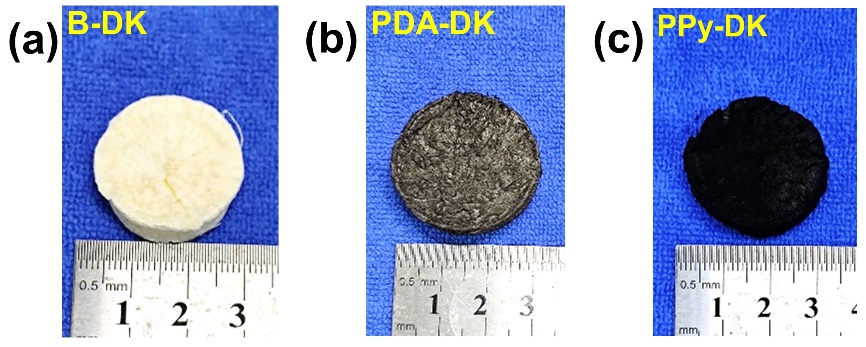
#These authors contributed equally to this work and should be considered co-first authors

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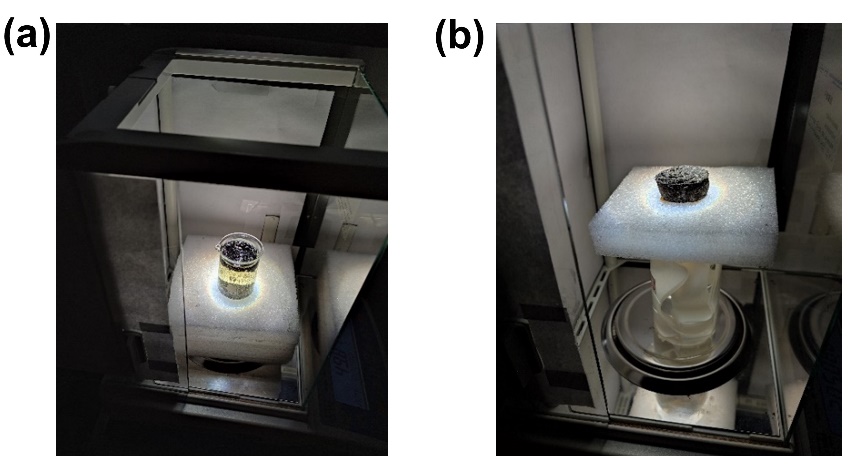
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**Characterization**

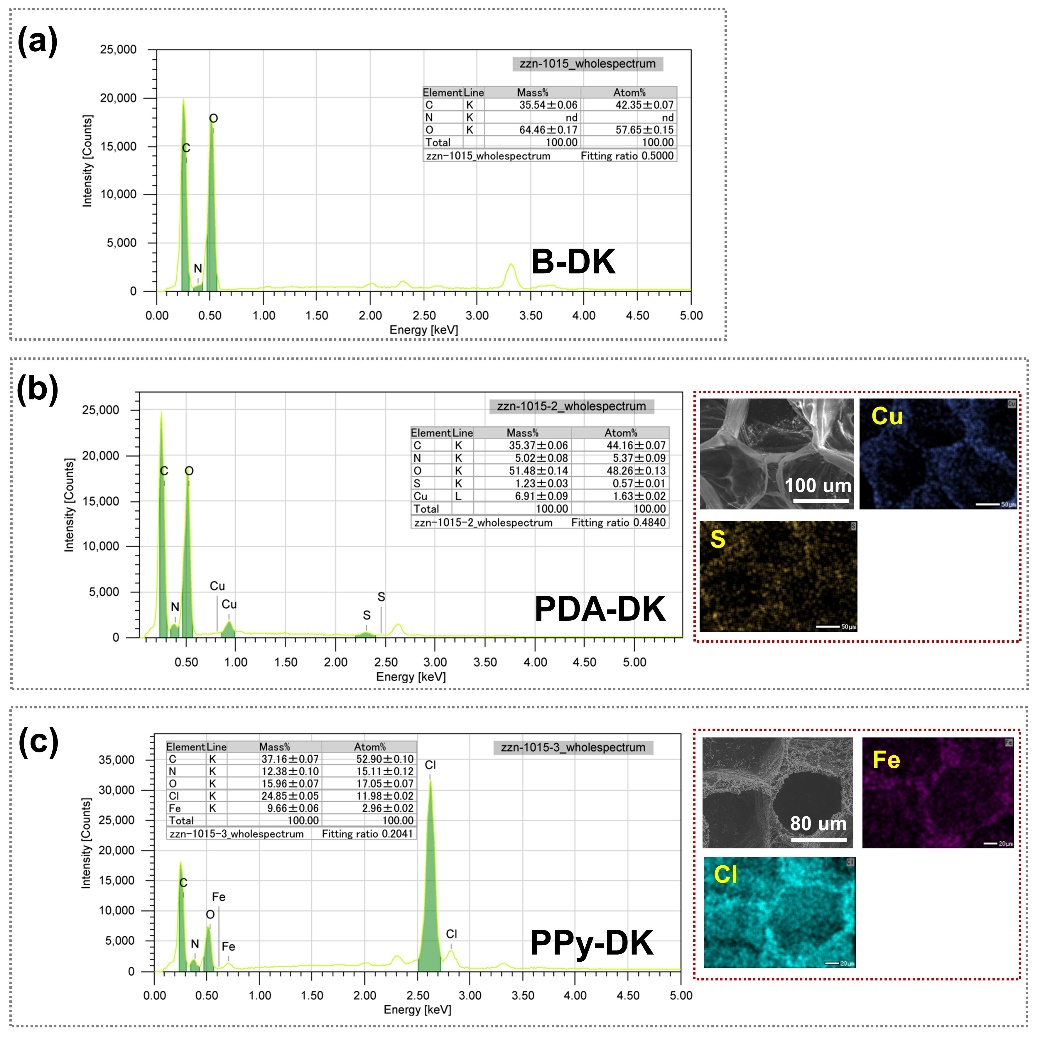
SEM was characterized through JEOL InTouchScope (JSM-IT500) SEM. XRD patterns were carried out on a Rigaku Ultima IV diffractometer with a Cu Kα radiation source. XPS analysis was detected on a Kratos Axis Ultra with a Delay Line Detector photoelectron spectrometer utilizing an aluminum monochromatic X-ray source. FT-IR spectra were recorded by a Thermos Nicolet FT-IR spectrophotometer (model 6700). UV-Vis-NIR spectra were measured by Solid Spec-3700 Shimadzu. SCAs were performed on a contact angle meter (OAC20, DaraPhysics) through the static sessile drop method. The concentrations of Na+, Mg2+, K+, Ca2+, Fe3+ and Cu2+ were detected by inductively coupled plasma-mass spectroscopy (ICP-MS) using Agilent 7700. UV-vis absorption spectra were carried out on TU-1950 Persee. The simulated solar intensity was calibrated by PL-MW2000 optical density meter from Perfectlight.



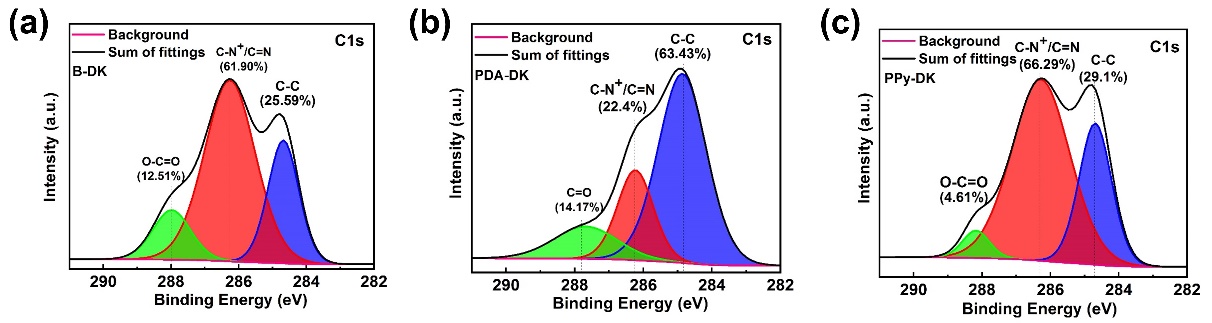
**Figure S1**. Photograph and diameter of (a) B-DK; (b) PDA-DK; (c) PPy-DK.



**Figure S2.** (a) The diagram of PPy-DK was direct put on the bulk water for solar steam generation; (b) the diagram of polyethylene foam (PEF) as insulating layer in PPy-DK system for solar steam generation.



**Figure S3**. (a) The energy dispersive X-ray (EDX) spectroscopy B-DK; (b) the EDX spectroscopy and element mapping of PDA-DK; (c) the EDX spectroscopy and element mapping of PPy-DK.



**Figure S4**. The high-resolution C 1s spectra of (a) B-DK; (b) PDA-DK; (c) PPy-DK.

**Calculation equation of UV–Vis–NIR of B-DK, PDA-DK and PPy-DK**

The solar absorption ability of B-DK, PDA-DK and PPy-DK is calculated through the following equation [S1,S2]:

*A* = [ʃ(1– *R*)·*S*·*dλ*] / [*S*·*dλ*]

*A* stands for the solar absorption, *R* represents the reflectance. *S* is solar spectral irradiance (W m–2 nm–1). *λ* denotes the wavelength (nm).

**Table S1**. Proportion of light absorption in different spectral regions (300 – 2500 nm)

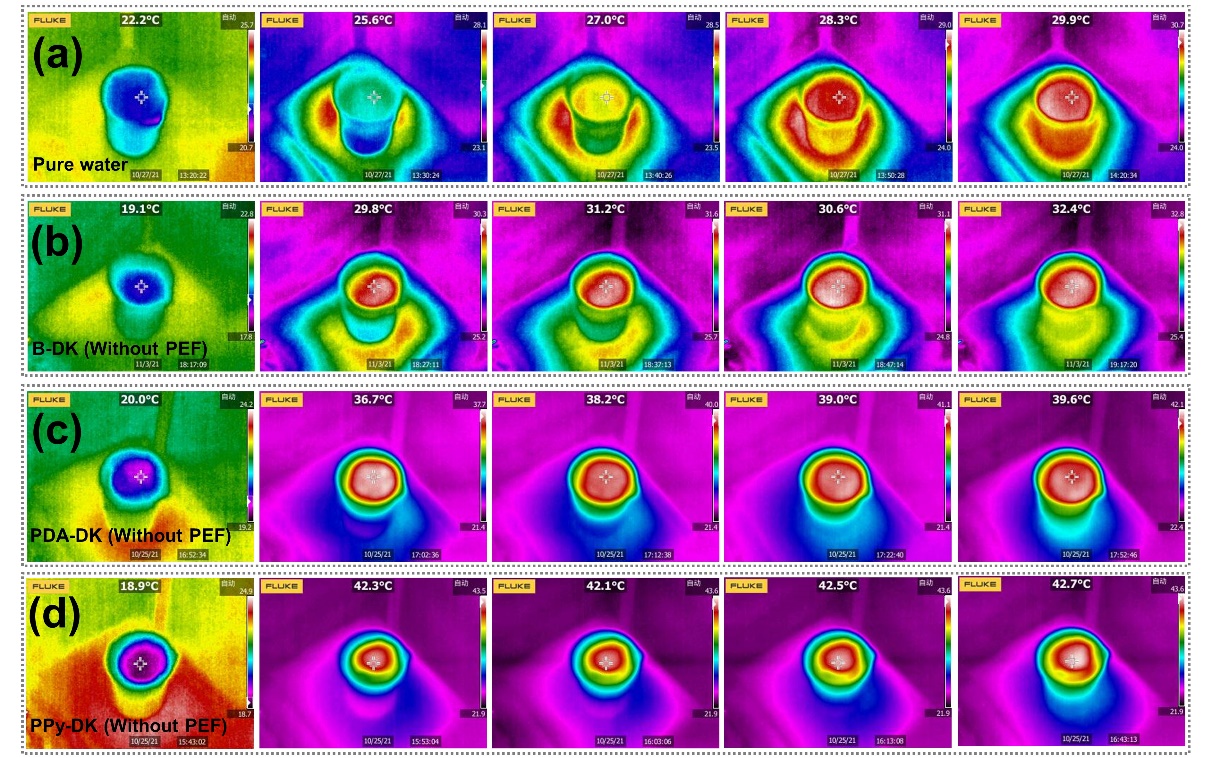
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sample | Total  absorption | UV  (300 – 400 nm) | Visible  (401 – 760 nm) | Infrared  (761 – 2500 nm) |
| Solar spectrum | 100.00% | 3.62% | 51.44% | 44.94% |
| B-DK | 33.13% | 2.00% | 16.83% | 14.30% |
| PDA-DK | 85.63% | 3.45% | 48.16% | 34.02% |
| PPy-DK | 98.11% | 3.58% | 50.90% | 43.63% |

**Calculation equation of photothermal conversion efficiency (*η*)**

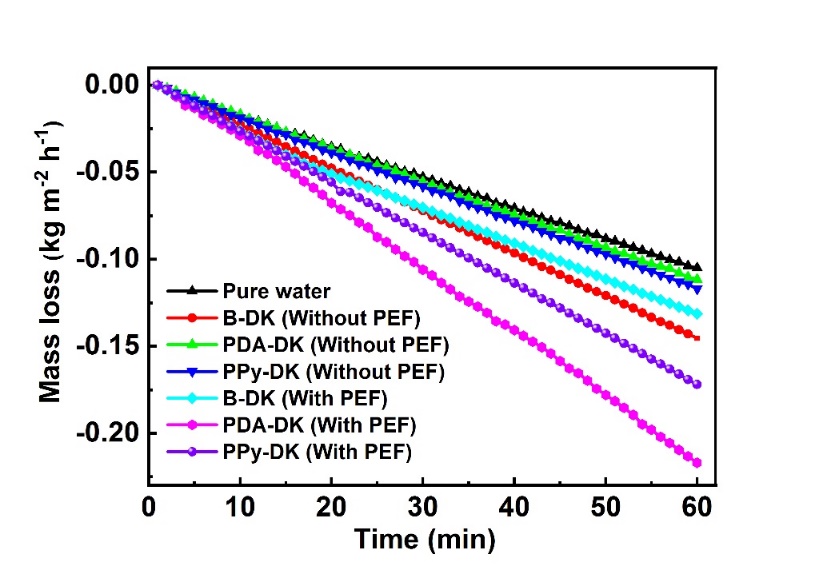
The solar energy conversion efficiency (*η*) is calculated through the following equations [S3,S4]:

*η* = *m*(*H*LV + *Q*)/*I*; *H*LV = 1.91846 × 106[*T*1/(*T*1－33.91)]2; *Q* = *c*(*T*1－*T*0)

Where *m* is the net water evaporation rate (kg m–2 h–1). *H*LV is the liquid-vapor phase change enthalpy. *Q* is the sensible heat (J kg–1). *I* stands for the power density of solar illumination. *T*1 is the temperature of evaporation (K), *T*0 is the initial temperature of the water, *c* is the specific heat capacity of bulk water (4.2 J g–1 K–1).



**Figure S5.** (a) IR images of pure water; (b) IR images of B-DK (without PEF); (c) IR images of PDA-DK (without PEF); (d) IR images of PPy-DK (without PEF) at 0, 10, 20, 30 and 60 mins, respectively.



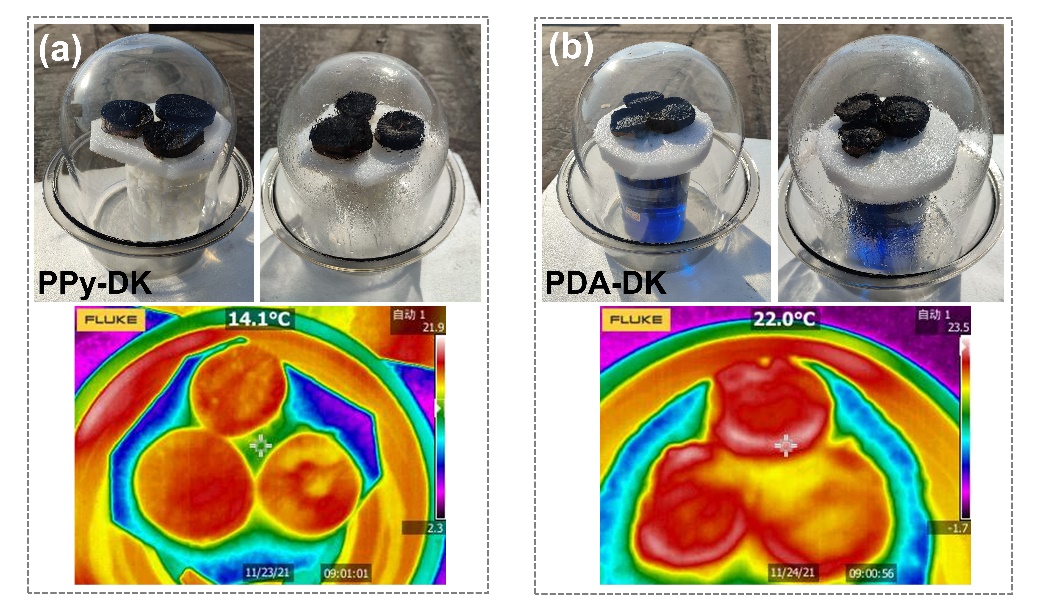
**Figure S6.** The dark field evaporation rates of pure water, B-DK (Without PEF), PDA-DK (Without PEF), PPy-DK (Without PEF), B-DK (With PEF), PDA-DK (With PEF) and PPy-DK (With PEF), respectively.

**Table S2. Comparison of solar steam generation performance of PDA-DK with some previously reported PDA coated photothermal materials under 1-sun illumination**

|  |  |  |  |
| --- | --- | --- | --- |
| Entry | Photothermal material | Evaporation rate  (kg m-2 h-1) | Reference in S.I. |
| 1 | PDA-based bacterial nanocellulose | 1.00 | [S5] |
| 2 | PDA-based cellulose aerogel | 1.36 | [S6] |
| 3 | Ag-PDA@Wood | 1.58 | [S7] |
| 4 | PDA-carbon black-based PP non-woven fabric | 1.68 | [S8] |
| 5 | PDA-RGO-PTFE film | 1.45 | [S9] |
| 6 | Ag-PDA@Wooden flower | 2.08 | [S10] |
| 7 | PDA-DK | 1.50 | This Work |

**Table S3. Comparison of solar steam generation performance of PPy-DK with some previously reported PPy coated photothermal materials under 1-sun illumination**

|  |  |  |  |
| --- | --- | --- | --- |
| Entry | Photothermal material | Evaporation rate  (kg m-2 h-1) | Reference in S.I. |
| 1 | PPy-Wood | 1.33 | [S11] |
| 2 | PPy-Sponge | 1.45 | [S12] |
| 3 | PPy-based melamine foam | 1.57 | [S13] |
| 4 | PPy-based sugarcane | 1.59 | [S14] |
| 5 | PPy-based polyvinyl alcohol | 1.68 | [S15] |
| 6 | PPy-paper | 1.38 | [S16] |
| 7 | PPy-based natural latex | 1.76 | [S17] |
| 8 | PPy-based sunflower discs | 1.74 | [S18] |
| 9 | PPy-DK | 1.60 | This Work |

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**Figure S7**. (a) Outdoor experiment of PPy-DK for desalination; (b) Outdoor experiments of PDA-DK for purification dyeing wastewater (methyl blue solution 20 mg L–1).

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