Supporting Information

Salt-tolerant, Scalable Janus Fabric Evaporator for Desalination and Multi-species Wastewater Purification

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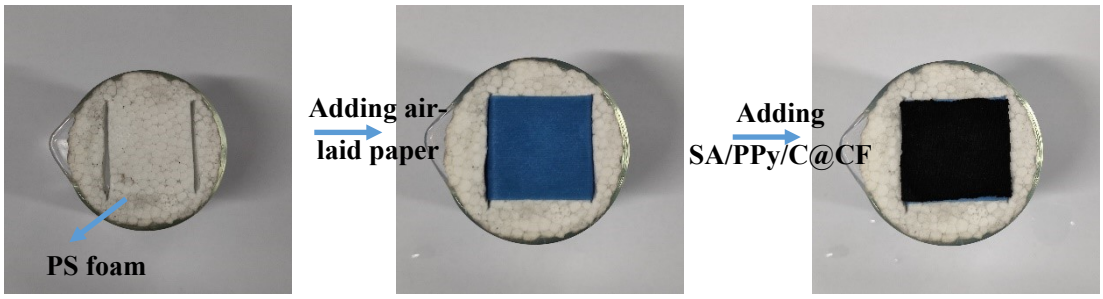

Fig. S1. The assembly process of the evaporator.

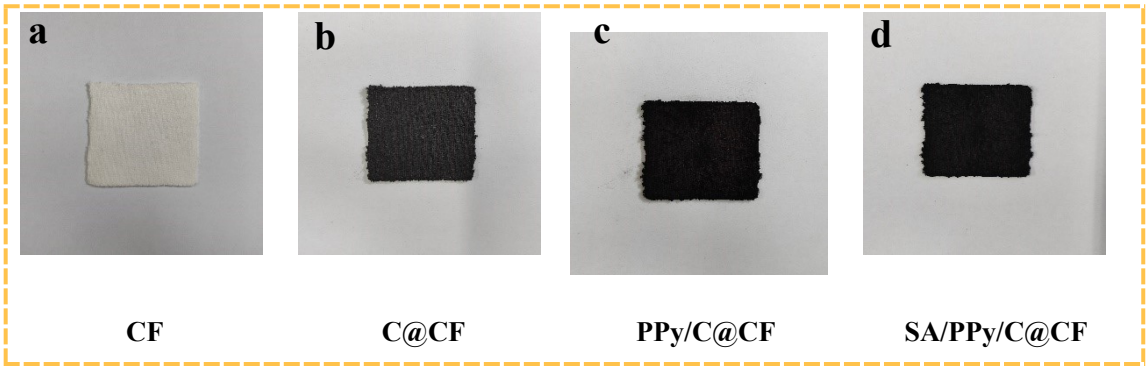

Fig. S2. Photographs of (a) CF, (b) C@CF, (c) PPy/C@CF, (d) SA/PPy/C@CF, respectively.

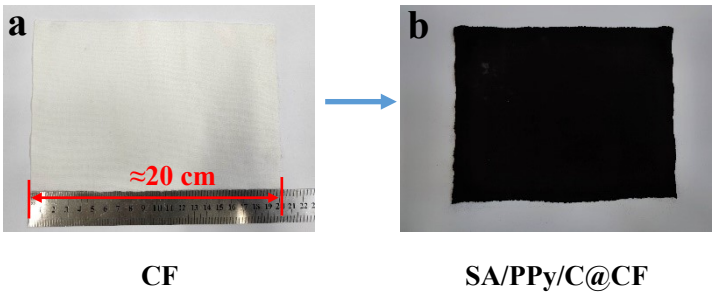

Fig. S3. Photographs of a large-size (a) CF and (b) SA/PPy/C@CF.

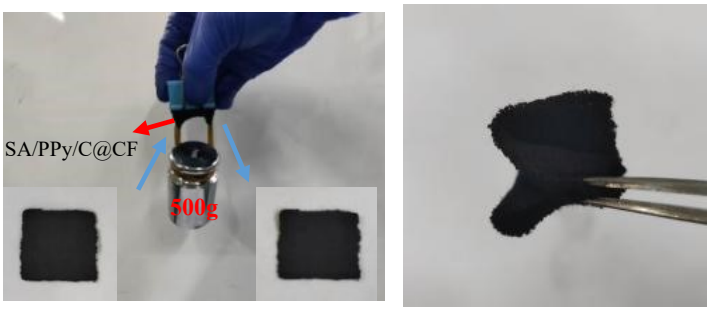

Fig. S4. Photographs of SA/PPy/C@CF with excellent mechanical strength and good flexibility.

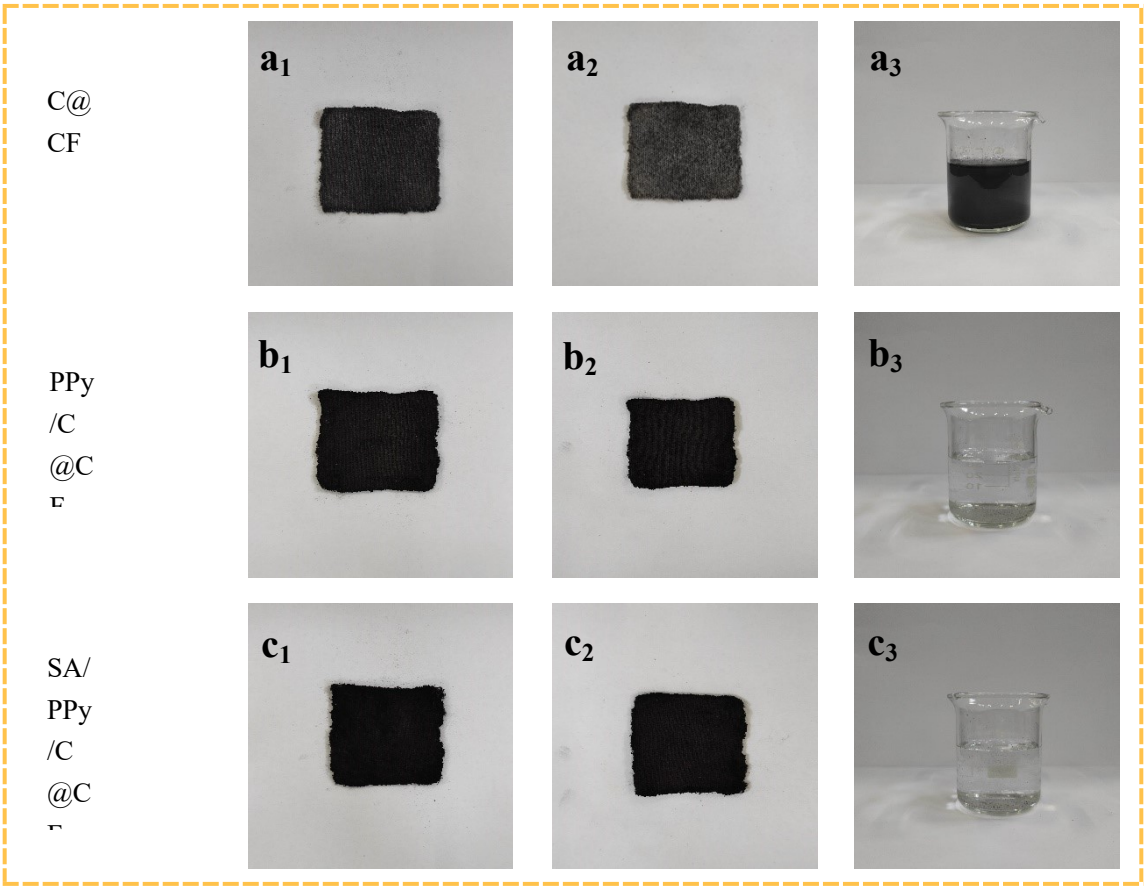

Fig. S5. (a_1, b_1, c_1) Photographs of C@CF, PPy/C@CF and SA/PPy/C@CF before sonication in water. (a_2, b_2, c_2) Photographs of C@CF, PPy/C@CF and SA/PPy/C@CF after 30min of sonication in water. (a_3, b_3, c_3) Photographs of aqueous solutions of C@CF, PPy/C@CF and SA/PPy/C@CF after 30min sonication in water.

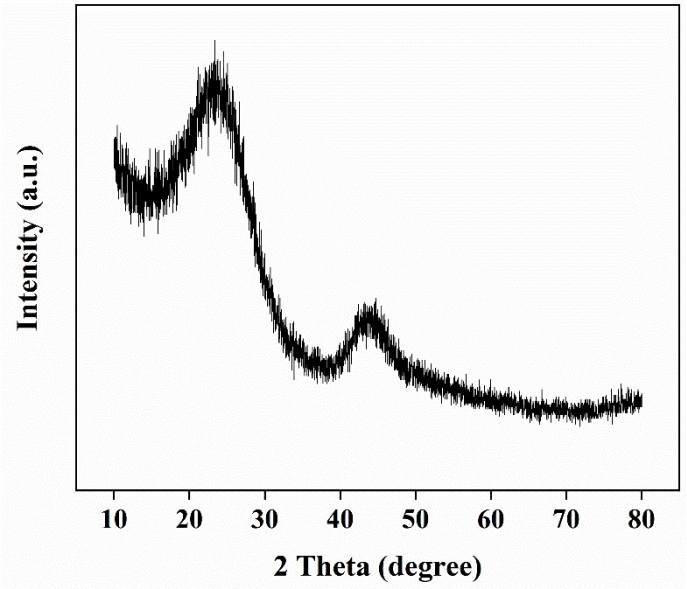

Fig. S6. XRD patterns of carbonized corncob powder (C).

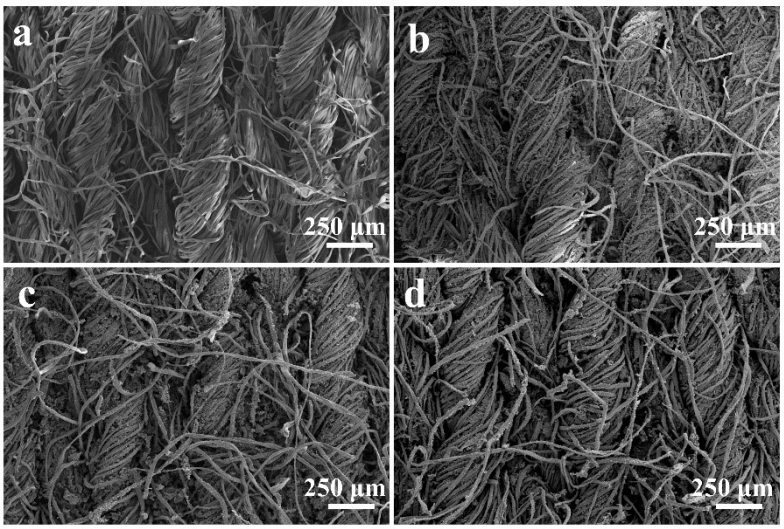

Fig. S7. Low magnification SEM images of (a) CF, (b) C@CF, (c) PPy/C@CF, (d) SA/PPy/C@CF.

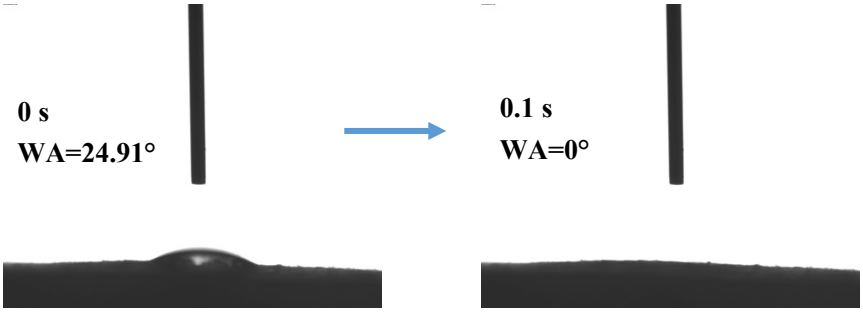

Fig. S8. Image of the contact angle of water droplets on the air-laid paper surface over

time.

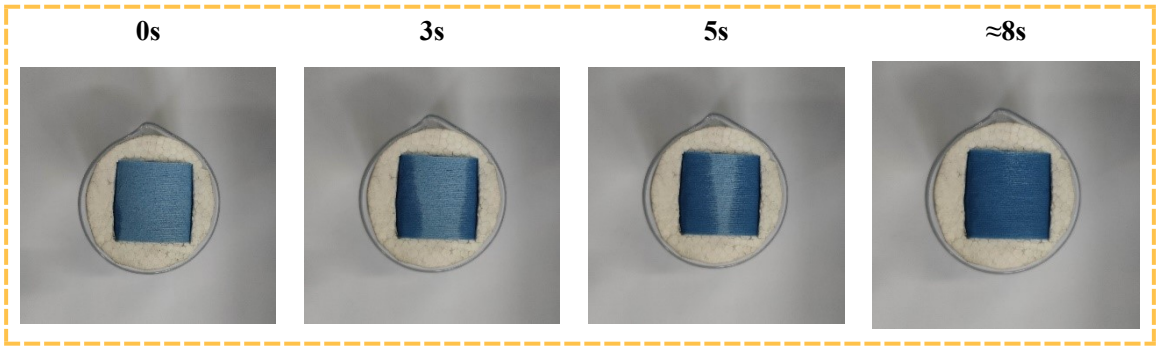

Fig. S9. Test of the time it takes for air-laid paper to transport water to the evaporator surface.

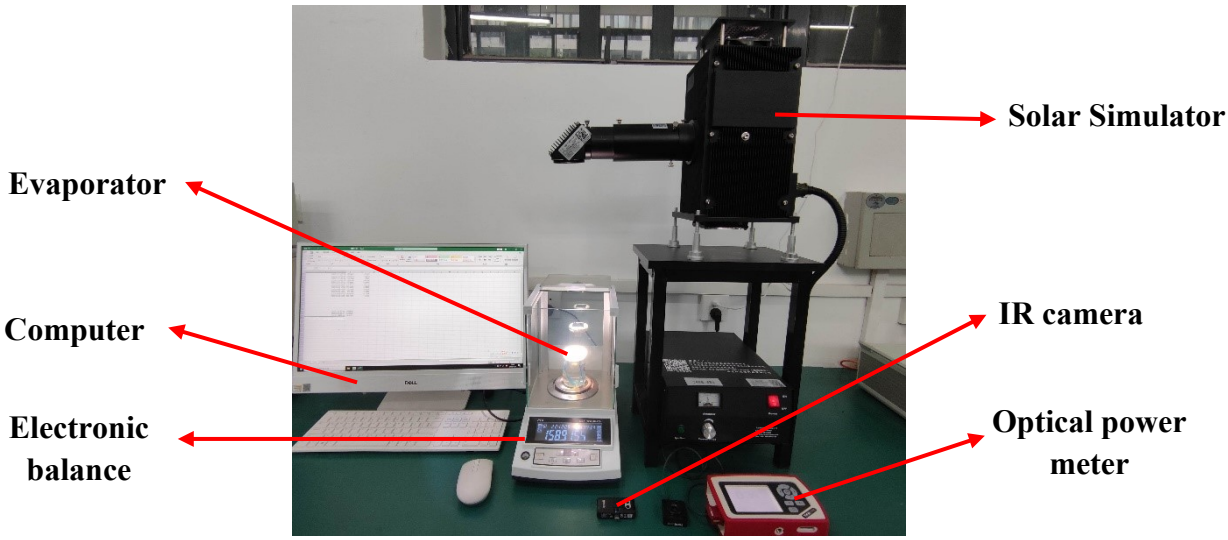

Fig. S10. Solar steam generation test system.

Table S1. The weight parameters of SA/PPy/C@CF were prepared three times in duplicate.

Samples	M_1 (CF)	M_2 (C@CF)	M_3 (PPy/C@CF)	M_4 (SA/PPy/C@CF)	$\triangle G(M_4\text{-}M_1)$
1	0.2052 g	0.2546 g	0.2956 g	0.2996 g	0.0914 g
2	0.2044 g	0.2530 g	0.2971 g	0.2979 g	0.0935 g
3	0.2050 g	0.2566 g	0.2947 g	0.2957 g	0.0907 g

Average	0.2049 g	0.2547 g	0.2958 g	0.2988 g	0.0919 g

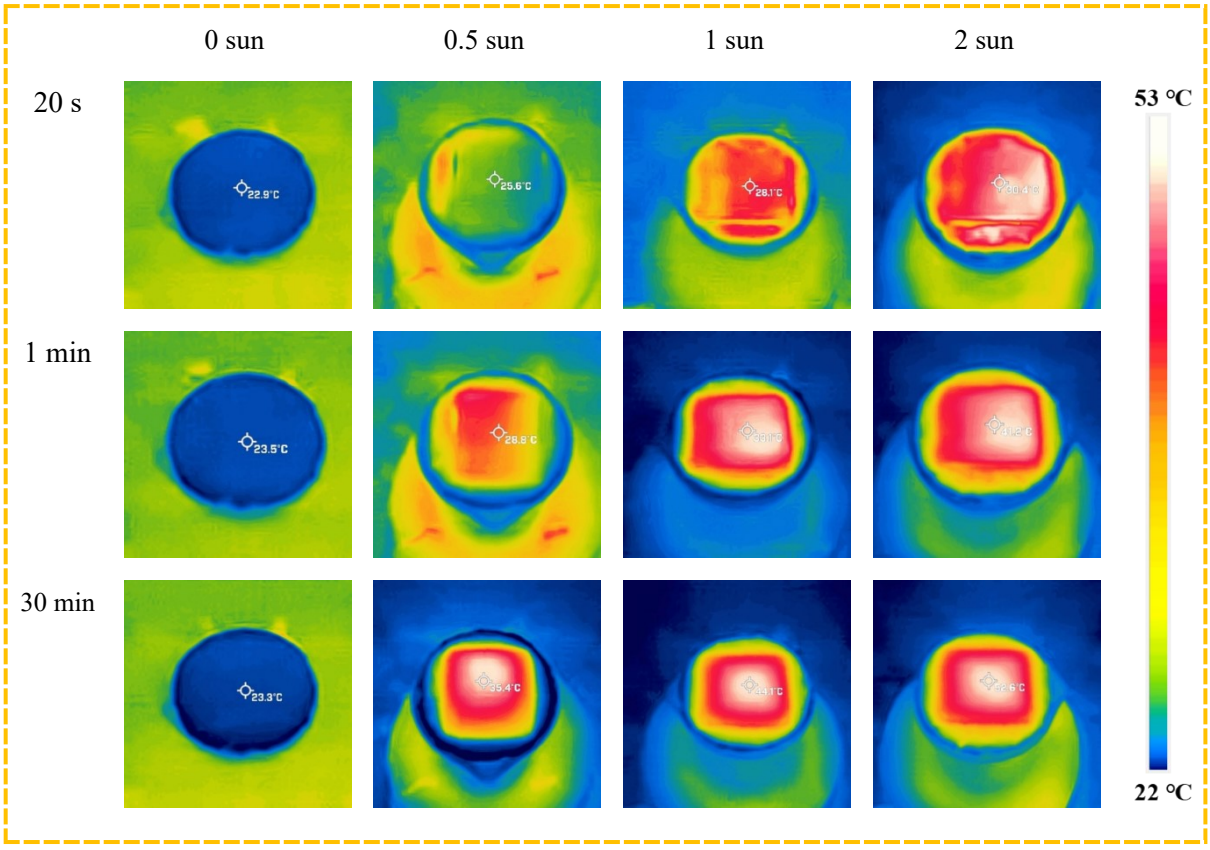

Fig. S11. IR images of SA/PPy/C@CF evaporator under different light intensity irradiation.

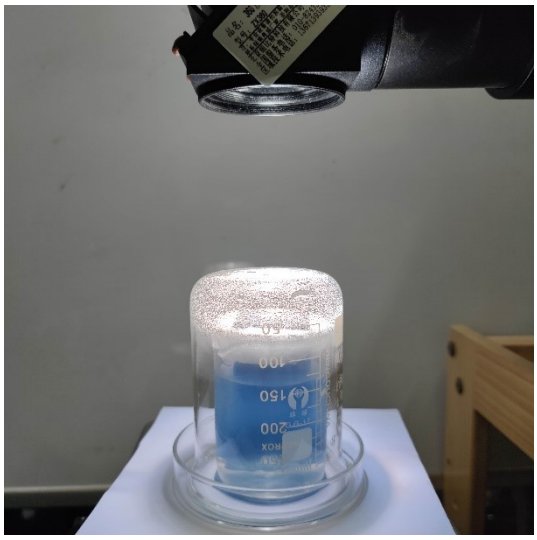

Fig. S12. Digital photographs of indoor evaporative condenser.

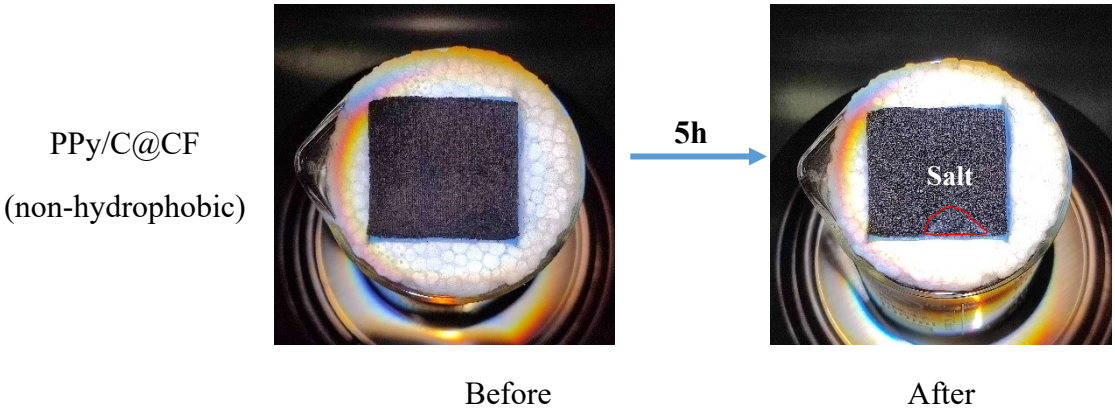

Fig. S13. Digital photographs of non-hydrophobic PPy/C@CF for seawater desalination within 5 h under 1 sun.

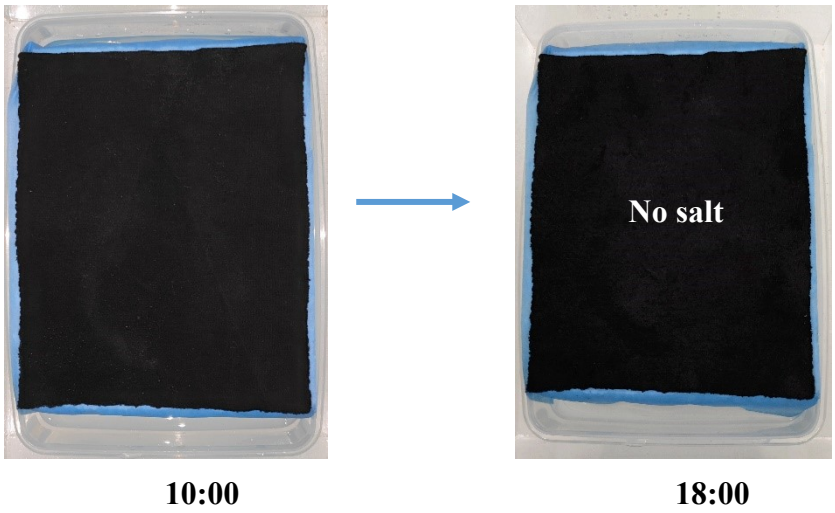

Fig. S14. Digital photographs of SA/PPy/C@CF for outdoor seawater desalination.

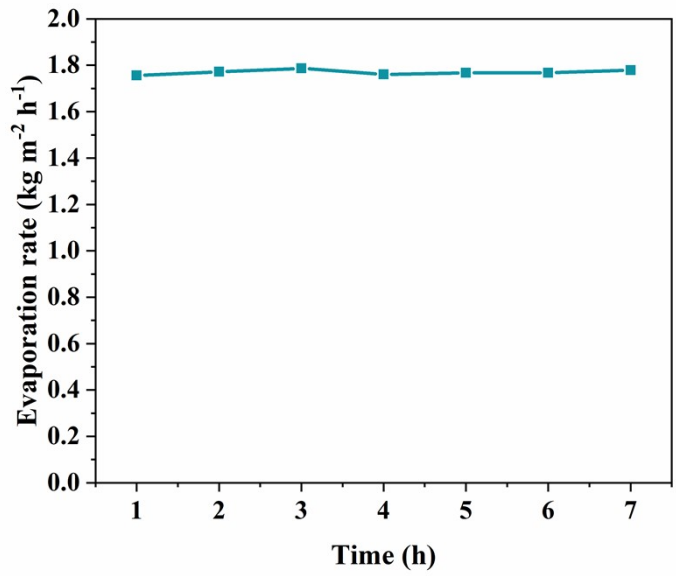

Fig. S15. Stability of SA/PPy/C@CF evaporative pump oil-water emulsion.

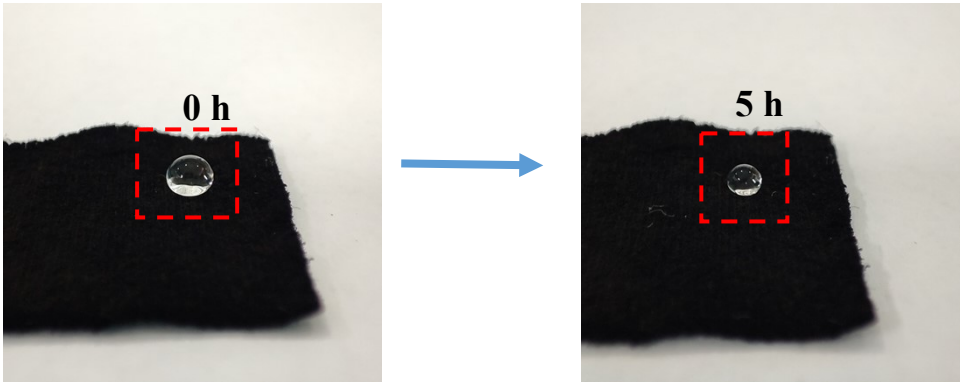

Fig. S16. Photos of droplet impregnation process on the surface of SA/PPy/C@CF.

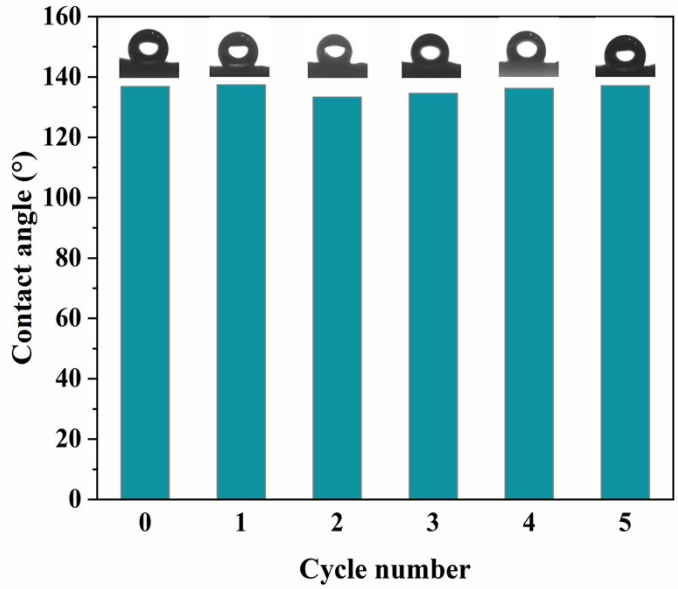

Fig. S17. Cyclic hydrophobicity of SA/PPy/C@CF evaporated seawater.

Calculation of absorption rate

The absorption spectrum is calculated from the reflection and transmission spectra with the following equation:

$$A = 100\% - R - T \qquad \text{(Eq. S1)}$$

Where the A is absorption, T refer to reflectivity and the R is transmittance.

Calculation of evaporation efficiency

The solar energy conversion efficiency (η) was calculated according to the following equation:

$$\eta = \frac{m' \times h_{LV}}{C_{opt} \times q_0} \qquad \text{(Eq. S2)}$$

where m' (kg m^{-2} h^{-1}) is the water evaporation rate calibrated with the dark evaporation rate, h_{LV} is the equivalent vaporization enthalpy of water in evaporator, C_{opt} is the optical concentration, q_0 is the power density of 1 sun (kW m^{-2}).

$$m' = m_{light} - m_{dark}$$

where m_{light} (kg m^{-2} h^{-1}) is the evaporation rate under 1 sun, m_{dark} (kg m^{-2} h^{-1}) is the evaporation rate in the dark.

In this work, h_{LV} was calculated according to the reported method in reference [1-3]:

$$h_{LV} = \frac{h_{vap} \times m_0}{m_g}$$

where h_{vap} was the vaporization enthalpy of water at room temperature (25°C = 2443 J), m_0 was the evaporation rate of bulk water, m_g was the evaporation rate of the samples. Notably, here the water and samples had the same surface area, and the evaporation experiments were tested under dark condition with the same environmental temperature and humidity. The corresponding evaporation rates are listed in Table S2. Therefore, h_{LV} of the samples can be obtained and used in the efficiency calculation.

Table S2. Water evaporation rates of bulk water and the samples under dark condition.

Sample	Bulk water	CF	C@CF	PPy/C@CF	SA/PPy/C@CF
Evaporation rate / kg m^{-2} h^{-1}	0.1596	0.2103	0.1904	0.2157	0.2242

Table S3. Comparison of evaporation rate and efficiency based on various materials under one sun irradiation.

Materals	Evaporation rate ($kgm^{-2}h^{-1}$)	Evaporation efficiency (%)	References
CB/PMMA/PAN Janus absorber	1.3	72	4
Polypyrrole-functionalized pomelo peel (FPyPP)	1.22	76.61	5
Carbonized mushrooms	1.475	78	6
SiO_2@CoFe/C-700	1.26	76.81	7
PPy-bamboo	1.125	76.87	8
rGO-MWCNT membrane (G-88C)	1.22	80.4	9
PANI/Ag/MWCNTs-COOH/PDA@BC	1.37	84.7	10
MCNTs/CPIMs	1.26	72.7	11
M-TiO_2 @Ti	1.57	73.5	12
SA/PPy/C@CF	1.83	80.16	**This work**

References

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