Supporting Information

A Solar-Electro-Thermal Evaporation System with High Water-Production Based on a Facile Integrated Evaporator

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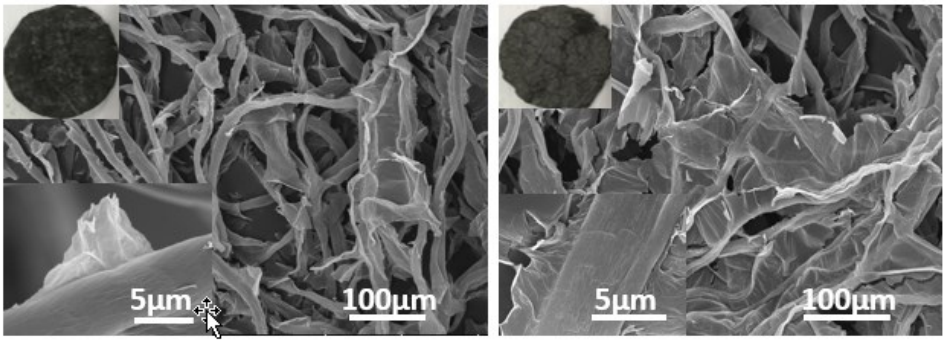

Figure S1. SEM images of carbonated degreasing cotton dipped in GO and pretreated at 800 °C and 900 °C

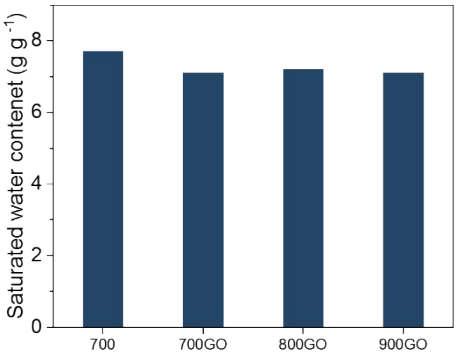

Figure S2. Saturated water contents in different evaporators.

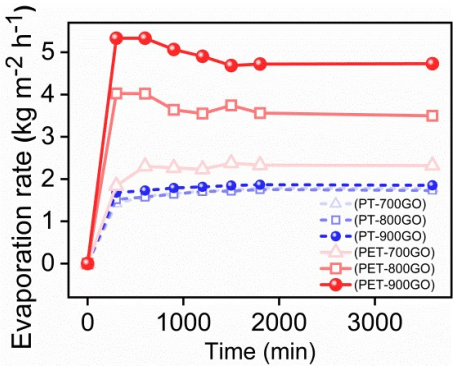

Figure S3. Evaporation rate over time from different evaporators under 1 sun illumination.

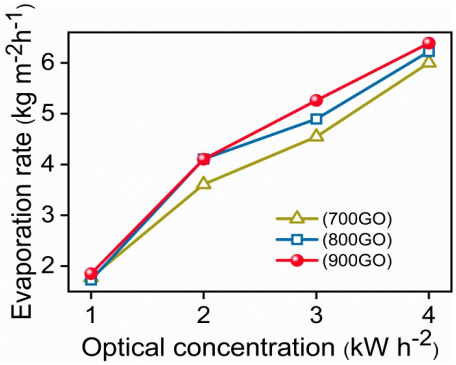

Figure S4. Evaporation rate of water through different evaporators under 1 to 4 suns illumination.

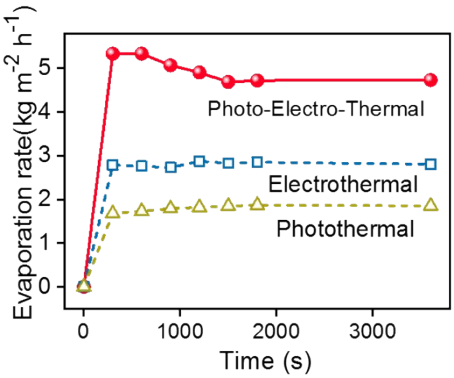

Figure S5. Evaporation rate of the 900GO evaporators with 1 sun illumination or with applied voltage over time.

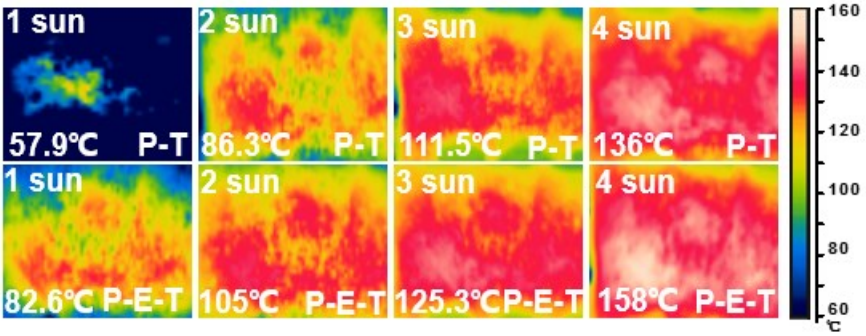

Figure S6. Infrared images of dry 900GO when illuminated with 1 to 4 suns, with/without electricity applied respectively (PT/PET).

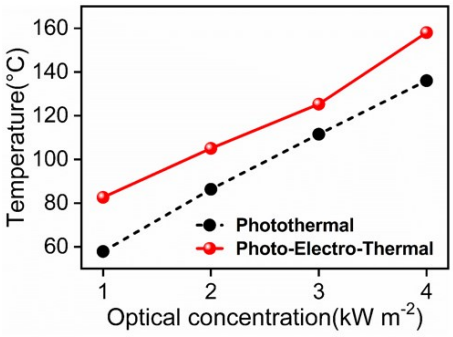

Figure S7. Surface temperatures of dry 900GO when illuminated with 1 to 4 suns, with/without electricity applied respectively.

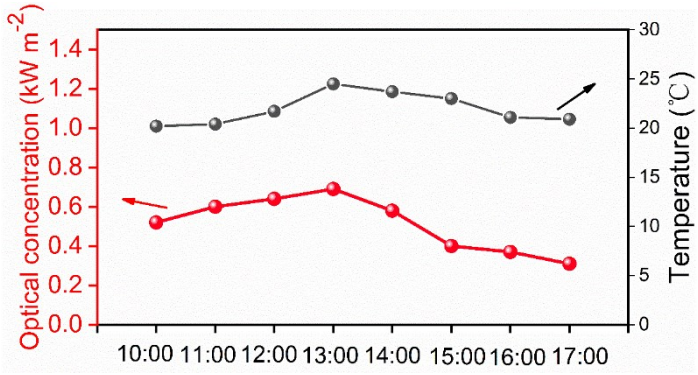

Figure S8. Outdoor solar intensity and temperature variation curves from 10:00 to 17:00 on June 16th, 2019.

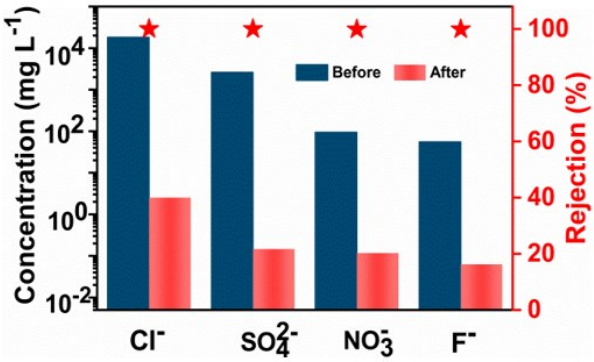

Figure S9. Measured ions concentration and rejection before and after evaporation during desalination.

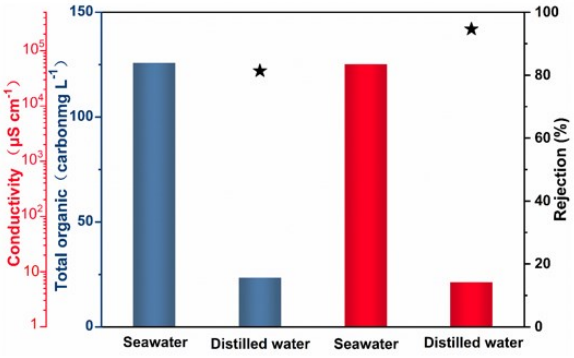

Figure S10. Measured the amount of TOC before and after evaporation during desalination.

Estimation of energy conversion

Here, the total energy conversion efficiency (η) regarded as an important parameter of the evaporation system were described by the following equation (1):

$$\eta=E_1/(E_2+E_3) \quad (1)$$

where E_1 represents the energy of required to produce water vapor, which could be described by the formula (2):

$$E_1= mH_{LV} \quad (2)$$

where m is the mass flux (without natural evaporation), H_{LV} is the total enthalpy of liquid vapor phase change, that include the energy of the liquid phase raised the temperature and requires for vaporization, here, the generation of steam rate of evaporation system based on photo-electro-thermal could be 4.7 kg m^{-1} h^{-1}, when the surface temperature was tested to 42.8°C, which is close to the surrounding vapor temperature, E_1 was calculated to be 3.15 kW m^{-2}.

where E_2 is the solar energy that irradiation on the sample, which be expressed as the formula (3):

$$E_2= C_{opt}q_i \quad (3)$$

Where C_{opt} is the optical concentration, q_i is the normal direct light irradiation of 1 kW m^{-2}, E_2 was 1 kW m^{-2}.

Where E_3 is the electric energy input to the evaporator and described by the following formula (4):

$$E_3=UI \quad (4)$$

Where U is the input voltage, I is the input current density, E_3 was calculated to be 2.5 kW m^{-2}. Hence, the energy conversion efficiency of evaporator was 90 %. which is better than many previous reports, because of its thermal localization and little heat loss design.

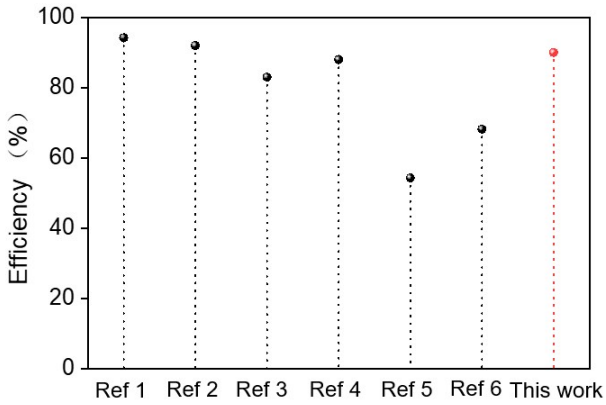

Figure S11. Comparison of the efficiency among different evaporators under the 1 kW m^{-2}.

Reference

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2. K. Yu, P. Shao, P. Meng, T. Chen, J. Lei, X. Yu, R. He, F. Yang, W. Zhu and T. Duan, *Journal of Hazardous Materials*, 2020, **392**, 122350.
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