Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Highly Flexible and Washable Nonwoven Photothermal Cloth for Efficient and Practical Water Evaporation Applications

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S1. Morphology of electrospun materials with different polymers and there tensile strength test.

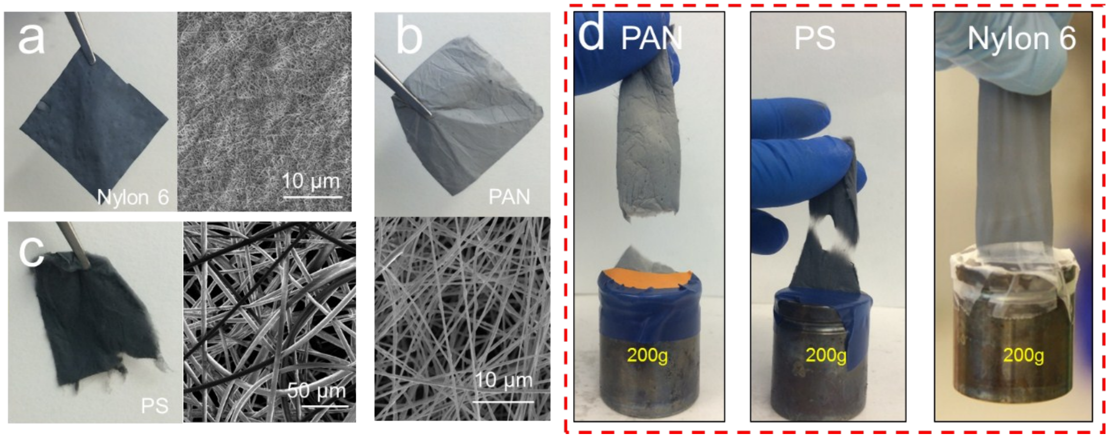

Figure S1. Optical and SEM images of the electrospun (a) nylon 6/carbon cloth; (b) PAN/carbon cloth; (c) PS/carbon cloth; (d) images show that the nylon-c cloth can easily hold 200g weight while the PAN and PS ones cannot. The width of the tested clothes is 2 cm in all cases.

S2. Light reflection of the PAN/carbon cloth prepared with different ratios of carbon black to PAN.

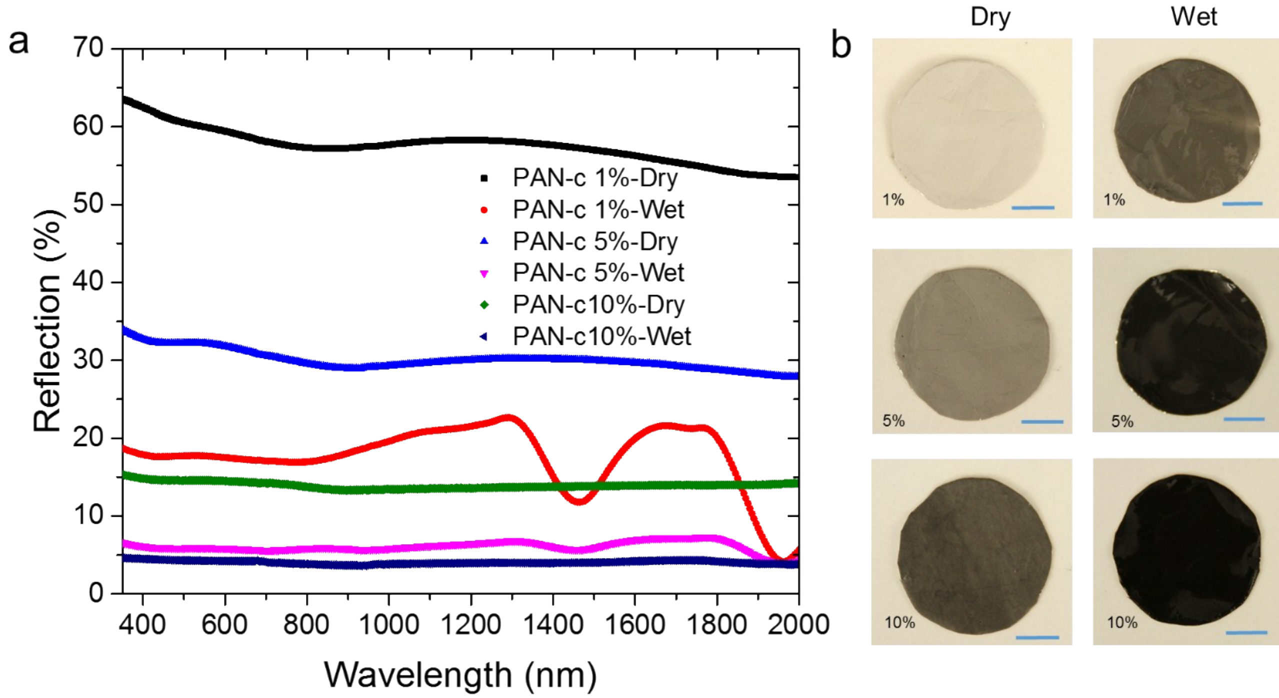

Figure S2. (a) UV-Vis-IR reflection of the nonwoven clothes composed of different carbon black to PAN ratios in dry and wet conditions; (b) optical images indicating the color of nonwoven cloth composed of different carbon black to PAN ratios in dry and wet conditions, scale bar:1cm.

S3. Light reflection of the PS/carbon cloth prepared with different ratios of carbon black to PS.

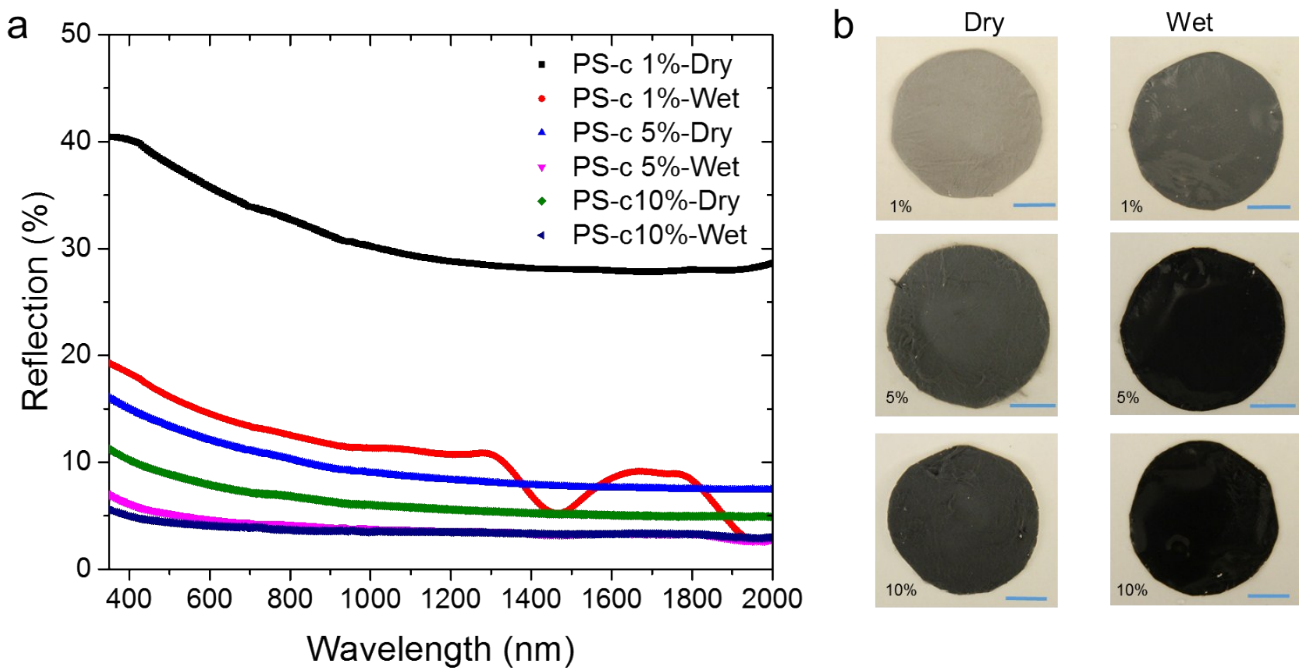

Figure S3. (a) UV-Vis-IR reflection of nonwoven cloth composed of different carbon black to PS ratios in dry and wet conditions; (b) optical images indicating the color of nonwoven cloth composed of different carbon black to PS ratios in dry and wet conditions, scale bar:1cm.

S4. Light absorption of pure carbon black versus the wet nylon-c cloth

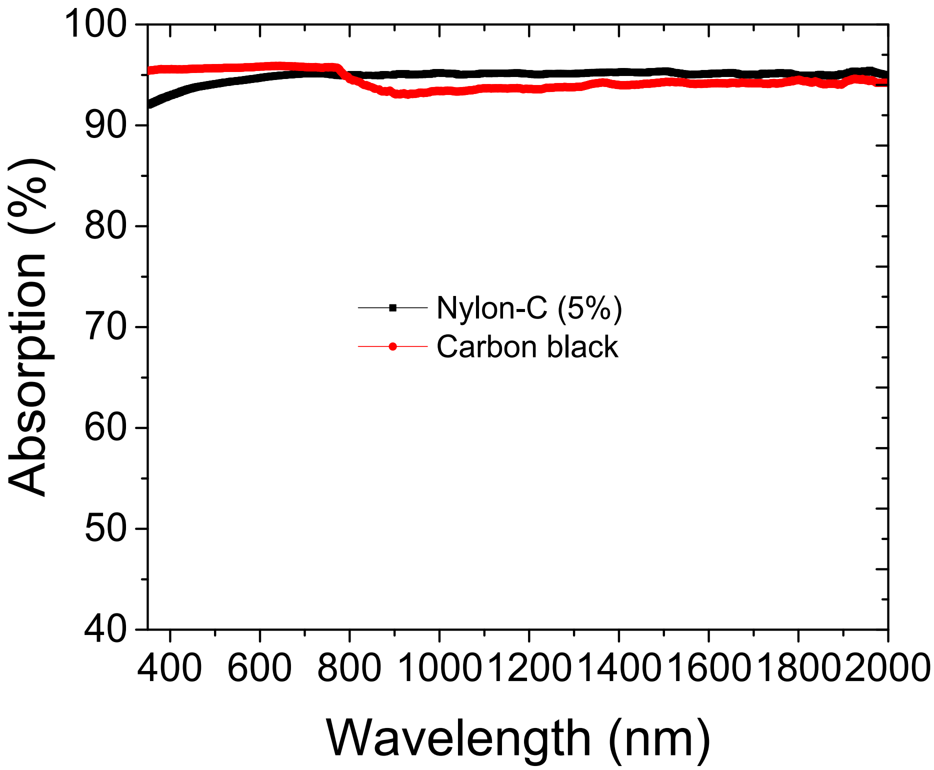

Figure S4 Light absorption of pure carbon black *versus* the wet nylon-c cloth

S5. Wettability of nylon-c cloth

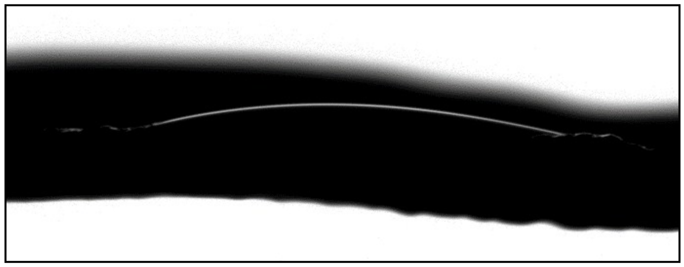

Figure s5. Super hydrophilic property of nylon-c cloth. Due to the hydrophilic property of nylon 6 and porosity of the cloth, water can easily spread on the cloth.

S6. Calculation of Rayleigh number and heat transfer coefficient in our system.

Calculation of convective heat transfer coefficient (h_c):

In a horizontal natural convection problem, a dimensionless number, Rayleigh number (Ra), is critical in determination of h_c. Rayleigh number can be expressed as:

$$R_a = GrPr = \frac{g\beta(T_s - T_\infty)\delta^3}{\nu^2}\mathrm{Pr} \quad (Equation\ S1)$$

Where Gr (= $\frac{g\beta(T_s - T_\infty)\delta^3}{\nu^2}$) is the Grashof number which is a dimensionless number in fluid dynamics and heat transfer approximating the ratio of the buoyancy to viscous force acting on a fluid. Pr is a dimensionless number defined as the ratio of momentum diffusivity to thermal diffusivity. g is the gravitational constant. β is coefficient of volume expansion, 1/T. δ is characteristic length of the geometry. v is kinematics viscosity of the fluid.

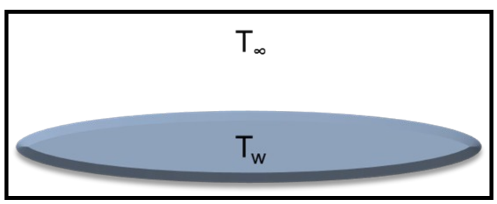

Figure S6

As shown in the above figure, the substrate temperature T_w is 38ºC and the ambient environment temperature T_∞ is 21 ºC. The diameter of substrate, D, is equal to 3.74 cm.

Film temperature T_f= (T_w+ T_∞)/2= 29.5 ºC=302.5K

β= 1/ T_f=3.3 x10^{-3} K^{-1}

v=1.6 x10^{-5} m^2/s at 30 ºC

g=9.8m/s^2

δ=Area/ Perimeter=r/2=0.0.94 x10^{-2}

Pr=0.71 at 29.5 ºC for air

R_a=1783

Nusselt number: Nu=0.59 x$R_a^{0.25}$=3.9

$$h_c = \frac{N_u \times k}{\delta} = 1.1$$

Note that humidity has little effect on the Pr and kinematic viscosity. Thermal conductivity of air at low temperature does not significantly vary with humidity.

After applying all the parameters, Ra in our system is 1783 for an equilibrium temperature of 38 ºC, which is quite small. At even lower equilibrium temperature (27 ºC), the main heat transfer to the ambient air is by conduction which can be neglected due to the low thermal conductivity of air. This result indicates that major heat transfer from the nylon-c cloth is by the radiation loss (~105 W/m^2) and heat convection loss is small (19 W/m^2). Thus, the overall solar energy utilization efficiency is around 82% for the nylon-c cloth with a 5% carbon ratio. The efficiency of the cloth with1% carbon black ratio is smaller than 5% due to its poor light absorption in the visible range.

S7. Synthetic seawater evaporation by the salt-fouled nylon-c cloth and the same cloth after being hand-washed to have cleaned the salt off.

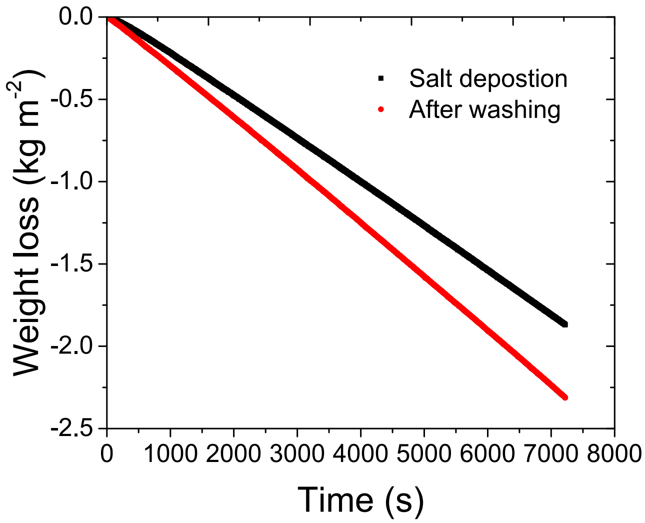

Figure S7. Synthetic seawater evaporation by the salt-fouled nylon-c cloth and the same cloth after being hand-washed to have cleaned the salt off.