Supporting Information for

**Tree-root mimicked Janus evaporator for solar evaporation of saturated saline water**

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**This file includes:**

**Supplementary Fig. S1.** Salt rejecting performance of mangroves in nature.

**Supplementary Fig. S2.** 3D printing process of bionic evaporators.

**Supplementary Fig. S3.** Characterization of carbon nanoparticles.

**Supplementary Fig. S4.** Water transportation process inside microchannels.

**Supplementary Fig. S5.** The whole set-up for solar water evaporation.

**Supplementary Fig. S6.** The temperature changes of absorber surface with different arrangements of microchannels and macrochannels.

**Supplementary Fig. S7.** The temperature changes of absorber surface with different salinity of water.

**Supplementary Fig. S8.** Purification of bulk water with metal ions.

**Supplementary Fig. S9.** Purification of bulk water with organic dyes.

**Supplementary Fig. S10.** Different assignments of microchannels and macrochannels.

**Supplementary Fig. S11.** Stability of our evaporator under saturated saline water.

**Supplementary Fig. S12.** Salt rejecting performance of our bionic solar evaporators for supersaturated salty water.

**Supplementary Table S1.** Parameters for the 3D printing process.

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**Other Supplementary Materials for this manuscript include the following:**

**Movie S1 (.mp4 format).** Hydrophilic properties of the evaporation surface.

**Movie S2 (.mp4 format).** Water transportation inside the bionic microchannels.

**Movie S3 (.mp4 format).** Simulations of microfluidic performance.

**Movie S4 (.mp4 format).** Solar water evaporation process.
Section S1. Salt rejecting performance of poplar trees in nature

Poplar trees always live in the saline-alkali soil, contributing to preventing of wind and sands, regulating climate of oases as well as biodiversity maintenance. As presented in Fig. S1, photosynthesis occurs in the leaves, and the salt will be transported to the trunk through special urinary salt system, which demonstrates an excellent salt rejecting capability.

**Fig. S1** Salt rejecting performance of poplar trees in nature
Section S2. 3D printing process of bionic evaporators

The 3D printing process of bionic evaporators is shown in Fig. S2. The 3D model of bionic structures is firstly designed with a CAD software and then sliced to several 2D images. Afterwards, those 2D images are sent to a 3D printer to achieve a layer-by-layer printing. After cleaning by deionized water and alcohol for three times, the sample is blown by nitrogen to clean residual resin and dust.

Fig S2 3D printing process of bionic evaporators
Section S3. Characterization of carbon nanoparticles

The SEM image of carbon nanoparticles is shown in Fig. S3, it can be obtained that the diameter of carbon nanoparticles is about 10 nm.

**Fig. S3** SEM image of carbon nanoparticles
Section S4. Water transportation process inside microchannels

As presented in Fig. S4, due to the capillary force inside the microchannel, bulk water can be transported from bottom to the top of the evaporators. The speed of transportation for water is about 35 mm/s.

Fig. S4 Water transportation process inside microchannels
Section S5. The set-up for solar water evaporation

The whole evaporation system consists of sunlight simulator, solar vapor generator and clean water collector. The electrical balance can record the mass loss during the whole solar vapor generation and collection process.

Fig. S5 The whole set-up for solar water evaporation
Section S6. The temperature changes of absorber surface with different arrangements of microchannels and macrochannels.

With the number of macrochannels increasing, water can be transported back to bulk water easier, leading to a better heat sinking capability, thus the temperature of surface will be lowered.

**Fig. S6** The temperature changes of absorber surface with different arrangements of microchannels and macrochannels.
Section S7. The temperature changes of absorber surface with different salinity of water

![Temperature changes of absorber surface with different salinity of water](image)

**Fig. S7** The temperature changes of absorber surface with different salinity of water.

The surface temperature of our solar evaporators will decrease a little with the increasing salinity of water.
Section S8. Purification of bulk water with metal ions

The purification of bulk water with different metal ions is tested. It can be obtained that the color of the solution will disappear, demonstrating the excellent purification capability of the evaporation system.

Fig. S8 Purification of bulk water with metal ions
Section S9. Purification of bulk water with organic dyes

The purification of bulk water with different organic dyes is also tested. It can be obtained that color of the solutions will disappear, demonstrating the excellent purification capability of the evaporation system.

![Fig. S9 Purification of bulk water with different organic dyes.](image)
Section S10. Design of different assignments of microchannels and macrochannels

The different assignments of microchannels and macrochannels are shown in Fig. S10. The macrochannel is surrounded by several microchannels with the assignments of $N_1:N_2$ vary from 2 to 8. The radius of microchannel and macrochannel are 400 μm and 1000 μm, respectively.

Fig. S10 Different assignments of microchannels and macrochannels.
Section S11. Stability of our evaporator under saturated saline water

As shown in Fig. S11, we have measured the evaporation rate every hour during the 8 hours’ test. The evaporation rate can maintain at a stable evaporation rate and it could hardly found any salt crystallization on the evaporation surface, demonstrating the stability of our evaporator to achieve an 8-hour tolerance to saturated saline water.

![Graph showing stability of evaporator under saturated saline water](image)

**Fig. S11** Stability of our evaporator under saturated saline water.
Section S12. Salt rejecting performance of supersaturated salty water

As presented in Fig. S12, some salt granules are placed on the surface of a bionic absorbers first. During the solar evaporation process, the temperature of surface will be increased, leading to a higher solubility of salt solution. Therefore, the salt granules will be brought back to bulk water, demonstrating an excellent salt rejecting capability.

Fig. S12 Salt rejecting performance of our bionic solar evaporators for supersaturated salty water.
Section S13. Parameters for the 3D printing process

Table S1 Parameters of printed resin

<table>
<thead>
<tr>
<th>Parameters of resin</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness (D)</td>
<td>82</td>
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<tr>
<td>Tensile strength (MPa)</td>
<td>38</td>
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<tr>
<td>Elongation (%)</td>
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<tr>
<td>Modulus of elasticity (MPa)</td>
<td>1149</td>
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<tr>
<td>Bending strength (MPa)</td>
<td>49</td>
</tr>
<tr>
<td>Modulus of bending (MPa)</td>
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</table>