Supporting Information

Enhancing vapor condensation efficiency of solar water purifier by rapid heat dissipation to bottom bulk water

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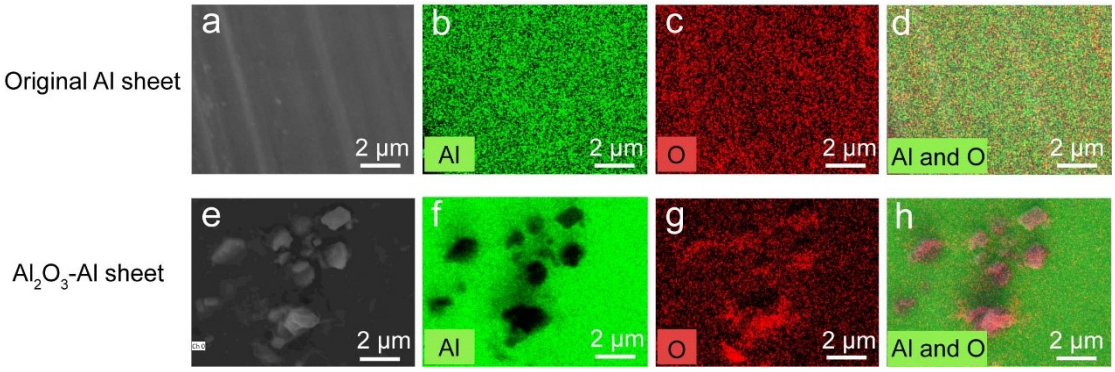

Fig. S1 (a) and (e) The respective low resolution SEM images of commertional Al and alkaline solution oxidized Al sheets. (b-d) The corresponding Al, O and Al+O element mapping images of a. (f-h) The corresponding Al, O and Al+O element mapping images of e.

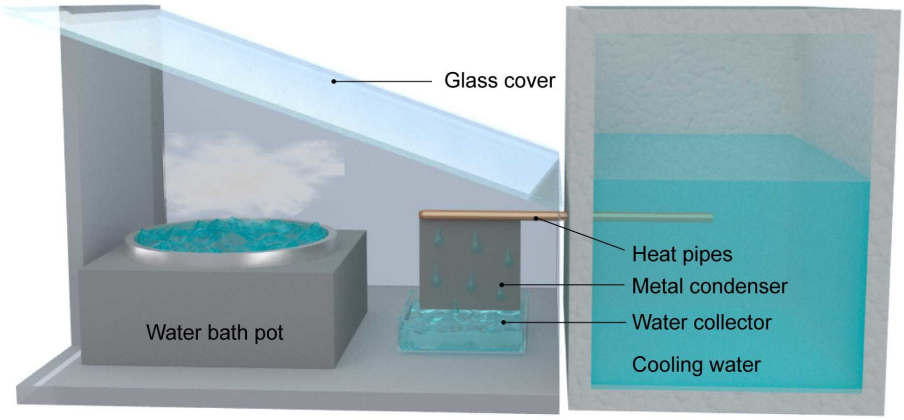

Fig. S2 The schematic diagram for the indoor vapor condensation experiment set.

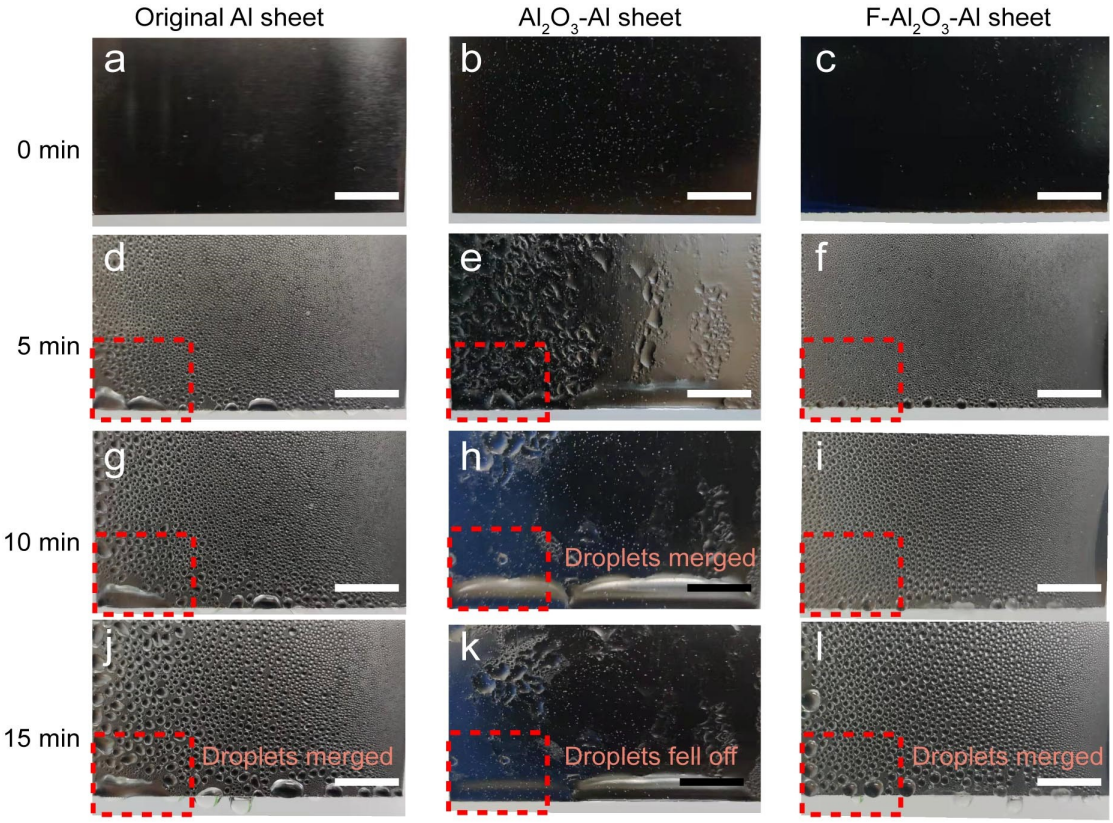

Fig. S3 Photographs of the respective sheets during the condensation experiments on (a-d) Original Al sheet, (e-h) Al_2O_3-Al sheet and (i-l) F-Al_2O_3-Al sheet.

Note that the water droplet on Al_2O_3-Al sheet grew and merged faster than on Al and F-Al_2O_3-Al sheets. As shown by Figure 3f-g, the water droplet on Al_2O_3-Al sheet grew up and fell off at 15min. While the water droplets on Al and Al_2O_3-Al sheets are still there (Figure 3b-d and Figure j-l). The scale bars on all photos represent 1cm.

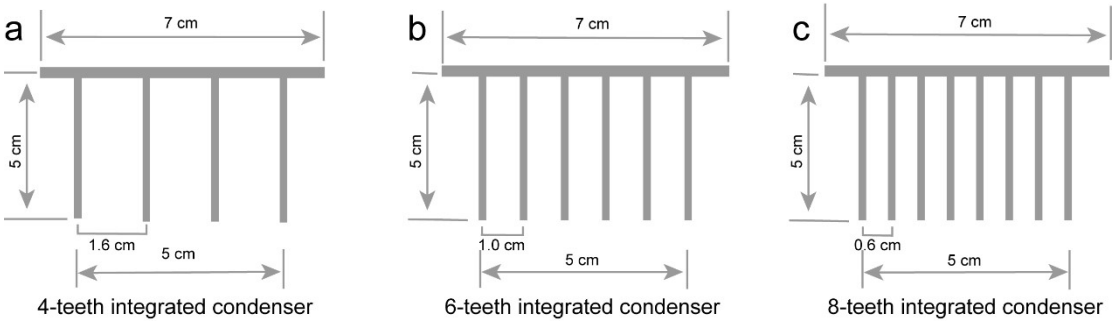

Fig. S4 Schematic illustration of (a) four-teeth integrated condenser, (b) six-teeth integrated condenser and (c) eight-teeth integrated condenser.

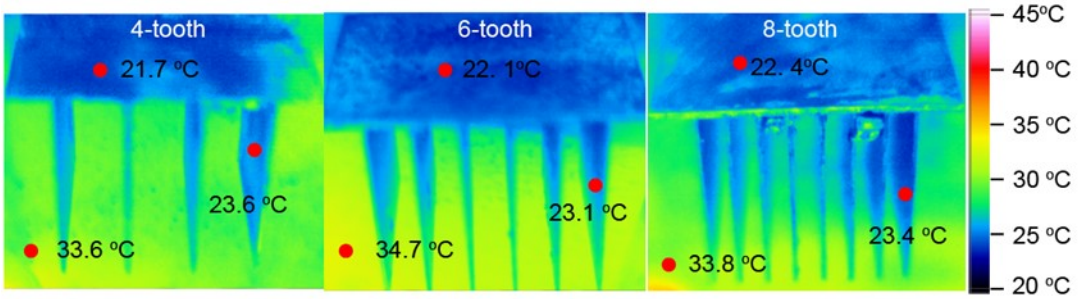

Fig. S5 The thermal infrared photos of the three condensers during a vapor condensation experiment, with the presence of continuously generated hot vapor by a water bath.

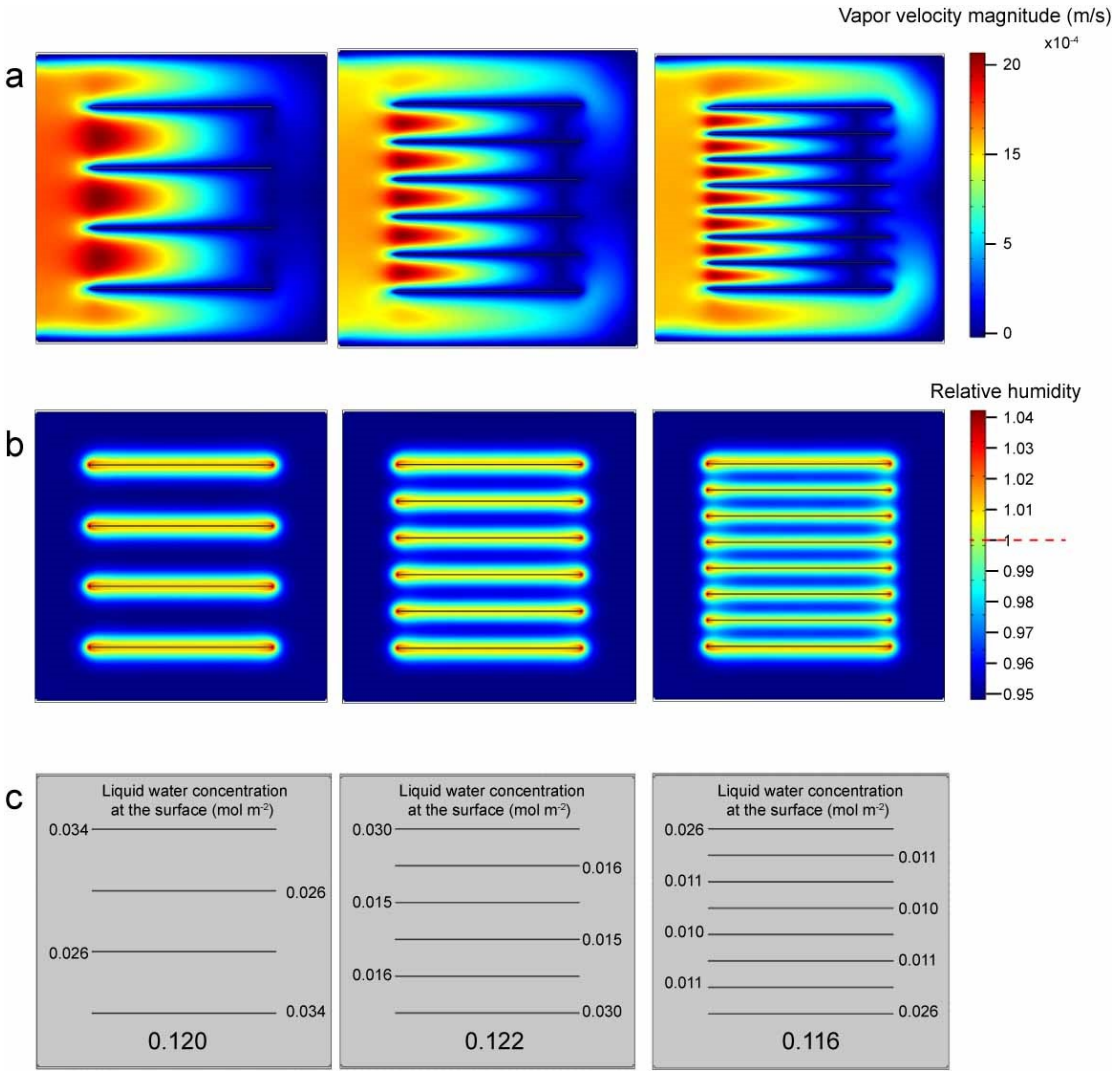

Fig. S6 Simulated vapor diffusion velocity and relative humidity in a closed chamber with three condensers with 4, 6 and 8 teeth number, respectively. (a) Vapor diffusion velocity. (b) The distribution of relative humidities surrounding the teeth surface. (c) The respective condensed liquid water concentration on the teeth surface. Noted that all the simulations were carried out after the vapor condensation carried out after 4 hours to ensure a steady state.

Note that the RHs of the inner teeth surface of the three condensers decreased gradually from 1.01 to 0.99, but 4 and 6-tooth condensers still owns a RH above 1, which indicating that the vapor inside the condenser still can condenser on the teeth surface. While for the 8-tooth structure, the RH surround most of the teeth surface fell below 1, indicating that there are few vapor can condense there. The liquid water concentration on the tooth surface reflects the amount of condensate produced when the vapor

condensation in the chamber reached a steady state. It can be seen that, the water concentration on single tooth piece decreased along with the increased teeth number, and the 6-teeth structure presented the overall highest water collection concentration.

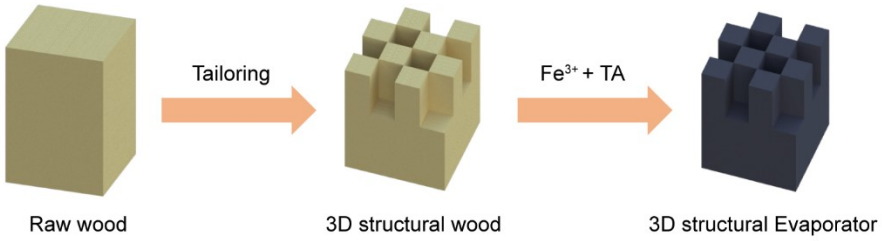

Fig. S7 Schematic illustration of the fabrication process for 3D-wooden evaporator.

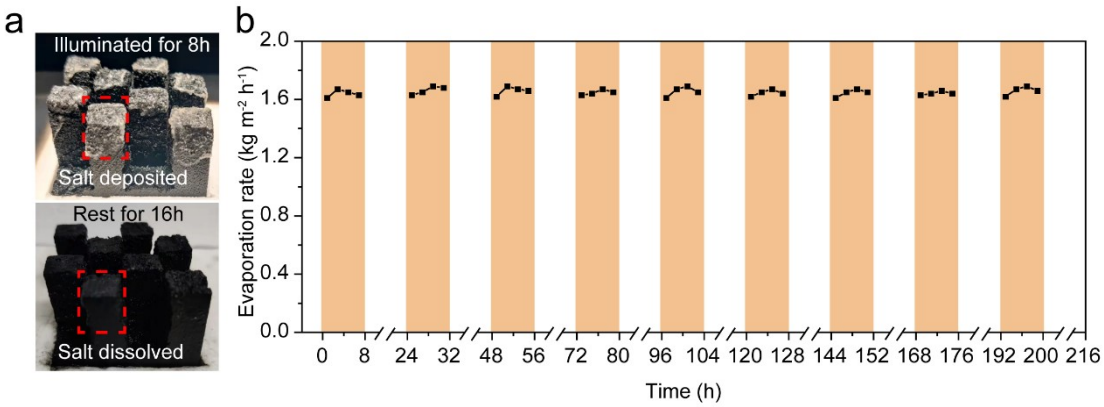

Fig. S8 (a) The respective photographs of the 3D wooden evaporator during the solar evaporation test after irradiated for 8 h (top) and rested for 16 hours (bottom). (b) The evaporation performance of the 3D wooden evaporator during a 9-day continuous evaporation test towards simulated seawater with 3.5% salinity, under simulated one-sun irradiation.

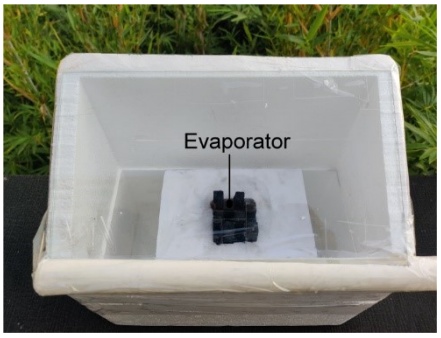

Fig. S9 Photograph of the air cooling-assisted vapor condensation set during outdoor experiment on rooftop at Zijingang campus.

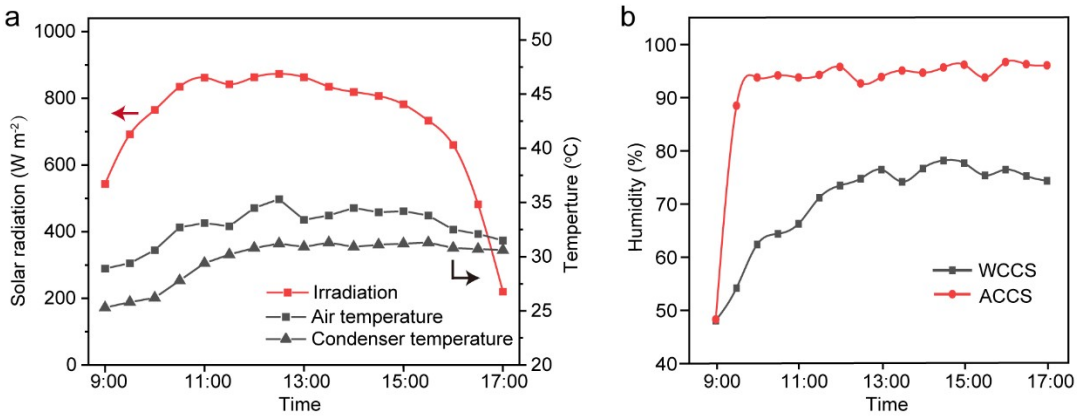

Fig. S10 (a) Monitoring of the solar irradiation and temperatures during the outdoor experiment at Zhejiang University, Zijingang campus, on 24th June 2021. (b) The respectively measured humidity in WCCS and ACCS during the outdoor experiment at Zhejiang University, Zijingang campus, on 24th June 2021.

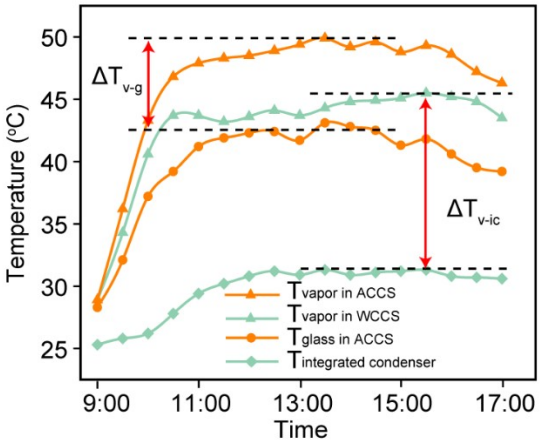

Fig. S11 The temperature difference between vapor and glass cover ($\Delta T_{v\text{-}g}$) in ACCS and temperature difference between vapor and integrated condenser ($\Delta T_{v\text{-}ic}$) in WCCS.

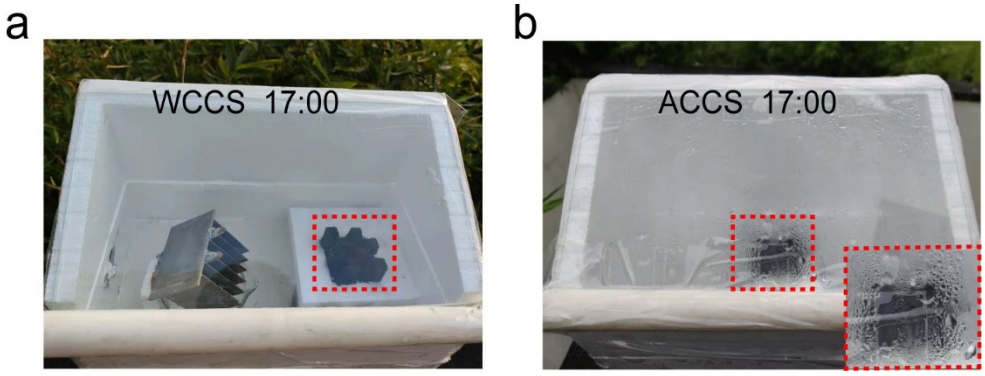

Fig. S12 Photograph of the WCCS and ACCS at Zhejiang University, Zijingang campus, at 17:00 on 24th June 2021.