Supporting information

Architecting a Janus biomass carbon/sponge evaporator with salt-rejection and easy-floatation for sustainable solar-driven steam generation

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Figure S1. Digital photos of steam generated under 3 solar irradiation of JBCS.

Figure S2. Absorption spectrum of JBCS before and after 12 h steam generation under 1 sun irradiation.
Figure S3. Camera photos of MS before and after 180 min solar steam generation (1 kW m\(^{-2}\)).

![Image of camera photos]

Figure S4. The measured concentrations of four primary ions in a simulated seawater sample before and after desalination.

![Image of bar chart showing the concentration of Na\(^+\), K\(^+\), Ca\(^{2+}\), Mg\(^{2+}\) before and after desalination.]

The energy contribution of each part of the JBCS evaporator in the steam generation process.

1. **Water evaporation loss \(\theta_1\)**

   The water evaporation loss of JBCS is approximately equal to the evaporation efficiency, so \(\theta_1 \approx 86.5\%\).

2. **Sunlight reflection loss \(\theta_2\)**

   Measured by UV spectrophotometer, \(\theta_2 \approx 4\%\).

3. **Conduction loss \(\theta_3\)**

   \[
   \theta_3 = \left( \frac{J_{\text{cond}}}{J_{\text{in}}} \right) \cdot A
   \]

   Calculated according to Fourier’s law, \(J_{\text{cond}} = k \cdot (\Delta T/L)\), \(k\) represents the thermal conductivity of the evaporator, which is 0.046 W m\(^{-1}\) K\(^{-1}\). \(\Delta T/L\) is the temperature gradient.
of the JBCS evaporator, about 842 K/m. $J_{in}$ represents a standard sunlight, which is 1 kW m$^{-2}$. After many statistical calculations, $A$ is about 8. It can be seen that $\theta_3$ is approximately 3.1%.

(4) Radiation loss $\theta_4$

$$\theta_4 = A \varepsilon \sigma (T_1^4 - T_2^4) \quad \varepsilon=0.92, \quad \sigma=5.67\times10^{-8} \text{ W m}^{-2} \text{ K}^{-4}, \quad T_1$$ is the average surface temperature of the evaporator under one sun exposure, about 310 K, $T_2$ is the ambient temperature (301 K), in result, $\theta_4 \sim 4.3\%$.

(5) Convection loss $\theta_5$

$$\theta_5 = h A \Delta T, \quad h=5 \text{ W m}^{-2} \text{ K}^{-1}, \quad \Delta T = 310 \text{ K}. \quad \text{Thus}, \ \theta_5 \sim 1.3\%.$$

Therefore, 86.5% + 4% + 3.1% + 4.3% + 1.3% =99.2%, other 0.8% of energy may disappear in other forms of diffusion.