Supplemental information

Preparation of three-dimensional graphene-based sponge as photo-thermal conversion material to desalinate seawater

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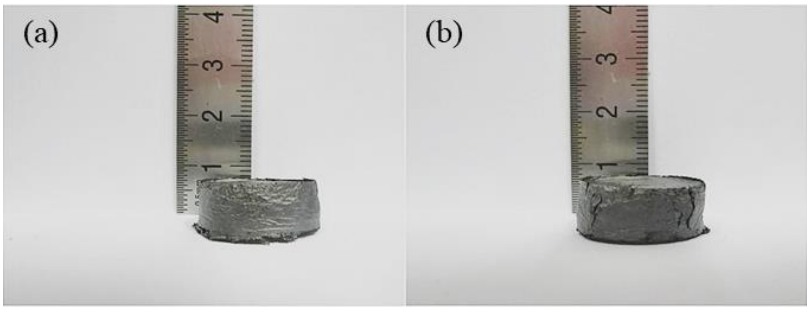
Fig. S1 Images of GAC-3, GAC-5, GAC-7 and GAC-9 (from left to right)

Fig. S2 Images of GO-MSC-1, GO-MSC-3, GO-MSC-5 and GO-MSC-7 (from left to right)



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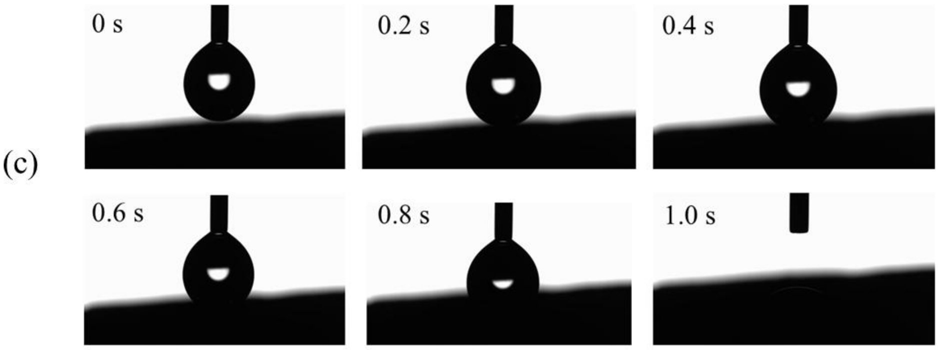

Fig. S3 Images of GAC-7 (a) before and (b) after 30 times compression by 500g weight (c) water contact angles of GAC-7 at different time points

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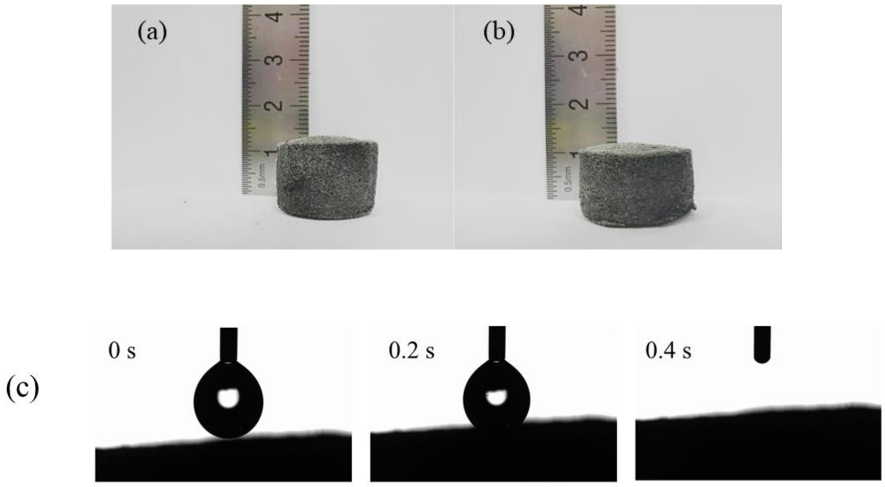

Fig. S4Images of GO-MSC-5 (a) before and (b) after compression by 500g weight (c) water contact angles of GO-MSC-5 at different instant

To explore the thermal conductivity of GAC-7 and GO-MSC-5, the materials were illuminated in air by the simulated sun light. The temperature data of the bottom and top surfaces of the materials were recorded when the temperature is stable, ignoring the heat loss of the material to the environment [1]. And thus the thermal conductivity of the material skeletonscan be calculated by Eq. S(1).

$$S \times \alpha = \lambda_1 \frac{\Delta T}{\Delta x} \qquad S(1)$$

Where*S* represents the intensity of the sun, which is 1000 $W \cdot m^{-2}$;α is the average light absorption rate of the material in the full spectrum range, and λ_1 is the thermal conductivity of the material skeleton, $W \cdot m^{-1} \cdot K^{-1}$; ΔT is the temperature difference between the top and bottom of the materials in the air, ℃; Δx is the thickness of the material, m. The thermal conductivity of GAC-7 and GO-MSC-5 was calculated as 0.32 $W \cdot m^{-1} \cdot K^{-1}$and 0.42$W \cdot m^{-1} \cdot K^{-1}$. Besides, the thermal conductivity of pure water is 0.60 $W \cdot m^{-1} \cdot K^{-1}$[2].

The comprehensive thermal conductivity of materials containing water during the evaporation can be calculated using Eq.S(2).

$$\lambda = \frac{\lambda_1 A_1 + \lambda_2 A_2}{A_1 + A_2} \quad S(2)$$

Where λ represents the comprehensive thermal conductivity of the material with water, λ_1 is the thermal conductivity of the material skeleton, A_1 is the surface area of the material skeleton, λ_2 is the thermal conductivity of water, and A_2 is the surface area of water among the pores of the materials.

Reference:

[1] Abdolhosseinzadeh S, Asgharzadeh H, Seop Kim H. *Scientific Reports*. **2015**, 5(1).

[2] Sharqawy M H. *Desalination*. **2013**, 313, 97.