Supporting Information

Simply Adjusting Unidirectional Liquid Transport of Scalable Janus Membranes toward Moisture-Wicking Fabric, Rapid Demulsification and Fast Oil/Water Separation

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Supplementary Movies

Movie S1. The dynamic process that water droplets were transported from hydrophobic layer to hydrophilic layer from side view.

Movie S2. The dynamic process that water droplets were blocked and spread on the hydrophilic layer of Janus fabric-2 from side view.

Movie S3. Wetting and spreading behavior of a water droplet (100 μL) dripped on the hydrophobic layer of Janus fabric-2.

Movie S4. Wetting and spreading behavior of a water droplet (100 μL) dripped on the hydrophilic layer of Janus fabric-2.

Movie S5. The process of water collection under oil using a laboratory-made collector with Janus fabric-2.

Movie S6. The demulsification of oil-in-water emulsion with Janus fabric-2.

Movie S7. The separation of light oil/water mixture using Janus fabric-5.

Movie S8. The separation of heavy oil/water mixture using Janus fabric-5.

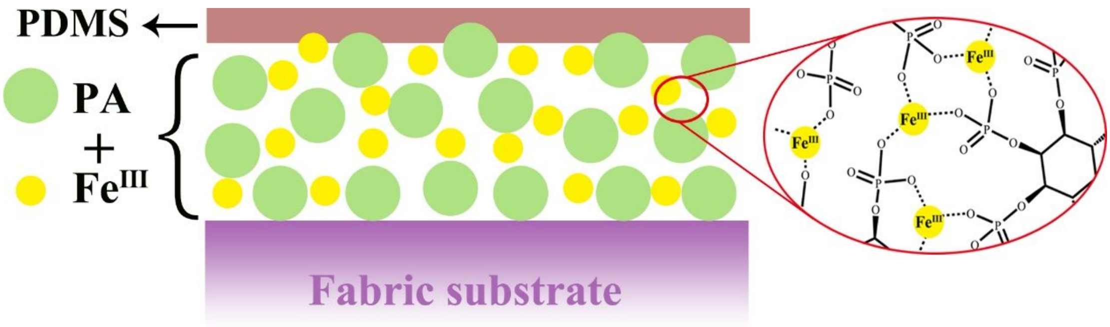

Figure S1. Illustration of chemical composition of Janus fabric

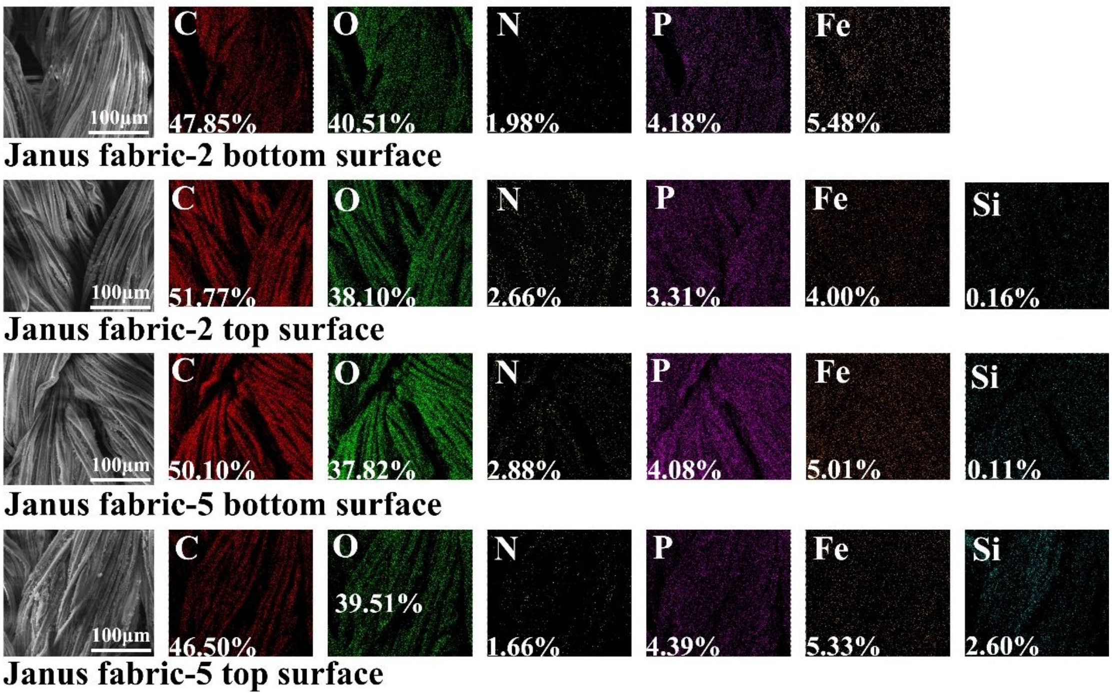

Figure S2. EDS spectra and element ratios of top surface and bottom surface of Janus fabric-2 and Janus fabric-5.

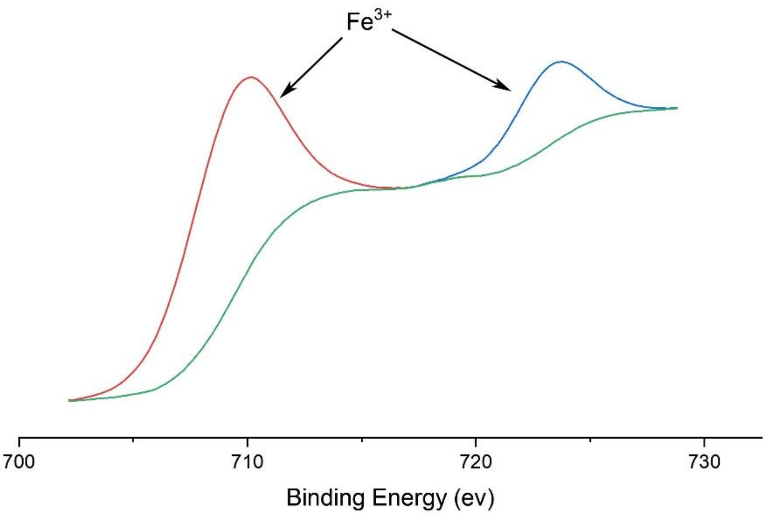

Figure S3. The high-resolution XPS spectra of Fe$^{\mathrm{III}}$ of PA-Fe$^{\mathrm{III}}$ coated fabric

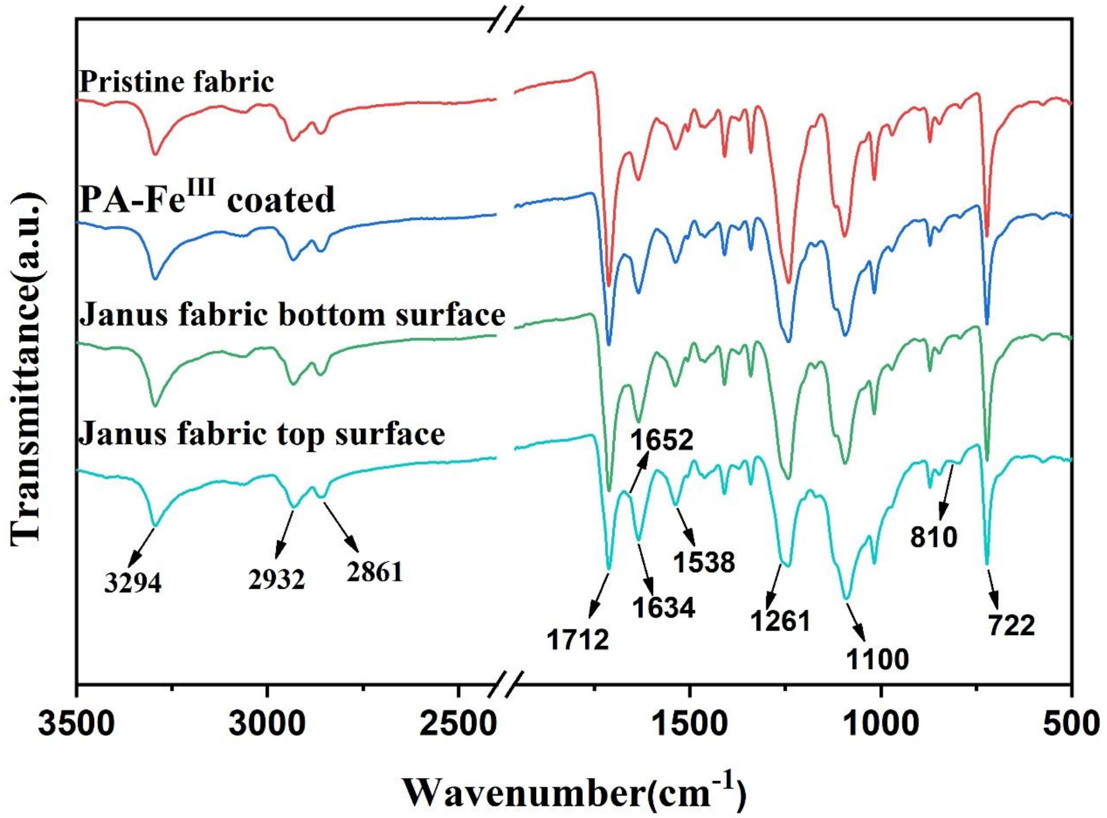

Figure S4. FTIR spectra of pristine fabric, PA-$Fe^{Ⅲ}$ coated fabric, Janus fabric top surface and bottom surface.

The peaks at 3294 cm^{-1} and 1538 cm^{-1} are stretching vibrations and bending vibration of -NH; the peaks at 1634 cm^{-1} and 1712 cm^{-1} are attributed to bending vibration and out-of-plane bending vibration of -C(=O)-. The above peaks are all from the -NHCO- group of substrate fabric of nylon. After treatment with PA and $Fe^{Ⅲ}$, the characteristic peaks at about 1652 cm^{-1} and 1100 cm^{-1} were observed, representing the P=O and $–PO_4^{3-}$ of PA respectively. But the two peaks were weak because of overlap of -C=O and C-O band. On the top surface of Janus fabric, a bending vibration of Si–CH_3 (1261 cm^{-1}) and a symmetric stretching vibration of Si–O–Si (810 cm^{-1}) were observed, which indicating the successful modification of PDMS.

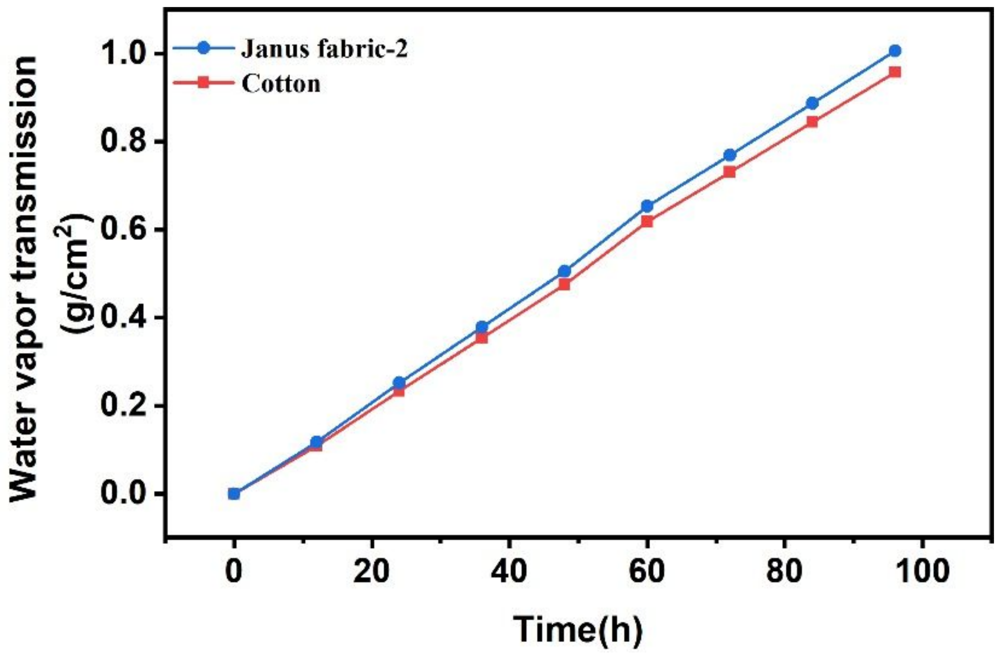

Figure S5. The water vapor transmission rate of different fabric samples.

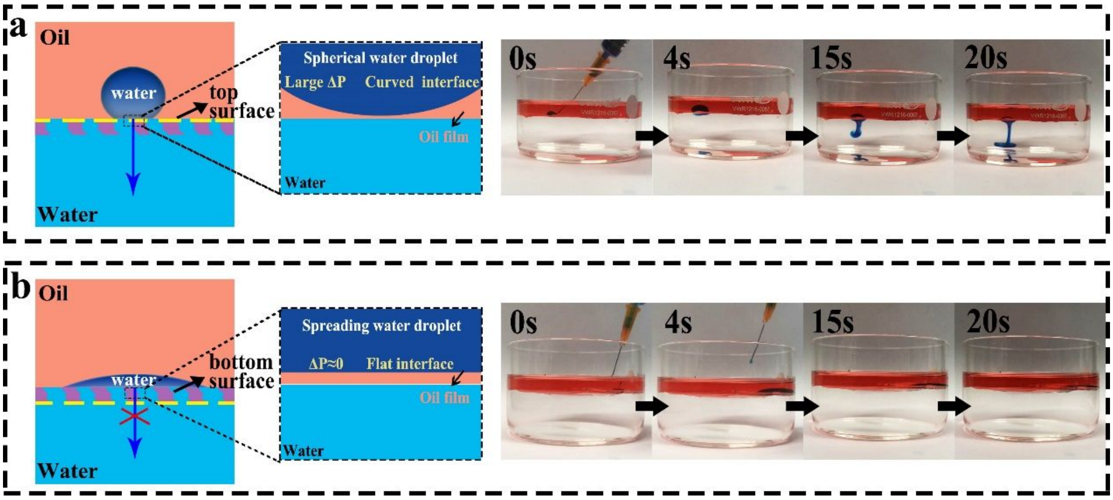

Figure S6. Schematic and photos of water transportation across Janus fabric-2 with (a) top surface facing upward and (b) bottom surface facing upward. Water droplets was dyed by methylene blue and n-hexane dyed by oil red O for better observation.

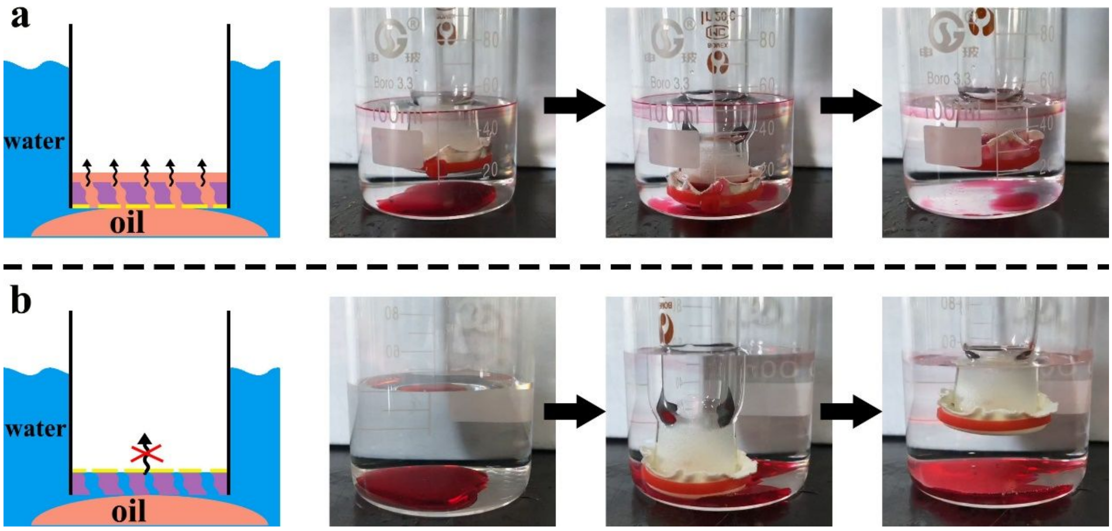

Figure S7. The schematic and snapshots of oil collection under water using (a) the hydrophobic side and (b) hydrophilic side of Janus fabric-2.

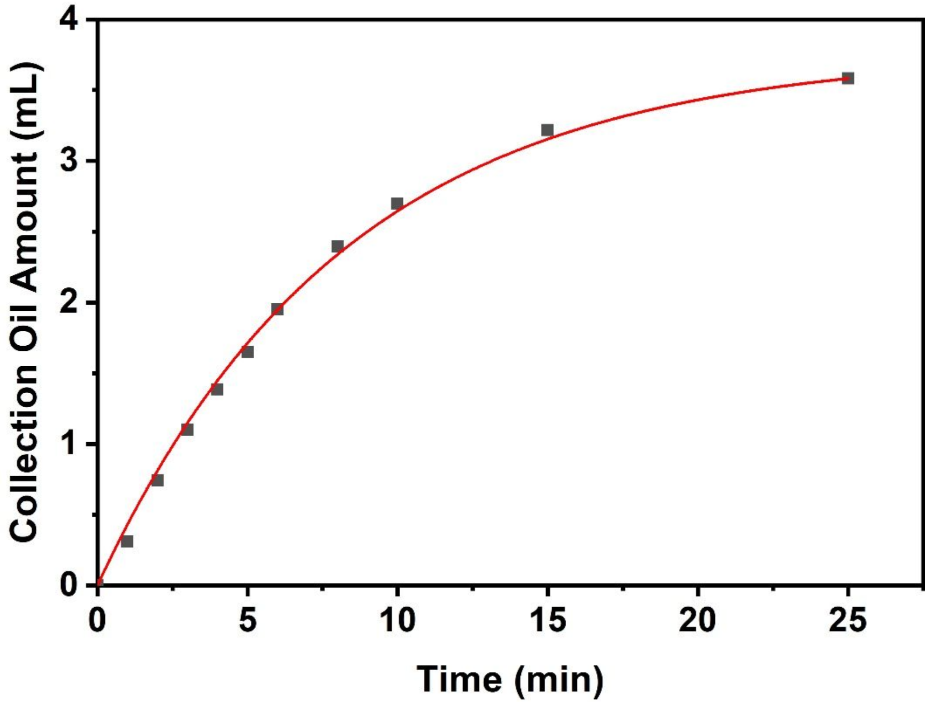

Figure S8. Increases in the volume of oil collected in the right cell after 20.0 mL of an oil-in-water emulsion (f_{oil}=20%) was added into the left cell.

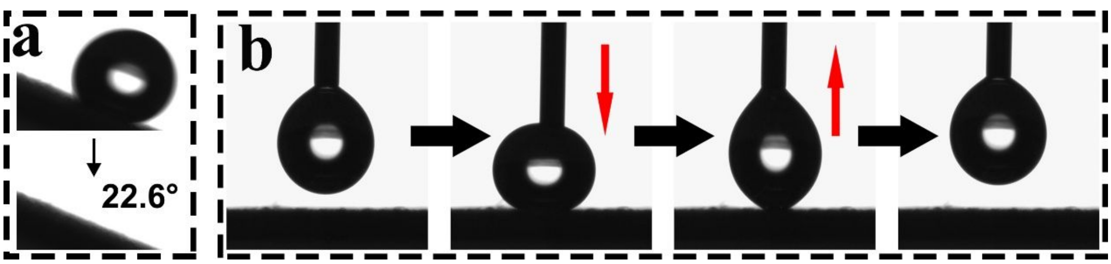

Figure S9. (a) the WSA of top surface of Janus fabric-5. (b) Dynamic water-adhesion of top surface of Janus fabric-5.

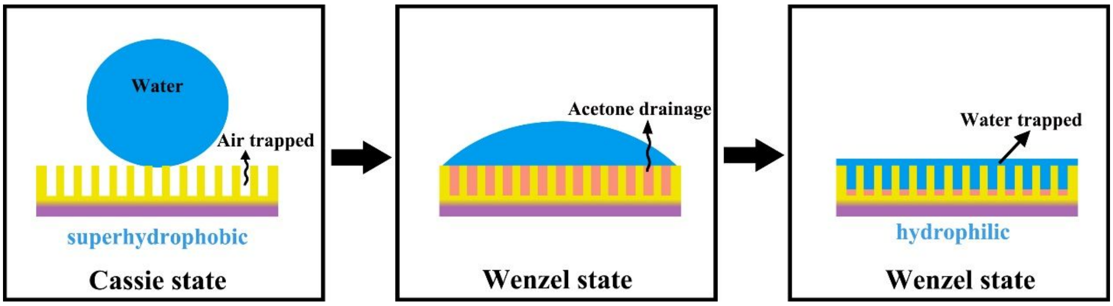

Figure S10. Illustrations of how water replaces the air after the drainage of acetone on the superhydrophobic layer.

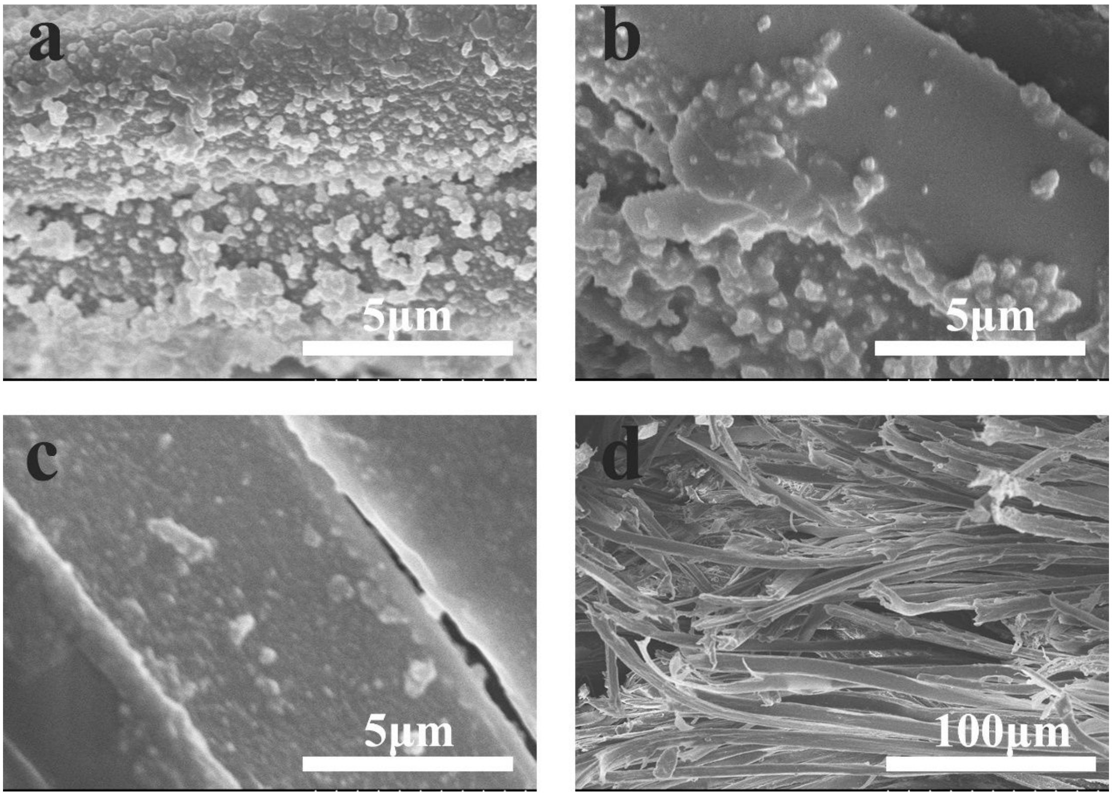

Figure S11. SEM images of Janus fabric (a) before mechanical test, (b) after tape-peeling test, (c) after ultrasonic-peeling test and (d) after sandpaper abrasion test.

Table S1. Comparison with other reported Janus membranes on the oil/water mixture separation.

Types of materials	Preparation method	Water flux (L m^{-2} h^{-1})	Oil flux (L m^{-2} h^{-1})	Operating pressure	Refs.
PA/Fe^{III}/PDMS cotton fabric	Cyclic self-assembly and spray coating	2.55×10^4	2.38×10^4	gravity	This work
PDA-PET/PTFE membrane	Immersion and tape-peeling	1.899×10^3	3.243×10^3	gravity	1
PVDF/PDA/PEI membrane	In situ mussel inspired chemistry	4.5×10^3	7.58×10^3	0.02 Mpa	2
SiO_2/PS/PLA nonwoven Fabric	Subsequent graft	n.a.	1.1×10^4	gravity	3
PLA & NC/nanoclay cotton fabric	electrospinning	6.5×10^4	n.a.	gravity	4
Graphene/PVA aerogel	Direct freeze-shaping technique and subsequent mussel-inspired modification	1.909×10^3	5.092×10^3	gravity	5
Lotus leaf	Micro-pore punching	700	180	gravity	6

References:

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