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Novel 3D solar evaporator delivers crystal-clear water solutions

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A super-efficient, portable 3D solar evaporator developed by South Australian researchers will enable vulnerable communities to access reliable and affordable fresh drinking water.

Using sunlight as an energy source, Associate Professor Haolan Xu (pictured right) and Dr Xuan Wu from the University of South Australia's Future Industries Institute, have developed a novel solar evaporation technique to derive fresh water from sea or contaminated water.

More efficient than previous solar evaporation techniques and mimicking the natural water cycle, the 3D solar evaporator provides clean water solutions that are cheap, free to run and require minimal maintenance.

Easy to set up and made of materials almost entirely sourced from a local supermarket, Dr Wu says the key to the technology's heat absorption is in the deliberate design of the 3D evaporator's reservoir.

"The most reported two-dimensional photothermal evaporators have a flat evaporation surface resulting in a 10-20 percent energy loss to the bulk water and the surrounding environment," said Dr Wu.

"We have developed a three dimensional, heatsink-like evaporator which not only effectively prevents heat energy loss from the evaporation system, but additionally extracts large amount of energy from the bulk water and surrounding environment to contribute to the evaporation."

Dr Wu says the 3D evaporator contains a fin-like evaporation structure, which is effectively a bamboo paper sprayed with reduced graphene oxide.

"We know reduced graphene oxide is very efficient at absorbing light and converting it to heat and have incorporated these efficiencies into our photothermal sheet to evaporate sea water," said Dr Wu. "We have achieved an extremely high evaporation rate of 4.10 kg m−2 h−1 which can deliver between 20 and 30 litres of freshwater per square metre per day."

> "It has been very convenient to have all these instruments available and ANFF-SA's support to confirm the quality of the reduced graphene oxide and the evenness of the coating at microscale.
>
> ***Dr Xuan Wu, University of South Australia***"

Together with A/Prof Xu, Dr Wu developed the portable and passive solar-thermal desalination device utilising cutting-edge nanotechnology equipment housed at the South Australian node of the Australian National Fabrication Facility (ANFF-SA) based at the University of South Australia's Mawson Lakes campus.

Their research team used ANFF-SA's Sessile drop for contact angle measurement, sputter coater for sample preparation, and a combination of transmission and scanning electron microscopy for morphology/structure characterisation.

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Co-located at the University of South Australia and Flinders University, ANFF-SA is a world-class micro and nanofabrication facility providing researchers, academics and industry with open access to cutting-edge equipment and support from expert staff.

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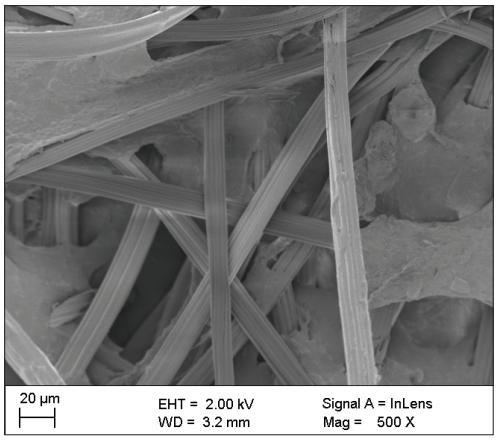

SEM image of original bamboo paper composed of fiber bundles with a thickness of ± 20µm. Spray coating with reduced graphene oxide filled the gaps.

South Australian Node of the Australian National Fabrication Facility
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