Innovative Absorbent Fins Are Used to Harvest Drinking Water From the Air

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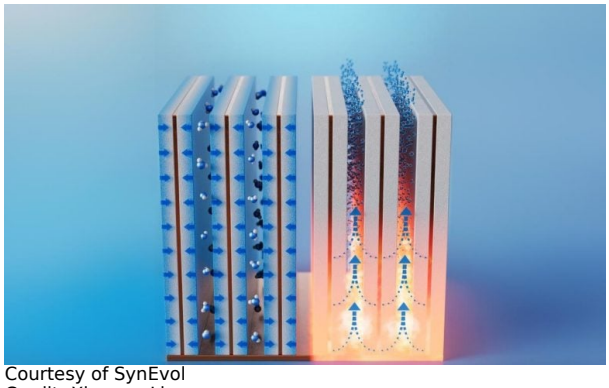

Courtesy of SynEvol
Credit: Xiangyu Li

Clean, safe water is a scarce resource, and access to it is dependent on local bodies of water. However, even in arid locations, there is some water vapor in the air. To capture small amounts of humidity, researchers created a compact device with absorbent-coated fins that hold moisture before producing potable water when heated. They claim the prototype could assist fulfill rising water demands, particularly in desert regions. Details are published in the journal ACS Energy Letters.

Trillions of liters of fresh water vapor exist in the Earth's atmosphere, but collecting this colorless, clear, and dilute gas is tough. Previously, researchers created systems that trap dew or fog and collect the liquid into containers. However, in arid places with little dew, specific materials such as temperature-responsive hydrogels, metal-organic frameworks, and zeolites (crystalline aluminosilicates) may assist draw small amounts of moisture from the air and release it when heated.

However, for these absorbents to be useful in the real world, they must be integrated into compact and portable equipment with a waste heat source, such as high-temperature applications or systems that produce heat as a byproduct. So, Xiangyu Li, Bachir El Fil, and colleagues created a humidity harvester that met those requirements.

The researchers created water-adsorbent "fins" by sandwiching a copper sheet between copper foams coated with commercially available zeolite. In contrast to prior studies that concentrated on material development, the authors claim that co-designing the adsorption bed with material qualities resulted in thin adsorbent fins that are compact and can quickly capture water.

For proof-of-concept demonstrations, they built a device with 10 tiny adsorbent fins spaced about 2 millimeters apart on a copper base plate, maximizing moisture capture from desert-like air with 10% relative humidity. The fins saturated within an hour and then released the contained moisture when the base reached 363 degrees Fahrenheit.

Extrapolating to 24 collection-release cycles, the team determined that 1 liter of absorbent coating on the fins may create up to 1.3 liters of drinkable water per day in air with 30% relative humidity, which is two to five times more than previously established devices.

The study highlights a critical possibility for quick moisture capture and water harvesting from dry air several times per day. According to the researchers, with future improvement, this technology might be linked into existing waste heat-producing infrastructures such as buildings or transportation vehicles, providing a cost-effective option for creating drinkable water in desert places.