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Converting air moisture into water

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Atmospheric water harvesting could be an alternative to conventional water sources, particularly in regions affected by drought and water stress.

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The idea of collecting water from the atmosphere showed up in accounts and legends centuries ago when mankind began trying to artificially collect dew as a source of fresh water by using stone or ponds[1,2]. However, it was not until the twentieth century that the construction of such condensers was confirmed[3]. In recent years, the development of modern atmospheric water harvesting (AWH) technologies has had a resurgence in interest because of necessity (given water scarcity problems) and because our knowledge in materials science now allows for promising technology.

It is estimated that the Earth's atmosphere contains six times more water than in all the territorial rivers[4]. However, despite the substantial value of the potentially extractable fresh water worldwide, the distribution of AWH systems remains a significant challenge, as few systems are currently operating commercially. Most of the commercially available atmospheric water harvesters are based on active condensers for dew water collection, which use additional energy inputs. The energy inefficiency and the low water productivity are two of the primary issues involved in the process[3].

AWH utilizes various approaches to extract water from the atmosphere, such as fog harvesting, dewing, and sorption-based approaches[5]. While fog harvesting and dewing are constrained by climate and geography, sorption offers broader applicability and cost-effective potential by harnessing renewable energy sources[6].

This issue of *Nature Water* includes three articles that explore progress in the field of AWH. The technology is particularly relevant for places such as arid areas and remote communities where traditional water infrastructure is scarce or nonexistent. In their Article, Woochul Song and co-authors expand on their previous work by designing a passive AWH device based on metal–organic frameworks to be used in one of the driest areas of the world, without any power or energy input aside from natural sunlight. They showcase that the communities threated by drought might greatly benefit from the development of readily deployable, user-friendly, cost-effective, and adaptable AWH devices.

Exploiting the unique structure and properties of water is beneficial for the interpretation of water movement from an energy point of view, leading to the design of better AWH technologies. The Review by Renyuan Li and Peng Wang utilizes a unique chemical-potential-based approach and critically analyzes and synthesizes the available literature on sorption-based AWH. In terms of the development of sorbent materials, many of the inspirations come from nature. Yi Wang and co-authors unveil in their Review the bioinspired surface design principles to control the surface properties in water capture/transport processes in different water harvesting systems, thus enabling customized characteristics that enhance water sorption performance.

Whether AWH will play a major role in providing freshwater is still open for discussion, and it will depend on technological development and also on economics considerations. We should keep in mind that the technology offers some unique advantages. It is accessible anywhere and can be easily co-operated with a renewable energy source for local needs. For example, AWH shows immense promise for implementation in post-disaster periods, when ensuring a safe drinking water supply becomes a top priority[7]. Indeed, simulations of commercialized AWH devices have been mostly implemented in areas struck by drought, disaster, contamination, and so on.

Unlike other clean-water technologies that have already undergone significant optimization since they were first applied, the development of modern AWH technologies has only witnessed significant progress in recent years. The potentials of AWH still need to be fully explored and realized.

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