A new solar-powered desalination technology could help solve water shortage problems without any damage to the environment, according to researchers. They evaluated a prototype model and demonstrated that it could produce up to 12 litres of freshwater a day per m² of equipment.

The World Resources Institute predicts that by 2025 at least 3.5 billion people will experience water shortages. Providing clean water requires energy and currently this is sourced from fossil fuels, meaning future demand for water will deplete fossil fuel reserves and increase greenhouse gas emissions.

Since 97 per cent of the world’s water is in the sea and oceans, desalination is a popular option for producing drinking water. Desalination involves evaporating the water to leave behind the salt. However, most desalination technologies are costly, energy-intensive and rely on fossil fuels. Using renewable energy to power desalination could be a sustainable solution, especially for low-income rural and remote communities. Solar energy has been identified as a particularly suitable renewable source for this process.

The study evaluated a prototype of a solar-powered desalination process with a set-up that creates near vacuum conditions, i.e. there is very little air in the evaporating equipment. This means that the water can evaporate at about 40-50°C, which is a much lower temperature than needed for other desalination processes, such as flat bed solar stills which trap the sun’s energy in simple glass-covered containers to heat water. Such systems require temperatures of 60-100°C to evaporate water and therefore also need more energy.

Two forms of the prototype were tested: a low-cost system using solar energy directly to evaporate the water, and a more efficient system which used 6m² of solar photovoltaic panels to charge a battery bank, which in turn powered a heater for evaporation during hours when there was no sunlight.

The results indicated that the first construction could produce up to 4.95 litres of freshwater a day per m² of area used for evaporation of water. If a reflector was installed to increase the solar energy reaching the system, up to 7.5 litres per day per m² could be produced, which is equivalent to three times the amount of water produced by a normal solar still without the vacuum technology. The second system produced up to 12 litres of water a day per m² of evaporator area.

These preliminary results indicate strong potential for desalination processes that use renewable energy sources, particularly for remote areas without a connection to the electricity grid and where freshwater and electricity are scarce. It could also be used in combination with energy from waste heat derived from processes, such as air-conditioning systems and power plants, which would make the process more effective. However, this evaluation of the technology was done at a small-scale and large-scale testing is needed to ensure the natural vacuum principle still works.


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