Researchers create tiny pump that provides continuous and spontaneous antigravity water delivery

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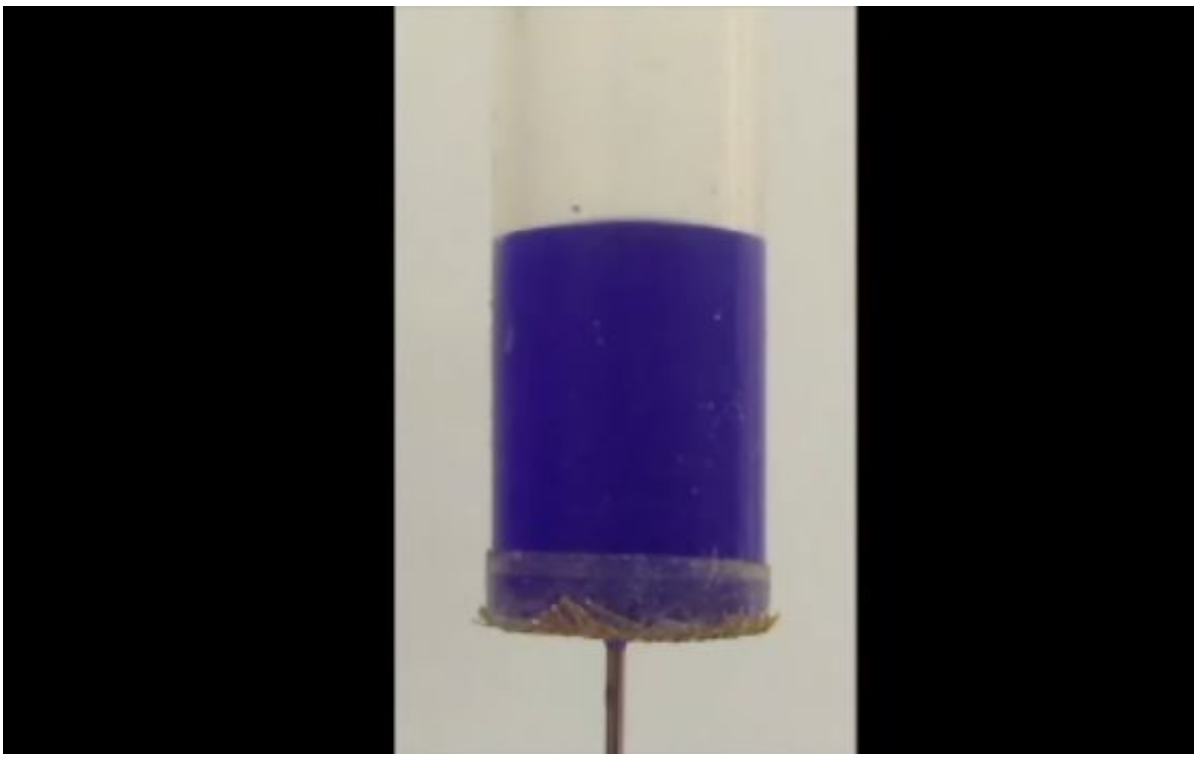

(Phys.org)—A team of researchers at Beihang University in China has created a very tiny pump that is able to lift a drop of water without the use of any power source and move it to a higher location. In their paper published in the journal *Advanced Functional Materials*, the team

describes how they built their pump and the ways it might be used.

For perhaps thousands of years people have wished for a way to move water from one location to another without the need for a power source, i.e. carrying or pumping it, especially when moving it uphill. In this new effort, the researchers have found a way to do that, albeit, with severe limitations.

As the researchers note, scientists have seen many examples of water being moved up from a lower location in nature, capillary action, etc., but not in the way they were looking for. In this new effort the team looked to improve on such examples by taking advantage of both surface tension and a superhydrophobic material.

To build their pump, the researchers created a superhydrophobic material by exposing a copper mesh to an alkali solution—the microscopic sized pockets it created caused water to slide with almost no friction. They then affixed the mesh to the bottom of a plastic tube that sat vertically. They next attached another tube to the first creating a right angle at the top and then attached a very short third tube to the second at its other end, this one pointing straight down. That was all it took. To use the pump, a bit of liquid was introduced into the pump, priming it, then a drop was introduced from beneath the pump, through the wire mesh. The liquid in the pump rose, because it was repelled from below, into the second tube and then into the third where it was expelled.

The team notes that such a device can only pump to a few centimeters in height before gravity wins over, preventing the drop from entering, much less pushing other liquid up.. They suggest it could be used as a design for advanced materials and in developing new kinds of technology applications in microfluidics, microdetectors or with intelligent systems.

More information: Superhydrophobic "Pump": Continuous and Spontaneous Antigravity Water Delivery, *Advanced Functional Materials*, DOI: 10.1002/adfm.201501320

Abstract

Antigravity transportation of water, which is often observed in nature, is becoming a vital demand for advanced devices and new technology. Many studies have been devoted to the motion of a single droplet on a horizontal or inclined substrate under specific assistance. However, the self-propelled water motion, especially continuous antigravity water delivery, still remains a considerable challenge. Here, a novel self-ascending phenomenon driven only by the surface energy release of water droplets is found, and a superhydrophobic mesh to pump water up to a height of centimeter scale is designed. An integrated antigravity transportation system is also demonstrated to continuously and spontaneously pump water droplets without additional driving forces. The present novel finding and integrated devices should serve as a source of inspiration for the design of advanced materials and for the development of new technology with exciting applications in microfluidics, microdetectors, and intelligent systems.

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