

Plants model more efficient thermal cooling method

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Patricia Weisensee and her lab studied the temperature and evaporative behavior of a drop pinned to a vertical surface. Credit: Weisensee Lab



When drops of water touch the surface of a lotus flower leaf, they form beads and roll off, collecting dust particles along the way. In contrast, water droplets on a rose petal also form beads, but remain pinned to the petal's surface. A mechanical engineer at Washington University in St. Louis combined the two concepts to find a more efficient way for droplets to evaporate from a surface.

Patricia Weisensee, assistant professor of mechanical engineering & materials science in the McKelvey School of Engineering, initially planned to establish a pattern on a surface that would both repel liquid, similar to the lotus leaf, or pin <u>droplets</u>, similar to the rose petal, to influence wetting during droplet impact, such as during rain. Like the lotus leaf, when water impacts a repellent—or superhydrophobic—surface, droplets easily rebound, similar to rain on treated windshields.

In heat transfer and evaporation, these <u>superhydrophobic surfaces</u> are very inefficient due to a short contact time between the water and the surface. Conversely, when liquid comes in contact with a hydrophilic surface that can be wetted, it spreads over the surface, forms a liquid puddle and takes a long time to evaporate. Weisensee wanted to create a surface with both repelling and wetting properties that would create small sub-droplets, combining the advantages of both types of surfaces: droplet pinning and evaporation on the wetting surface without the risk of flooding the entire repelling surface. She then observed their behavior to learn more about evaporation as a cooling method for thermal management of high-tech electronic devices.

Results of her work were published online Dec. 20 in Langmuir.

More information: Wenliang Qi et al. Evaporation of Sessile Water Droplets on Horizontal and Vertical Biphobic Patterned Surfaces, *Langmuir* (2019). DOI: 10.1021/acs.langmuir.9b02853



Provided by Washington University in St. Louis

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