Artificial Leaves Generate Power by Pumping Water

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Inspired by water transport in natural leaves (shown), researchers have created a synthetic, microfabricated "leaf" that can generate power from evaporative flow. Image credit: pdphoto.org

(PhysOrg.com) -- Natural leaves constantly lose water through evaporation, as the water in their veins is pumped up to the top of the tree. This process, called transpiration, could also create a mechanical water pump effect in synthetic leaves, and be used to generate power.

Researchers from the University of California, Berkeley, the University of Michigan, and MIT have constructed leaves out of glass wafers with tiny veins through which water can flow. The veins open at the tips of the glass "leaves," where evaporation draws water out of the veins at a rate of about 1.5 cm/sec.

Then, the researchers wired the leaves by adding metal plates to the walls of the central stems and connecting them to a circuit. By charging the metal plates, the researchers created a capacitor made from the two conducting plates separated by an insulating layer.

Next the researchers added air bubbles into the leaf veins to periodically interrupt the flow of water. Every time a bubble passed between the metal plates, it changed the capacitance and generated a small current. The current then passed to an external circuit where it increased the voltage on a storage capacitor.

Each bubble could create about 2-5 microvolts, or 2 microwatts per cubic centimeter. The researchers predict that they could easily improve this amount to a few hundred microwatts per cubic centimeter. This power density is still much less than that of batteries or fuel systems, and the power output is still modest compared to solar technology. Still, the researchers hope that, as an energy scavenging system, the synthetic leaves might serve as a complementary solar technology, with sunlight driving the transpiration process.

More information: Ruba T. Borno, Joseph D. Steinmeyer, and Michel M. Maharbiz. "Charge-pumping in a synthetic leaf for harvesting energy from evaporation-driven flows." *Applied Physics Letters* (DOI: 10.1063/1.3157144).

Via: New Scientist