

# Researchers partner with brewery to collect urine and generate fertilizer

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When customers of Sudwerk Brewery Co. in Davis, Calif., answer nature's call, they can do their part to help nature.

Urine collected in a special outhouse outside the brewery is being used by University of California, Davis, researcher Harold Leverenz and his colleagues to develop natural [fertilizer](#) that may eventually support local agriculture. Installed in June, the outhouse solved a supply problem that Leverenz faced as he worked on a chemical process that isolates the nutrients in urine. He and his colleagues are perfecting the process and hope to attract funding to carry their project forward.

Referred to as the "pee hive," the outhouse contains a urinal made from a sawed-off beer keg that drips contributions from men and women into a small container below. When full, a pump powers on to move the urine out of the hive and into a collection tote that can hold about 250 gallons and requires changing about once a week. Leverenz and his team use a forklift to load the tote into a pickup truck and drive the collected urine to their nearby treatment facility.

Urine has high levels of nitrogen and phosphorus, essential plant nutrients in crop fertilizer. Leverenz, a [wastewater treatment](#) specialist, often thinks about the valuable nutrients lost down the pipes when we flush the toilet.

"How can we recover these nutrients as viable fertilizer rather than disposing of them?" he said.

At the treatment facility, Leverenz and his two colleagues [PHYS.ORG](#) UC Davis graduate student Jessica Hazard and sanitary engineer Russel Adams [PHYS.ORG](#) are able to process about 100 gallons of urine a day.

Leverenz describes the procedure in three main steps: hydrolysis, distillation and precipitation.

The first step uses enzymes from naturally occurring bacteria to convert the urea into ammonia. In the second step, steam evaporates the ammonia through one end of a column and condenses at the other end for collection as ammonium carbonate, which can be used for [nitrogen fertilizer](#). The final step mixes in Epsom salt to recover the phosphate left over in the urine. The overall process separates and purifies the vast majority of nitrogen and phosphate, leaving behind any drugs or infectious materials that may be present.

To date, much of the research has been self-funded. Construction of the pee hive was made possible in part by donations from Sudwerk.

Adams has been leading the commercialization effort for the team. He says the fertilizer they make can be added directly to the drip irrigation systems farmers already use. And Adams believes the fertilizer will receive certification for use in organic farming.

Most of the fertilizer produced so far has been used for testing. Leverenz and his team need to know the outcome on fertilizer strength that adjusting conditions of their purification process would have. The next phases of the project involve working with farmers to produce fertilizers that meet the needs of different crops at different parts of their growing cycle.

Flushing the toilet sends nutrients into the wastewater system, where nitrogen is processed and treated into gas that is released into the

atmosphere. The manufacturing of nitrogen fertilizers first extracts nitrogen from the atmosphere and ultimately converts it into ammonium nitrate. By processing urine at its source, Leverenz and his team cut out intermediate steps in fertilizer production and improve energy efficiency.

Other benefits of the pee hive include reduced water use since the toilet is flush-free. To keep it clean, workers rinse out the urinal each night with vinegar.

Thomas Miller, co-founder of Sudwerk, jumped at the opportunity to take part in the pee hive. He sees a close alignment between the mission of Leverenz's team and that of the craft brewery.

Miller views craft breweries as willing to try new ingredients or brewing processes to produce the highest-quality beer for customers. In the same way, he feels creating locally sourced fertilizer challenges conventional wastewater treatment.

"We're helping the process of science through [urine](#) collection," says Miller. "It's not your status quo thing," he said. "That's what we're doing in the craft brewery business, too."

The pee hive at Sudwerk is just the beginning in Leverenz's vision. Similar to the culinary movement toward locally sourced ingredients, Leverenz's goal is to decentralize wastewater treatment and create locally sourced fertilizers that could support local food production.

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