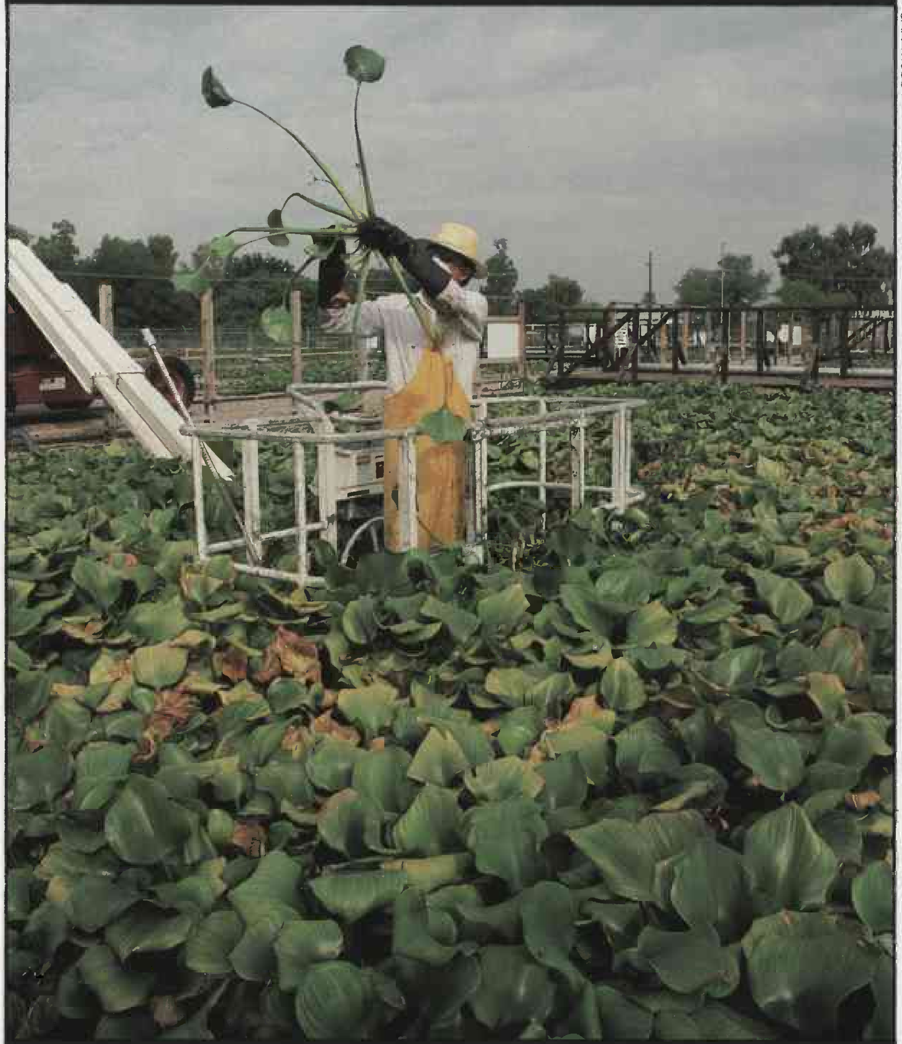
Treating Waste Water



JAN McCOY

With Weeds

Water hyacinths are aggressive, fast-growing aquatic weeds that can treat waste water to acceptable standards.

BY JAN McCOY

Martin Karpiscak and his staff have been working among the water hyacinths since 5 a.m. on yet another muggy June day. What first appears to be a plant nursery is actually a research facility where plants thrive in waste water from Pima County sewers.

Karpiscak and his team are collecting plant and water samples at the Pima County Water Hyacinth Wastewater Treatment Research Facility. Results from this pilot project will determine whether the plants can be used as an alternate waste water treatment system in Pima County.

Water hyacinths are aggressive, fast-growing aquatic weeds that have been proven to treat waste water to acceptable standards. Both the plant, and the organisms that live in its root zone, treat waste water by removing nutrients from it. Facilities in Austin, Texas, and San Diego, Calif., use water hyacinth systems to treat portions of their cities' waste water.

The question is whether the system will work in the temperature extremes of Southern Arizona.

"Water hyacinths are a tropical species," says Karpiscak, a research scientist in the University of Arizona Office of Arid Lands Studies. "We have to see how our winter frosts affect the system and how much water is lost to evapotranspiration during the hot summer months."

After a feasibility study by the UA Office of Arid Lands Studies in 1984, George Brinsko, head of the Pima County Wastewater Management Department, received authorization to build a prototype facility to find that out.

Pima County and the UA are conducting the research at the 3-acre site built next to the county's Roger Road treatment plant, just west of Interstate-10, off Sweetwater Drive. Research, which began in late 1988, is expected to last from three to five years.

(Above) UA research assistant Glenn France harvests plant samples from a pond at the Pima County Water Hyacinth Wastewater Treatment Research Facility.

Although the designs of conventional waste water facilities vary, all use similar methods of treating waste water.

The primary treatment of waste water involves separating sand, grit and larger solids from the liquid. Screens, settling tanks and skimming devices are most commonly used for the separation. Primary treatment removes from 35 percent to 50 percent of the pollutants from the water.

Most treatment plants provide a largely biological secondary treatment that removes about another 40 percent of the pollutants from the water. Air is supplied to stimulate the growth of bacteria and other organisms that consume waste material. Finally, any remaining solids and organisms are separated from the water, which then is disinfected with chlorine, and released to a nearby lake, river or stream.

Pima County facilities use variations of this method at the two large Tucson facilities at Roger Road and Ina Road, and at 12 smaller outlying facilities throughout the county. The two Tucson plants discharge about 80 percent of the treated water into the nearby Santa Cruz River. The remaining 20 percent is reclaimed by the City of Tucson and is re-used to water golf courses and other areas.

The solid material removed during the treatment process is called sludge. Pima County sludge has been

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KEEPING AN EYE ON SLUDGE

IAN PEPPER

Pima County sludge has been applied to crops in Pima and Pinal counties since 1983.

Pima County sludge has been tested by both county and University of Arizona scientists, and proved to be an excellent fertilizer and soil conditioner. The sludge also is nearly free of heavy metals and organic chemicals.

The county's treatment process removes about 99 percent of pathogenic bacteria and viruses from the sludge, yet the remaining 1 percent may still be a substantial number. The question becomes: how long do those remaining organisms survive?"

If they die quickly and move slowly, there's no problem," says Ian Pepper, a microbiologist in the UA department of soil and water science. "If they survive a long time, and move quickly, then we've got problems."

Pepper has worked with the Pima County Wastewater Management Department for five years to evaluate the benefits and potential hazards of sewer sludge applied to farm land.

Pepper says UA studies, and studies in other part of the country, show organisms, such as *Escherichia coli, Salmonella typhimurium, Giardia* and fecal coliforms, die off relatively fast when added to soil.

"We've looked at different soils and different temperatures," he says. "Studies show the organisms die off in 14 to 50 days, depending upon temperature and soil type."

But a new scientific theory suggests that a hostile environment, such as the waste water treatment process, might not kill, but "sub-lethally" injure the pathogens.

"Conventional testing techniques may register a negative reading for the organisms, whereas in reality they may be viable," Pepper says. "The potential scenario then, is if pathogens encounter the correct host, they can revert to their fully viable state and be off and running."

Pepper and his staff are developing a fast, highly sensitive molecular technique that amplifies the DNA of a pathogen. DNA, or deoxyribonucleic acid, contains the genetic code and transmits the hereditary pattern of an organism.

"It's very difficult to try to find one pathogen in the midst of a thousand million other bacteria types," Pepper says. "But if you can amplify the target DNA of the pathogen, it's a lot easier to detect."

This process, called a polymerase chain reaction, can amplify target DNA a million-fold in three hours, he says.

The test works with pure laboratory cultures, but making it work with environmental samples is more difficult. Pepper's research, funded by a variety of federal, state and local grants, focuses on developing methods that will allow the pathogenic organisms to be detected in soil.

Then, Pepper says, "when conventional test methods say there are no pathogens in a soil sample, we'll use the test to confirm the results.

"This would assure us that added pathogens do indeed die off—which is what we assume now."

—Jan McCoy

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