



PRESS RELEASE

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WRRF USING ALGAE PILOT SYSTEM TO REMOVE NUTRIENTS

Nutrient and struvite reduction, energy savings key to development of RAB system

MUSCATINE, Iowa – The Muscatine Water & Resource Recovery Facility (WRRF) has a new tool to battle against struvite buildup ... algae. The WRRF is taking part in a pilot study that uses growing algae as a way to reduce nutrients in wastewater.

“Algae is a wonderful way to take nutrients out of water,” Jon Koch, WRRF director, said. “They do that naturally anyway, taking nitrogen and phosphorus from the water to grow more of themselves.”

Gross-Wen Technologies, based in Slater, Iowa, developed a sustainable water treatment solution that was algae based, and a pilot program was established in early April at the WRRF and is now operational.

The process was developed by a graduate student and professor at Iowa State University as a way to remove the nutrients from lagoons and similar places.





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"I was at a conference in Ames a few years ago when they presented this process," Koch said.

What started as a process for lagoons attracted the interest of wastewater people and how this process could be used at wastewater plants. The thought of using algae to treat wastewater was new to the group presenting the process at the conference, and it took a few years of development to bring the costs down to a more manageable level.

The company visited the WRRF in 2019 and proposed a pilot program for Muscatine.

"We kind of lost track of the company during the pandemic but when we got slammed so badly by struvite in 2021, I called them up and said we needed to revisit bringing a pilot program to Muscatine," Koch said.

The original cost for the six-month project was \$100,000, but after some refinements to the process the cost was whittled down to \$30,000.

"That is a lot more manageable," Koch said. "During the revisit I asked them if we could get a pilot program right away and they said they could. However, it still took several months before the mechanism was delivered and installed."

Struvite is a phosphate mineral crystal that is composed of magnesium, ammonia, and phosphate (referred to as MAP by the wastewater industry for the nutrient composition of struvite). Struvite is a common problem in sewage and wastewater treatment because it forms a scale in pipelines, belts, centrifuges, pumps, clog system pipes, and anaerobic digester systems. Damage to equipment, pipes and piping can lead to biosolids treatment mechanical and process failures.

To reduce the problems caused by increased struvite levels in wastewater, a "Revolving Algal Biofilm System (RAM™)" was developed for algae-based nutrient recovery from wastewater.



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The system also provides a cost-effective solution that can be used to comply with new, more stringent municipal and industrial wastewater discharge permits.

"This mechanism sits outside in a kind of greenhouse using the sun to keep the interior warm for good algae growth," Koch said.

The system uses vertically oriented conveyor belts that grow algae on their surface. As the algae grows, it consumes nitrogen and phosphorus from the wastewater while it uses sunlight and carbon dioxide from the atmosphere to rapidly grow algae biomass.

"The belt rotates through the effluent water and grabs nutrients from the wastewater," Koch said. "Algae grows on the belt as it rotates up into the warm air. The algae picks up more nutrients as the belt continues to rotate back down, through the water, and back up."

Algae is harvested by being scrapped off the belt, and can be used to make fertilizer, bioplastics, and biofuels, providing an additional revenue stream alongside an already more economical system.

"All that scraped off algae has the nutrients in it and the water that comes out has less nutrients than when it came in," Koch said. "The mechanism also puts oxygen in the water using a six hp motor."

Oxygen is needed by the bacteria to allow biodegradation to occur (breaking down the organic matter containing carbon to form carbon dioxide and water). At the present time, Koch is using three 150 hp and two 250 hp motors to add oxygen to the water.

"If I can use 6 hp to add oxygen instead of 800 hp I am saving a lot of electricity," Koch said.

The system benefits the WRRF by reducing the amount of nutrients in the water thus reducing the amount of struvite formation while meeting the more stringent DNR permit requirements and saving the WRRF money.



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"So, you are meeting your permit limits for the nutrients you are required to take out, you are saving electricity, you are reducing struvite formation, you are reducing the amount of solids because it will pull solids out as well, and you have a revenue source," Koch said. "This system kind of hits on a lot of different goals that we have."

Koch noted that using an algae-based system to remove nutrients from the water would quickly pay for itself.

"The savings you would have on energy reduction, and on the amount of time, energy, and chemicals used to prevent struvite formation along with the additional revenue from algae generation make this technology affordable," Koch said.

But it is not only in the benefits of nutrient reduction to prevent struvite formation and to meet DNR permit requirements that make the system practical.

"This will be a really good compliment to the watershed work," Koch said. "What this system can do for us as far as struvite removal is key, but you don't have to do the whole thing (nutrient removal) at the plant."

Koch noted that it would take an acre or more of these systems put together to do all the nutrient reduction and the cost would be pretty high.

"But if you scale it just where you need it, just enough to affect your struvite reduction and everything else, then maybe you can get most of that reduction done at the plant," Koch said.

And whatever you cannot get done at the plant, then you can go out to the watershed, put in prairie strips and things like that, and do other watershed work which is really inexpensive but beneficial to the entire watershed.



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“Muscatine city, the watershed as a whole, and the entire city basin will benefit from what we are starting to do at the WRRF today,” Koch said.

[WRRF RAM System Pilot Program installed at Water Resource & Recovery Facility](#) (Video)

[Gross-Wen Technologies RAM System Overview](#) (YouTube Video)

[Gross-Wen Technologies RAB](#) System (YouTube Video)

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