

New Solution for Aquaculture Wastewater Treatment

Aquaculture, or fish farming, is one of the fastest growing sectors of agriculture in the world today. However, farmers in the United States who wish to capitalize on this momentum face regulatory hurdles when dealing with fish waste. But new research shows that a simple, organic system can clean aquaculture wastewater effectively and inexpensively.

Researchers built bioreactors—long containers filled with wood chips—to treat wastewater from a fully operational recirculating aquaculture system in West Virginia. The idea is simple: water from the fish tank enters the bioreactor at one end, flows through the wood chips, and exits through a pipe at the other end. Along the way, solids settle out and bacteria housed in the wood chips remove nitrogen, a regulated pollutant.

Laura Christianson, assistant professor of water quality at the University of Illinois and lead author of the study, is a bioreactor expert. Her research has shown just how effective they are at removing excess nitrogen from tile-drained agricultural fields across the Midwest. But this project was a different kettle of fish.

“The bioreactors that we usually promote in Illinois are for taking nitrogen out of tile drainage,” Ms Christianson explains. “Wastewater from a fish farm is a lot gunkier. It looks brown and can be smelly. We wanted to see if we could get a bioreactor to take the nitrogen out of that kind of water without the bioreactor clogging up with solids.”

The team set up four identical bioreactors, varying only in retention time, or the amount of time it takes for water to travel from end to end.

“Retention time varied from 12 to 55 hours in the four bioreactors. If you’re trying to treat a lot of water, you want a lower retention time so you can keep it moving through. But the more time you give those bacteria to take the nitrogen out, the more effective they are. We were trying to find a balance between moving water through quickly and making sure it’s staying in there long enough to get treated properly,” Ms Christianson explains.

Solid waste in the water presented another complication. At high flow rates, more solids were entering the system, settling out, clogging the spaces between wood chips, and impeding flow. The researchers found that the optimal retention time to both treat the water and avoid immediate clogging was 24 hours.

“The long and the short of it is that the bioreactors worked great,” Ms Christianson says. “They worked as a filter for the solids and took nitrates out. But for systems that need to move a lot of water in a short amount of time, we recommend an additional microscreen filter to settle some of the solids out before they enter and clog up the bioreactor.”

At face value, a study about clogging potential of aquaculture bioreactors might not seem revolutionary, but the results could play a part in the evolution of the agriculture industry.

“In the US, we import more than 80 per cent of our seafood—mostly from southeast Asia and China—so it’s an important industry. If we want to increase our food security, especially around this great source of protein, we should raise more fish domestically. But to do that in an environmentally responsible way, dealing with the wastewater from fish farms will be really important,” Ms Christianson says.

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