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Intelligence

Freshwater Institute: Membrane bioreactors cut RAS water use

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By Responsible Seafood Advocate

Technology filtered and treated wastewater before recirculation, helping remove waste and maintain water quality

A four-month trial at the Freshwater Institute found that membrane bioreactor technology reduced water use in recirculating aquaculture systems (RAS) by 94 percent without affecting rainbow trout growth or survival.

The study, published in *Aquacultural Engineering* (<https://www.sciencedirect.com/science/article/pii/S0144860926000464>), compared standard RAS with systems equipped with multi-vessel membrane bioreactors, which treated and recycled wastewater from drum filter backwash and solids flushing before returning it to the system.

The membrane bioreactor systems reduced make-up water use from about 2,004 liters per day to 129 liters per day, cutting water exchange rates from 21 percent to 1.4 percent.



A Freshwater Institute study concludes that membrane bioreactors can cut water use in recirculating aquaculture systems by 94 percent, without affecting trout growth. Photo credit: Freshwater Institute.

The technology filtered and treated wastewater before returning it to the system, helping remove waste and maintain water quality while reducing the need for fresh water. Air pulses were also used to keep the membranes clean and improve system performance.

A banner for the Global Seafood Alliance. On the left is the logo, which consists of a stylized fish head inside a circle, followed by the text "Global Seafood ALLIANCE". To the right of the logo is the text "For the love of seafood." in a large, blue, serif font. Below this text is a blue button with the white text "BECOME A MEMBER". On the far right of the banner is a small, semi-transparent image of a woman smiling and holding a fish.

(<https://www.globalseafood.org/membership/>).

Rainbow trout performed similarly in both systems during the trial, with fish growing from about 1 kilogram to 2.8 kilograms and survival rates reaching 96 percent. The membrane bioreactor systems also showed lower rates of deformities.

The study reported that the systems removed more than 97 percent of nitrate nitrogen when enough supplemental carbon was added to support treatment performance. Low-dose ozone also improved water clarity and reduced concentrations of some metals in the low-exchange systems.

According to the researchers, the trial showed membrane bioreactors could be integrated into RAS to sharply reduce water use, potentially expanding aquaculture development into areas with limited water supplies or strict discharge regulations.

However, they noted that successful operation would require experienced staff, robust monitoring systems and further analysis of costs, energy use, and long-term performance.

[Read the full study \(https://www.sciencedirect.com/science/article/pii/S0144860926000464\)](https://www.sciencedirect.com/science/article/pii/S0144860926000464).

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