VACUUM AIRLIFT™

FOAM FRACTIONATION

A Case Study in Suspended Solids Removal and UV Transmittance

Situation

The accumulation of particulate organic matter (POM) in recirculating aquaculture systems (RAS) has become an important issue with the intensification of finfish production. The presence and accumulation of POM (faeces, uneaten feed, parasites and bacterial flocs) in RAS can decrease water quality which leads to increased biological stress of the reared organisms. The accumulated POM leads to an increase in biological oxygen demand (BOD) for the system and the development of heterotrophic bacteria. These contaminants create fish management risks ranging from; 1) slow growth and higher mortality of the fish during rearing to 2) higher oxygen demand and higher biofilter load in the water management system to 3) off flavor and illness in humans when the fish are consumed. All of these factors negatively impact the return on investment by increasing the cost of raising the fish or reducing the marketability of the fish.

Barramundi Rearing Tank with Accumulated POM

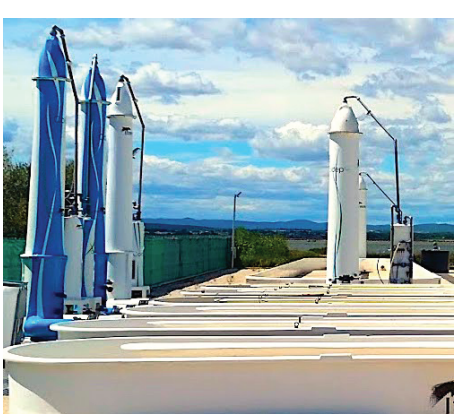
Requirements

A US Barramundi farmer wishing to address these risks investigated a number of techniques for management and removal of fine particulates. Traditional approaches such as drum, screen or sand filters are not effective due to pore size versus pumping cost limitations. Fixed screens or rotating microscreens are limited in their effectiveness below 40 µm due to poor flow capacity leading to higher pumping costs and increased cleaning frequency. Sand filters are likewise limited by high head loss and the need for frequent maintenance. To address these issues RAS facilities are increasingly turning to foam fractionation or protein skimming as a means of POM removal.

Foam fractionation is a water treatment technology that can easily be added to water reuse systems to directly remove dissolved and fine suspended solids. The process of foam fractionation, also known as floatation, protein skimmming or air stripping, consists of injecting fine air bubbles into the water being treated. Micron sized air bubbles attach to surface active particles and carry them to the free surface forming a concentrated layer of foam that is then removed. In rearing farms, foam fractionation allows removal of fine particles smaller than 40 µm giving rise to high quality water. The ability of these devices to extract microparticles makes them effective biosecurity tools as they extract bacteria, viruses, toxic microalgae and parasites.

Our Soution

The Vacuum AirLift™ (VAL™) provides a multi-functional solution to water treatment and management. The VAL™ is a patented technology that provides water circulation, gas exchange and particulate extraction in a simple, reliable and energy efficient device. The VAL™ continuously extracts fine particulates and pathogens through foam fractionation that contaminate finfish rearing water. If left untreated this contamination leads to off flavor, biosecurity issues and risk of human illness or death. In addition, the VAL™ extracts CO_2, N_2, H_2S and other undesirable dissolved gases while replenishing the O_2 consumed in the rearing and denitrification processes.

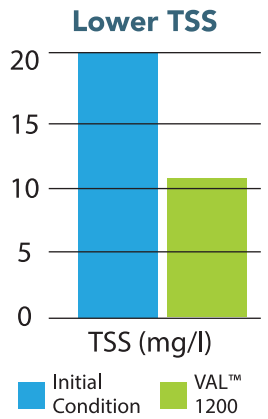


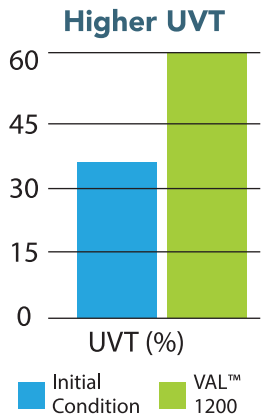
VAL™ Treating Rearing Tank Water

Results

A demonstration was conducted to illustrate the VAL's™ effectiveness in treating finfish rearing water. The demonstration was conducted using the VAL™ installed after the drum filter in Barramundi RAS. The system had a biomass of 12,000 lbs and a recirculation rate of 350 gpm. Total Suspended Solids (TSS), UltraViolet Transmittance (UVT) and Input Power were measured at the start of the demonstration and after stabilization. The test results are provided in the following table.

	Initial Conditions	VAL™ Model 1200
TSS (mg/l)	20	11
UVT (%)	37	59
Power (kW)	N/A	2.0





Low Clarity Before VAL™ Treatment

Improved Clarity After VAL™ Treatment

The test results indicate that the VAL™ reduced the TSS by 45%. As a result of the reduction in TSS the VAL™ increased the UVT by 22%.

A number of benefits accrue as a result of this performance:

1. Lower CAPEX due to reduced equipment cost
2. Lower OPEX due to reduced power consumption
3. Increased reliability due to less complex equipment
4. Decreased CO_2 and other undesirable dissolved gas levels due to VAL™ vacuum extraction
5. Increased O_2 levels due to VAL™ aeration and reduced BOD
6. Faster growth and fewer mortalities due to improved fish health
7. Increased biosecurity due to removal of pathogens and contaminants as well as more effective UV dosing
8. Increased margin due to improved product quantity and quality

This demonstration validates the VAL™ as a highly effective tool in addressing particulate removal and other aquaculture water management and biosecurity issues.

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