

# NUTS & BOLTS

BY GENNY WEST

## Solids Removal by Foam Fractionation

**T**here are many options for removing solids from aquaculture water such as pressurized media filters, microscreen filters, gravity separation, and flotation. The choice of technology will depend on the water quality and the treatment process. Each technology deserves its own article so we will start with particle removal via flotation.

Flotation systems operate by introducing bubbles into the liquid. Particulate matter attaches to the surface of the bubble as they rise through the water to the surface, where they can be skimmed off. Flotation technology is most appropriate for removing fine- and low-density particles that are difficult to remove through sedimentation. A small but significant percentage of the wastes generated in aquaculture systems are too fine to be removed by conventional filtration systems. Normally, these fine solids are flushed away with effluent water, however, in tight recirculating systems, they can build up, providing food for bacteria, which consume oxygen and release toxins into the water. Foam Fractionators are often used to remove these fine organics.

There are three basic types of flotation system:

- Dissolved-air flotation
- Vacuum flotation
- Air flotation

In dissolved-air flotation, gas is dissolved under pressure into the water. When the water is discharged into a vessel at atmospheric pressure, the dissolved gases come out of solution as fine bubbles. As air is most commonly used, this technology is rarely used in aquaculture facilities as the increased gas pressure may create problems with super-saturation.

In a vacuum flotation system, the water is passed into a vacuum chamber and the existing dissolved gases are drawn from solution as bubbles, due to the reduced pressure within the vessel. This technology is usually more complex and difficult to execute than the other options, and so, is the least likely to be used.

Air flotation systems involve injecting gas bubbles into the water column using diffusers

or a venturi injection system. Although achieving fine enough bubbles can be problematic, this is the easiest and most reliable technology, and is the one most commonly used in aquaculture facilities.

Flotation systems tend to be highly mechanical. Effectiveness is very dependent on the type of particulate matter, characteristics of the water, the bubble size and the air/solids ratio. Generating fine bubbles is relatively easy in salt water, but can be harder in fresh water systems. Although flotation system performance can be enhanced by the addition of chemicals, which change the surface tension of the water, these chemicals are not typically used in aquaculture facilities.

Foam fractionation is also known as protein skimming since it also allows the removal of suspended and dissolved waste such as proteins before they decompose to toxic compounds. Dissolved or suspended organic particles are drawn by polar charges on the particle to an air/water interface. One end is drawn to the water while the other end is drawn to the air. The bubbles rising to the water surface form a layer of foam. Skimming off the foam therefore removes the attached solids. Tiny bubbles are more effective than large bubbles because they maximize the surface area of the air/water interface and the length of time that it takes for the bubbles to rise to the water surface. A venturi is commonly used to create the fine bubbles.

The foam is usually collected in a chamber at the top of the vessel and is then directed to waste, carrying the fine particles with it.

### The use of Ozone

Foam fractionators can also be used for ozone injection, rather than using air. Ozone enhances the process by oxidizing potentially dangerous organisms including bacteria and viruses, thereby destroying these pathogens. Ozone also works well as a water clarifier and will make the particles easier to be captured by the bubbles.



Clear RK2 fractionator system.



RK2 system at Monterey Bay Aquarium.



Sander protein skimmers.

RK2 Foam Fractionator System.

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# SHOWCASE

## Larval Fish and Feeds

### New feed for rotifers

Reed Mariculture recently introduced an addition to its Instant Algae™ product line – Rotifer Diet 2™. Rotifer Diet 2 is a combination of the microalgae Nannochloropsis, Tetraselmis, and Chlorella and is specifically formulated for use in rotifer production systems, such as the Aquatic Eco-Systems (AES) High Density Rotifer System.

According to a press release from AES, Rotifer Diet 2 is a high energy feed for rotifers that helps them reproduce at peak levels. The release notes that: "Typical production yields in an AES Rotifer System using RD2 are 5,000 rotifers per ml and a 50% daily harvest, however the system can be pushed to significantly higher yields as needed." Nannochloropsis is the primary component in RD2 and the addition of Tetraselmis helps to increase the metabolism of the rotifers, while the Chlorella helps to provide a balanced diet.

"RD2 is an exceptionally 'clean' feed which helps increase performance in high density systems which rely on screens to contain the rotifers," adds the company. "Clean feeds like microalgae result in low bacterial content so the rotifers and their droppings are less sticky and much less prone to fouling the system or screens."

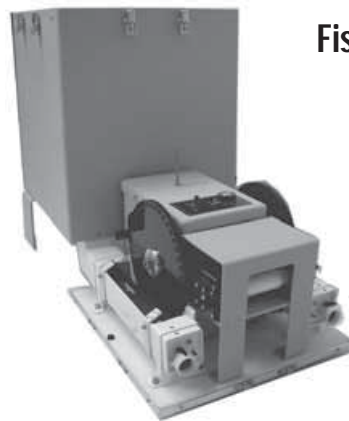
RD2 is packed in 10 liter bags and has a minimum eight week refrigerated shelf life. Information: [www.reed-mariculture.com](http://www.reed-mariculture.com)

The new diet is specially formulated for use in rotifer production systems such as the Aquatic Eco-Systems (AES) High Density Rotifer System pictured.



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### Site Manager Atlantic salmon hatchery

- Competitive Salary Package
- Tasmanian Location
- Excellent career opportunities

This is an excellent opportunity to join an Australian market leader who has experienced considerable change and is about to embark on tremendous growth.

Tassal Group Ltd is the largest aquaculture company in Australia, employing over 450 people and marketing 60% of the Tasmanian salmon industry's production. Tassal is a vertically integrated company from hatchery through to farming, processing, value-adding, distribution, sales and marketing. For more information on Tassal visit [www.tassal.com.au](http://www.tassal.com.au)

Heading up a small dynamic team this position will be located at the Russel Falls hatchery.

As an operational role it is expected that the successful candidate will;

- Be fully conversant with smolt hatchery operations from ova incubation to smolt delivery and have a minimum of 5 years practical experience in hatchery operations of Atlantic Salmon.

- Have proven experience in the management of staff, production planning and budgetary requirements.

- Hold tertiary qualifications in Aquaculture
- Commit to continual business improvement, exceeding production targets and the production of the highest quality smolt.

In return for the above you will be rewarded with a comprehensive salary package and excellent career opportunities.

For more information please contact Danielle Foster or forward your applications or enquiries to [danielle.foster@tassal.com.au](mailto:danielle.foster@tassal.com.au)

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Here are some good reasons to incorporate a foam fractionator into your system:

- Reduces system cleaning requirements by reducing the growth of bacteria on tank and pipe walls, drum filter screens, etc.
- Reduces oxygen demand by reducing heterotrophic bacteria concentrations.
- Reduces loading on biofilters by minimizing heterotrophic bacteria
- Improves water clarity.
- Improves transmissivity of UV light from sterilizer units, reducing power requirements.
- Is easy to incorporate in an existing treatment train.
- Requires very little maintenance and has low operating cost.

When purchasing a foam fractionator some information needs to be passed onto the supplier, as material and design modifications are often optional:

Will ozone be used? If so, ozone-resistant materials will need to be incorporated.

Is the application for fresh or salt water? The foam removal skimmers are usually different, depending on water characteristics.

What is the desired flow rate through the unit? Is it a side-loop arrangement or for full flow usage? If it is a side-loop a recirculation pump may have to be incorporated as well as the venturi pump.

Foam fractionation is a tried and tested method of removing small particles and is relatively inexpensive if incorporated with other filtration methods. Together they will reduce turbidity and organics from the culture water, which benefits the culturist since cleaning tanks and equipment is made easier. It also benefits the fish by reducing bacterial growth and improving oxygen concentrations and overall water quality.

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Check out the online Suppliers Guide  
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