



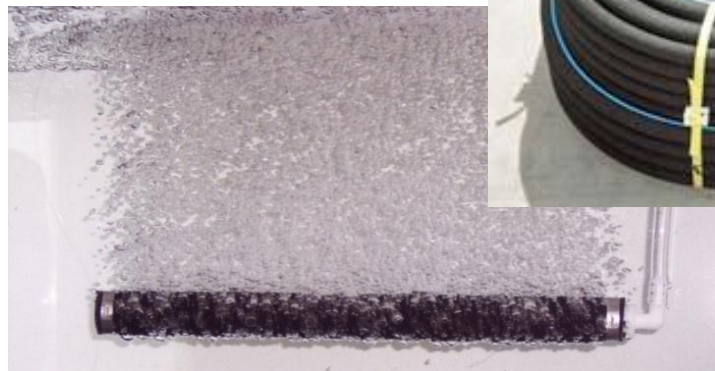
AERATION TECHNOLOGY: NEW ADVANCES IN AQUACULTURE The “Aero-Tube” Advantage



Independent testing company used for the enclosed evaluation

Aeration is an important key

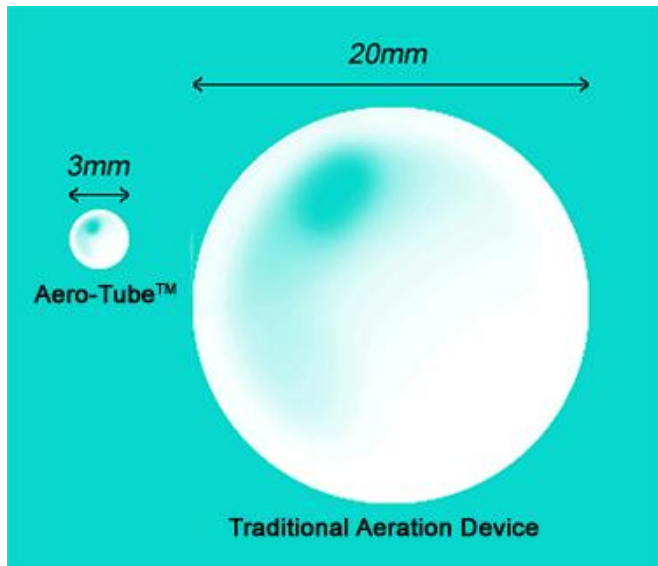
- Aeration is often one of the key limiting factors.
- Inefficient methods of aeration increase costs of production.
- New efficient aeration technologies must be developed.
- **Colorite Plastics, the world's leading manufacturer of garden hose and aeration tubing is proud to introduce Aero-Tube™ aeration tubing, the next major advance in water aeration. Building on our extensive knowledge and expertise, we have developed Aero-Tube™ aeration tubing, a more affordable and durable aeration tube (Patent #5,811,164) and one of the most efficient products on the market. Aero-Tube™ products are designed, manufactured and patented specifically for oxygen transfer and aeration efficiency. Aero-Tube™ continuous bubble aeration tubing delivers oxygen in volumes that are unmatched by other systems, and at an energy cost that is often less than half than that of conventional systems.**



Even bubble side, 1-3mm in diameter

Aeration Technology

It doesn't matter if an aeration system or device splashes, sprays, or diffuses air, the bottom line is how much surface area it creates. The surface area is where water contacts air and where oxygen transfer takes place. Smaller bubble size results in more surface area, which is why fine bubble aeration devices are superior in oxygen transfer than coarse bubble aerators. To maximize aeration efficiency in a system, an aerator must create fine bubbles while expending a minimum amount of energy. Aero-Tube™ technology meets both goals, and does so with a long-life, low-maintenance system.



The technology behind the extremely high performance and efficiency of Aero-Tube™ is our twice-patented manufacturing process which, through a unique combination of technique and raw material, creates numerous tiny pores throughout the length of the hose. These micro-pores allow the efficient transfer of air into the water. By combining Aero-Tube™ aeration tubing with an efficient clean air blower, you create a high efficiency, low cost method of aerating water.

Aero-Tube™ achieves its high energy efficiency in two ways:

Due to the number of pores created during our manufacturing process, there is little resistance created when pushing air through the tubing. Resistance equals energy demand. By working with Aero-Tube™, you can use significantly less horsepower when compared with traditional methods of aeration (paddlewheels, aspirators, less efficient tubing).

Aero-Tube's tiny pore size creates extremely small diameter bubbles. The smaller a bubble of air the more efficiently it transfers oxygen into water (more surface area!). Small bubbles also take longer to rise once they are introduced into water. Slower rising, small-diameter bubbles mean more contact with the water and a much higher rate of oxygen transfer. By creating significantly smaller bubbles, more efficiently, Aero-Tube™ products are able to deliver high rates of oxygen transfer and energy efficiency.

Versatile Aeration Applications



Aquaculture Ponds

Tanks and Raceways of all kinds

Thus Introducing: Colorite Aerotube Airlifts

(an aeration system alternative to the conventional aeration methods such as paddle wheels)

Colorite has specifically manufactured a grid using the Colorite aerotube in a PVC moulded air supply manifold. This grid is then placed in a 3 sided frame. Thus creating an air lift unit, with directional circulation.



Airlift Grid Only



3 Grid Airlift Model in operation

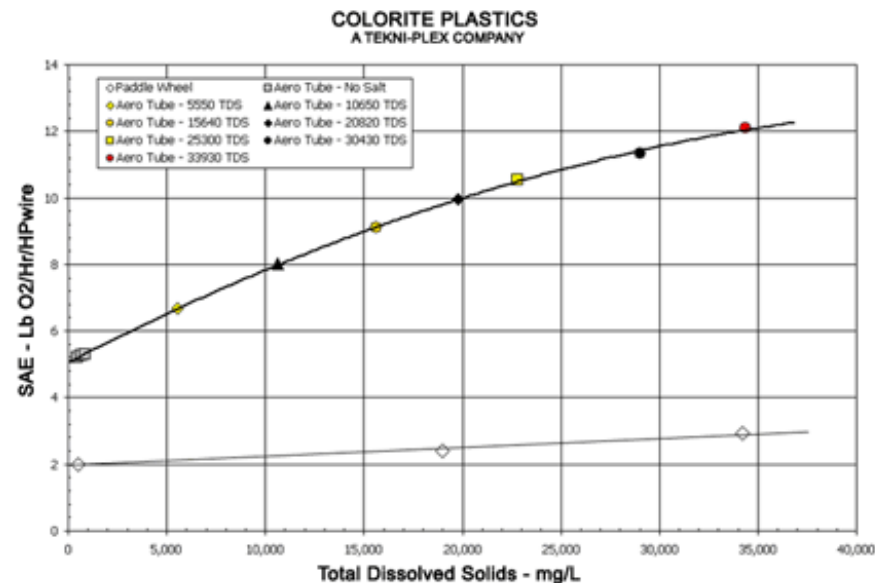
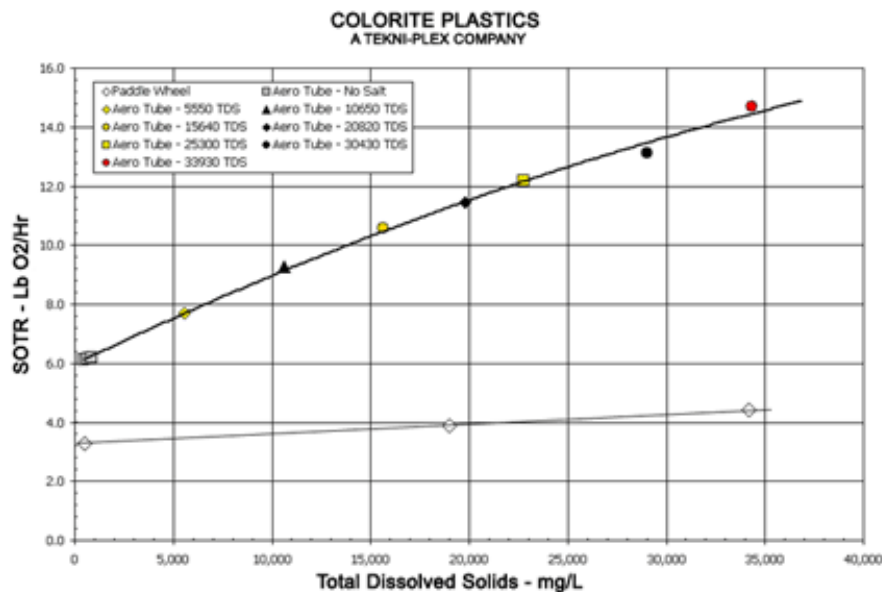


3 Grid Airlift Model, simple construction using non corrosive, light fibreglass frame & 3 airlift grids

Independent Testing

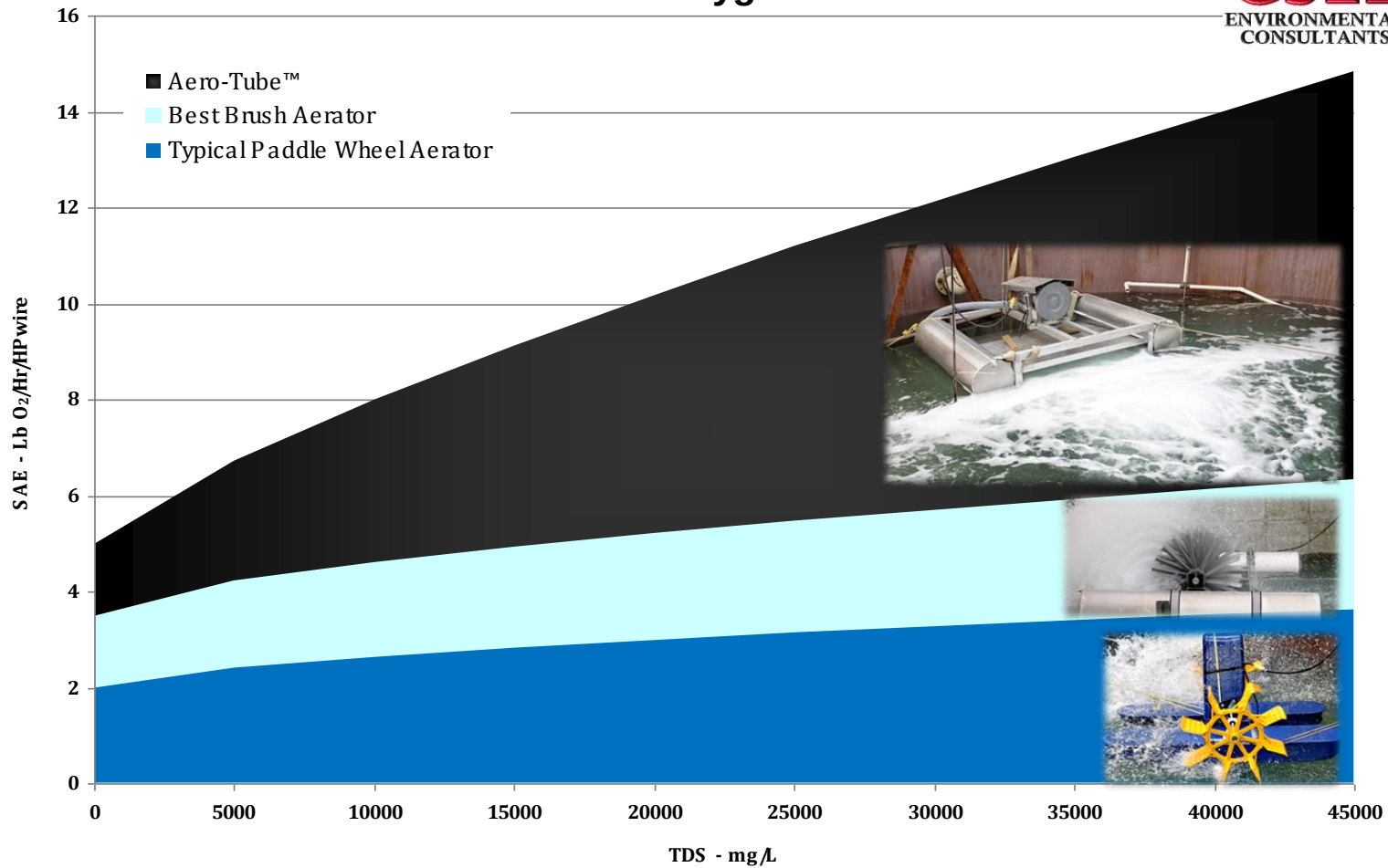
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These results are based on 60hz blower testing.

Effect of Salt (TDS) Concentration on Oxygen Transfer



Conclusions of Study

- Aero-Tube Fine Bubble diffuser tubing was much more efficient in transferring oxygen when compared to two different types of paddlewheel aerators.
- The oxygen transfer advantage of Aero-Tube increased with increasing salinity significantly. This is the first known documentation of an increase in aeration efficiency with salinity.
- Based on the SAE advantage, using an aeration system which incorporates Aero-Tube technology can save a significant amount of energy and money when compared with paddlewheel aeration in either fresh or saltwater.

Glossary of Terms

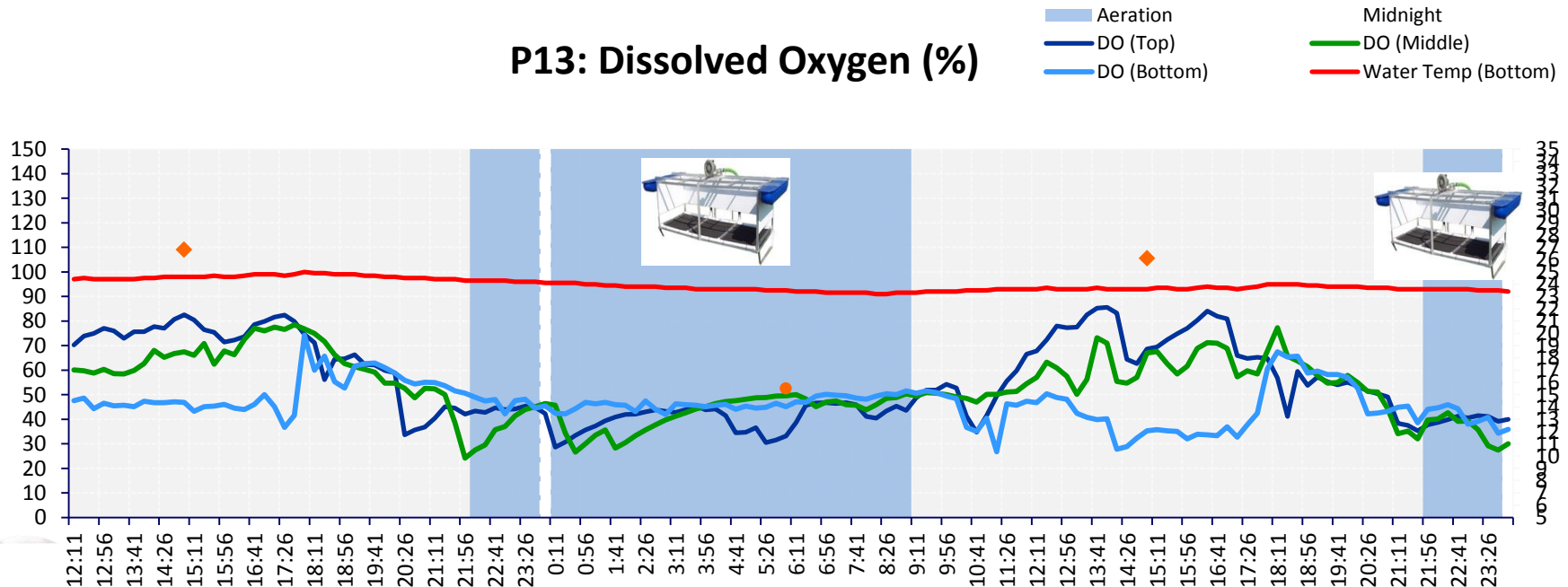
1) Standard Oxygen Transfer Rate (SOTR) – Pounds of oxygen transferred to water per hour (lbs O₂ /hour). SOTR is measured in clean water when the dissolved oxygen (DO) concentration is zero at all points in the water volume, the water temperature is 20o C, and the barometric pressure is 1.00 atm (101kPa)

2) Standard Aeration Efficiency (SAE) – Standard Oxygen Transfer Rate per unit total power input. SAE is typically expressed as the pounds of oxygen transferred to the water per hour per HP (lbs O₂ /hour/HPwire), and is sometimes referred to as SAE Wire. SAE is used as a measure of how efficiently an aerator is transferring oxygen.

Oxygen Distribution

You could also ask yourself the important question of where your fish spend much of their time? If it is in the lower levels of the pond zone and your DO levels in this zone is low? What efficiencies are you getting out of the food you feed your fish (FCR's)? We conducted a field trial in a 0.2ha pond, stocked with Silver Perch juveniles and monitored Dissolved Oxygen and Temperature, logged at 15 min intervals, applying 3 dissolved oxygen probes at various depths, near the water surface, mid water and just off the bottom (1.5m). As you can see from the below graph, during the period of time that the airlift was operating, the oxygen levels at each of the depths merged, indicating that the dissolved oxygen levels become very even throughout the pond. Thus significantly reducing oxygen stratification. The effects on production and productivity should not be under estimated.

P13: Dissolved Oxygen (%)



How Important Is Your Pond Bottom to your profitability?



Bottom DO's are also key to maintaining a healthy pond bottom.

Increasing capability of more food in, more fish out and meaning higher profitability.

Circulation Is Important



Proof is in the dye



18 minutes after dye release



30 minutes after dye release



55 minutes after dye release

Reduced stratification will create more consistent and healthier algal biomass. Resulting in greater consistency in water quality. Smoothing out the peaks and troughs in water quality.

Aquaculture Aeration

Since a majority of all aquaculture problems, including disease, are caused by poor water quality and, in turn, most water quality problems can be resolved with proper aeration (oxygenation), it is clear that aeration plays a crucial role in this process.

Oxygen is the main limiting factor in both recirculating and traditional aquaculture systems. Less than the required levels lead to poor water quality, poor feed conversion ratios (FCR), reduced growth and increased mortality. With high energy prices, energy efficiency is becoming much more important when comparing aeration techniques and devices. Many of the traditional aeration devices like paddlewheels and aspirator style aerators have a poor track record of reliability and higher overall energy requirements. "Aerator Graveyards" have become a common sight throughout the industry as old aeration devices are replaced and discarded year after year.



Typical Aerator "Graveyard"

OXYGEN TRANSFER COMPARED TO MECHANICAL AERATORS

AERATORS STANDARD OXYGEN TRANSFER RATE (SOTR) per Horse Power (kg O₂/hr)

	Freshwater	Saltwater
Typical Paddle Wheel	0.9	1.13
Single Airlift Grid Model	1	2.5
Double Airlift Grid Model	1.42	3.53
Triple Airlift Grid Model	1.58	3.9

So ultimately you can apply less Colorite Airlift's to achieve the same oxygen transfer that you would need if you were to use surface aerators such as paddle wheels. By doing so using less energy.

A recent Vietnamese prawn farm placed 4 – 2 grid airlifts (one at the corner of each 1 ha pond) 1000 airlifts operating in 250 ponds, which they fed through piping from multiple centralized blower locations. The results to date have been quite good in that they have been able to cut their electrical consumption 50% in comparison with their paddlewheel ponds. They have also found them to be much lower maintenance outside of the occasional cleaning, there is nothing to break or go bad unlike other aerators they have used in the past. “We have farms throughout SE Asia and now Latin America adopting the technology when the first reaction was “you can’t do that in shrimp” (says Ben Williams from Colorite)”.



Colorite Aero-Tube™ aeration tubing can solve these problems with these distinct its advantages:

- ✓ Reduces energy costs by up to 75%
- ✓ Lack of moving parts provides a very low maintenance alternative
- ✓ Maintains higher dissolved oxygen (DO) levels
- ✓ Allows for higher stocking densities
- ✓ Allows for higher feeding rates
- ✓ Allows for more frequent feedings
- ✓ Faster Growth and reduced FCR
- ✓ Low start up cost
- ✓ Low replacement cost
- ✓ Low maintenance
- ✓ Blowers provide greater reliability

Aero-Tube™ technology has been used successfully with a wide range of Aquaculture species and in a wide range of production systems. Whether you are producing shrimp or fish, anywhere you are using traditional aeration systems to oxygenate your water, you can benefit from the efficiency and durability of an Aero-Tube™ system. When planning for the proper aeration of an aquaculture system, there are many points to consider. Please feel free to contact Fresh By Design and we can help design and Aero-Tube™ solution for you.



Colorite Airlift Models

Complete airlift models are available from Aquasonic which include the blower (single, three phase 50 & or 60hz). The blowers we offer as standard, we have searched hard for the lowest energy unit that supplies the optimal flow rate at the best price for each model airlift. If you wish to operate multiple airlift units from a single blower, Aquasonic can assist you with sizing and recommending a blower for your application. Also if you already have a suitable blower, you can purchase the airlift on it's own, with or without floats to work in with your particular application as best. All airlift construction materials are non corrosive materials (FRP & Plastic), flat packed for inexpensive shipping .

Contact Aquasonic's technical staff for assistance with sizing and pricing for Colorite Airlift/s for your application.

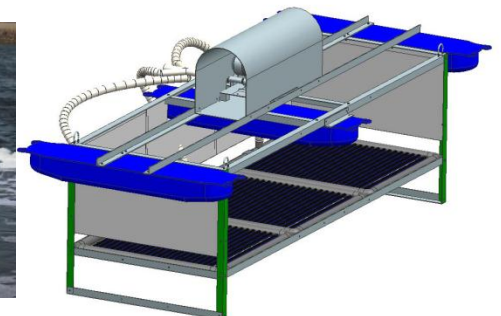
Single Colorite
Aerotube Airlift Unit



Double Colorite Aerotube Airlift Unit

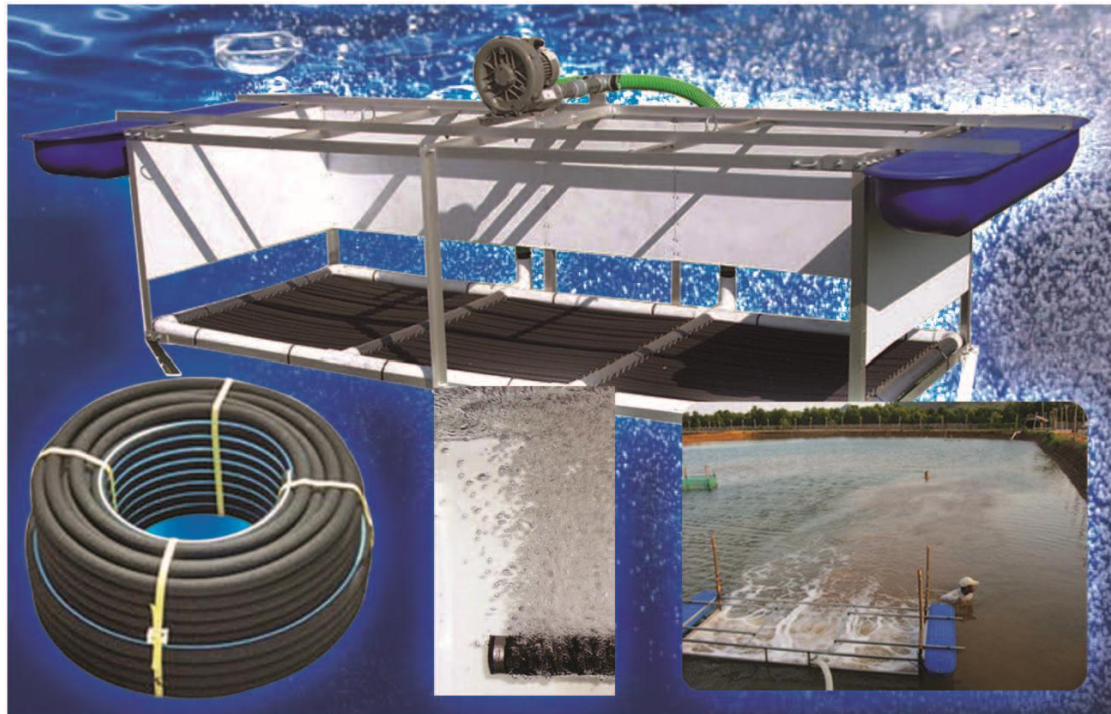


Triple Colorite Aerotube Airlift Unit



Colorite Air Lift Technology

“Adding Air to Water, not Water to Air”



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