Bioremediation Products for Aquaculture

AQUAculture INformation TECHnology Biotechnology Benefiting Aquaculture

Probiotics are defined as *living microbial preparations that when administered to an animal colonize the animal's intestinal tract and impact the animal's health in a favorable manner*. The term "probiotic" is widely misused in aquaculture and in fact, an analysis of the literature (gray and peer reviewed) suggests that the term may be meaningless. There are very few reproducible accounts of bacterial attachment in a consistent manner to the intestinal wall of fish (or shrimp) that can actually be shown to preclude the attachment of pathogenic bacteria to these same sites. Those scientists who have spent the most time in this field are of the opinion that many of the health effects attributed to the application of the various bacterial preparations that have been looked at are in fact simply stimulation of the innate or non-specific immune system, an indirect effect. This would not require living cells.

Some years back an early researcher in the field coined the term probiotic for use in aquaculture in an effort to market a product and have it appear distinctive from what it really was, a microbial tool for bio-remediation. This led to a proliferation of products very few of which have been shown to have statistically significant effects that can be explained via causal mechanisms. Correlation does not mean cause and effect.

For instance, enhanced disease resistance noted with a variety of preparations (living and dead bacterial, fungal and algal cells) can be explained by a generalized reaction of the immune system to generic cell wall components such as LPS, PG and glucans. It does not require attachment and competition for attachment sites for an explanation of the observed impact.

Many of the products that are currently available contain low levels of bacteria, bacterial species that are likely dead at the time the product is being used, bacterial species that cannot possibly do what the vendors claim that they do, or finally include substances that appear to cause an effect (such as antibiotics). While it is possible to sell bacterial preparations that do not consist of bacterial spores from gram positive bacteria, most of these products would be costly, require refrigeration and/or have extremely short shelf lives.

Microbial products can be divided into two broad categories. These may overlap.

Bioremediation: Bacterial species are added to ponds to degrade organic matter.

Immune Stimulation: Bacteria are fed to the fish to enhance their ability to non-specifically deal with a subsequent bacterial (or viral) onslaught.

AQUA-IN-TECH INC.

As a marine microbiologist with a Ph.D. in microbiology my knowledge of the current state of the art is likely a bit greater than that of many of the salesmen that work for the various companies selling various products. Some of my conclusions, which are embodied in our approach to our products are to the right.

- Stable bacterial preparations that are inexpensive make for the best products.
- Spore forming gram positive bacteria (Bacillus species) are the best candidates.
- Selected strains should have the properties that one is interested in.
- Ponds and animals already contain high levels of bacterial populations com posed of hundreds to many thousands of species. Typically in pond water and pond bottoms natural bacterial counts are in the millions per ml or gram. Similarly in the gut.
- Trying to change these through the use of generic low count products is not likely to be successful. Higher count products are essential for increasing the chances of the product doing what it can.
- Powdered products that are added to pond water are all plagued by a number issue. Adding high levels of cultured bacteria is costly and has little proven efficacy. Simple mathematic analysis suggests that it is not possible to cost effectively add meaningful levels of bacteria.
- Feeding living bacteria should only be done through the use of top dressing using bacterial species that are known to be shelf stable only when kept cold, although high titer Bacillus products may survive milling.
- Most products do not contain the types of bacterial species at the loads that are claimed.
- Many products contain bacteria that are in the product for the user and not for the fish or shrimp.
- The first clue that things are not what they appear to be is when vendors make claims based on a standardized addition of product (i.e. add one kg per ha, 5 liters, etc.). Each pond is different and effective programs need to take this into account.
- Repeat applications are essential for the benefits noted and optimum levels and frequency of delivery depends on the environment and desired impact. These are not drugs or biologics. The fact that the vast majority of purvey ors make drug claims does not change the facts. These products act by impacting water quality. ***They are tools for bioremediation.***

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AQUAculture INformation TECHnology Biotechnology Benefiting Aquaculture

Bioremediation for Aquaculture Environments

PRO4000X

A tableted mixture of bacillus species selected for their ability to degrade organic material. Each tablet contains at least 52 billion CFU of spores. Field trial data, letters of recommendation, etc. are available.

AQUAPRO-B

This powdered material contains at least 4 billion CFU per gram of material. It contains a range of nutrients as well and is well suited for several applications. We sell it in three forms.

Product # 1, **AQUAPRO-F**, is for incorporation into the feed at one or more kgs per MT. Although the process of milling the feed does result in high heat and shear for a short period of time, spores are typically heat resistant and while some will be killed, even three logs of killing still results in high spore counts in the final feed product (at least 4000 CFU per gram of feed per kg of product added to the diet). These germinate after the shrimp defecate and begin to digest the feed in-situ.

Product # 2 is in biodegradable plastic bags (**AQUAPROB-EZ**). These are thrown into the pond where, similarly to the tablets, they sink to the pond bottom and dissolve. Nutrients are then immediately available for bacterial growth.

Product # 3 is the straight powder (**AQUAPROB**) which requires soaking in warm water (should be clean water that is the same as that the ponds are that you plan on using the product in) before application. All of the products are based on the same bacterial species, *Bacillus subtilis* and *B. licheniformis*. These strains are the subject of the only US patent granted for products of this nature.

Custom Formulations

We can also custom formulate products that contain a wide variety of different bacterial strains for addition to the feed by top dressing or potentially as use in bio remediation. We like to work with progressive open minded clients who understand that each farm is different and that even within a given farm there may be differences between individual ponds. Products can include many different species of bacteria, enzymes, chemicals for aeration, etc.

Just Ask! Guaranteed low prices (based on bacterial counts!)

AQUA-IN-TECH INC.
TECHNOLOGY BIOSECURITY SUSTAINABILITY
Securing your investment through the science of aquaculture

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