

Diatomix: A Diatoms Enhancer

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Abstract:

Diatoms are unicellular aquatic microorganisms that belong to a major group of algae called the golden-brown algae. Diatoms get energy from sunlight and grow use organic matter as food (Carbon source) grown in aquaculture pond. They are the major oxygen producers in the world generates 20% oxygen on the planet earth. Different species of diatoms are cultured/grown in marine water and freshwater which helps for the juveniles as their primary food for shrimp and fish fry. In the larval stages of fish fry/shrimp larvae diatoms are the first food of choice. A unique product Diatomix which enhances the growth of diatoms in the pond by its micro mineral nutrient composition helps full fill the nutritional needs of aquatic species.

Keywords: Diatoms; Aquaculture; Diatomix; Shrimp; Fish

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Introduction

Background and justification

Aquaculture is the fastest growing food production sector in the world, providing almost half of the global fish and shrimp production which was peaked at about 171 million tonnes in 2016, among that aquaculture shares at 47% of the total and 53% of production system (FAO, 2017). Increasing population and health awareness, there is an increase in demand for fish and shrimp production all over the world. In different types of farming system, super intensive type of aquaculture system there is high stocking density and use of more large quantities of formulated feeds for feeding purpose. Use of larger quantity feeding method in super intensive system leads to uneaten feed at the pond bottom causes Eutrophication (Jones et al., 1986). This can be a problem in the pisciculture, because it triggers the growth of algal blooms, disrupting ecosystem, may consume all oxygen by increasing the nutrient load in effluents. This results in insufficient supply of essential nutrients, thus become problematic which leads to spoiling of water quality, settling at the bottom makes the pond water deteriorate leading to stress and increase in mortality of fish fry/shrimp larvae (Nixon, 1995).

To minimize this nutrient deficiency, to control eutrophication, reduce dependence upon formulated feed, there is an urgent need to promote growth of live feed such as phytoplankton and zooplanktons. Among this phytoplankton which is considered to be the primary food for aquatic organism. In phytoplankton community some of the species of diatoms contributes in large quantity, which is the first bioavailable food for fish and shrimps from the stage of larvae to adult.

To meet the demand of live feed in the pond it's an attempt to write a review on the innovative form of food supplement product which is formulated by Guybro Animal Health Pvt Ltd. it is a unique product DIATOMIX which is already in the market considered to be a very good micro nutrient formulation to enhance and rejuvenate beneficial diatoms in all kinds of aquaculture pond the live diatoms in the pond ecosystem.

What are Diatoms?

Diatoms are unicellular microscopic food power cells which converts carbon dioxide, nitrogen and phosphorus to an end product of oxygen rich organic compounds in a healthy ecosystem for shrimp and fish. Diatoms are the primary food source in aquatic animal in their food chain. Diatoms are unicellular organisms with different shapes and sizes (**Figure 1**). Diatoms are blessed with different pigments with yellow/golden brown/olive green in colour. Golden brown pigment is present in diatoms. The diatoms species consumed by fish and shrimps are *Navicula* spp.,

Cocconies spp., *Synedra* spp., *Tabellaria* spp., *Meridian* spp., *Fragilaria* spp., *Nitzschia* spp., *Pleurosigma* spp., *Amphifileura* spp., *Rhizosolenia* spp., *Cyclotella* spp., *Amphora* spp., *Melosira* spp., *Aclwanthes* spp., etc.

From **Table 1** and **Table 2** we can understand shrimp cannot take pelleted feed they can only consume diatoms for growth and improve survival.

Why aquatic organisms need live feed Diatoms?

The first feeding zoea I- Larval I in shrimp and fish fry is the most critical phase of their life cycle every organisms need micro particle sized feed particle phytoplankton which is unicellular minute microscopic organism. During early post larval development of fish and shrimps, high mortality is noticed due to shortage of live feed in pond water and (Early stages of shrimp and fish larvae) they do not react to commercial dry pellet feeds because of size that can't fit in to the gape and preferred live bioavailable feeds as their food.

Larvae rely on a food source:

- Which contains large amounts of bioavailable amino acids and proteins
- Which contains natural enzymes which allow autolysing (self-digestion)
- Which supplies all essential nutrients required by the larvae
- Which are available throughout the pond and slip easily in gape of shrimp and fish
- High nutritional value

How fish and shrimp detect diatoms?

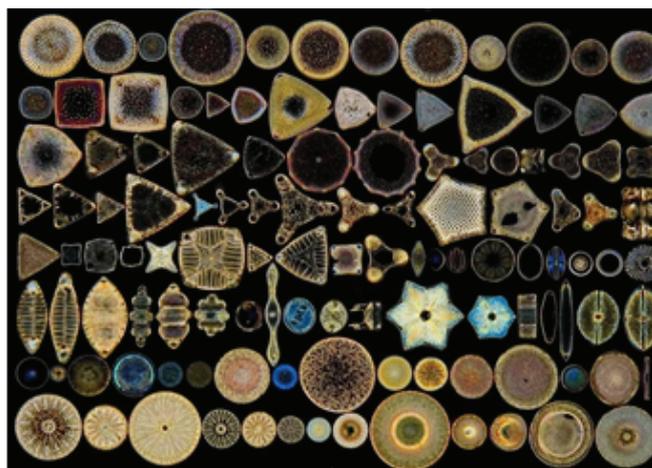


Figure 1: Different shapes of Diatoms.

Table 1: Showing size variations in diatoms, pellet feeds.

	Diatoms	Shrimp pellet Feed	Fish floating pellets	feed	Fish sinking pellets feed
Sizes	2 micron to 500 micron	1 mm	1-10 mm		2-4 mm
More than-Diatoms		25000 times	50000 times		
Gape size of Shrimp	160-500 micron				
Diatoms size varies from 2 micron to 500 micron (0.5 mm)					

Table 2: Proximate composition of Diatoms.

Avg. Diatoms % Different species	Protein 27-43%	Carbohydrate 18-37%	Lipid 17-36%
*Proximate composition of Diatoms Species by Brown 1991			

The degree of development of functional sense organs, including optical receptors (eyes), chemoreceptors (olfactory organs, taste buds) and mechanoreceptors (lateral line), is crucial. The eyes of fish and shrimp modified with internal rods like structure with more visual pigment in the retina and larvae contain only cones in the retina resulting in reduction in visibility. Live diatom food has better contrast than pellet and creates a triggering effect by its continuous movement allowing a better perception for feeding larva. The swimming activity of the live food assures a good distribution in the water column, allowing more frequent encounters with larva (FAO, Lavens and Sorgeloos, 1996).

Benefits of feeding diatoms

Diatoms are nature's live nutrients consists of protein, carbohydrates, lipids, DHA, vitamin, minerals, fatty acids, amino acid:

- Diatoms as a live feed provide the constituents of a complete and balanced diet.
- At younger stage, the shrimp/fish larvae usually feed on Diatoms.
- Diatoms have high protein and fat content, which promotes growth of fish and shrimp.
- To increase of diatoms in the live food of the aquatic ecosystem improves the growth of fish and shrimp and meets their growing nutritional demands.
- Diatom live feed improve livability of shrimp larvae/fish fry vs. pelleted feed which does not useful in their gape.

Farmers have opted for feed-based aquaculture to increase production levels, beyond those that cannot be obtained using only formulated feeds. Natural productivity is important even in those ponds where artificial feed is used or fry cannot use feed efficiently. Some aquaculture farmers, particularly shrimp farmers, are evaluating the abundance (and taxonomic composition) of the diatoms communities present in the water of their ponds. (They also apply a variety of treatments aiming to control the prevalence and composition of the microbial communities.) Algal strains are ubiquitous; several phytoplankton species will find their way. But farmers need enriched diatoms in their aquaculture ponds. Hence there is an urgent need of suitable nutritious live feed for shrimp and fish from the hatchery (larval stage) to harvest (adult stage).

Guybro Animal Health Pvt Ltd. Mumbai, has specially designed a novel product 'Diatomix' after considerable research to improve and rejuvenate diatoms in all kind of aquaculture ponds. Diatomix is a micro-nutrient formula that stimulates the growth of diatoms. Diatomix helps to generate live fresh feed in pond water, which is a diatom which helps to achieve sustainable growth, disease free, healthy feed for survival of shrimps and fish

and achieve maximum production. Diatomix tried in shrimp pond it was found it save upto 15% of commercial feed since shrimp prefers diatoms being freely available in pond is mainly due to diatomix. Diatoms in pond also improve DO level.

What is Diatomix?

Diatomix is a novel research product (Micro-nutrient formula) from Guybro Group, specially designed to improve and rejuvenate "Diatoms" in all kind of aquaculture ponds.

Diatomix promotes healthy ecosystem: Management of pond in a natural way with Diatomix every farmer can naturally improve productive conditions in the water that promote the ecosystem to become healthy and inhibit the toxic blue-green algae and other form of harmful planktons in pond.

Where Diatomix can be used?

Farmers can use Diatomix in all kind of aquaculture ponds. Diatomix can also be use where unwanted algal blooms occur and cause problems.

Benefits of Diatomix in aquaculture ponds:

- Reduces CO₂, Nitrogen, Phosphorus in pond
- Optimizes feed usage saves upto 15% of commercial feed
- Optimizes FCR & weight gain
- Minimizes nuisance algae & toxic gases
- Biodegrades organic matter
- Reduce total dissolved & suspended solids
- Improves pond water quality
- Improve dissolve oxygen level
- Reduce Biological oxygen demand

Karthik et al. (2017) noted benefits of Diatomix which have proved to be a best usage in pond environment and trials conducted gave better results in use of live feed product.

Diatoms benefits for aquatic animal health

Making use of Daitomix as a diatom promoter at the beginning of culture system creates an environment full of highly nutritious microorganisms that increase growth survival and also improves biosecurity.

To obtain optimum growth and production in aquatic ecosystem a better understanding between the water quality and aquatic productivity is essential. Different types of water colors of pond water indicate the abundant plankton's species in pond water. Maintaining sustainable plankton in pond water is the key factor in water quality management. Hence, maximum attention is

to be given to maintain water colour of the pond. The unique form of plankton growth with “Golden Brown” water colour indicates the pond is enriched with diatoms species in the pond. Diatom species such as *Chaetoceros* spp., *Navicula* spp., *Nitzschia* spp., *Skeleronema* spp., *Cyclotella* spp., *Synedia* spp., *Achnanthes* spp., *Amphora* spp. and *Euglena* spp. are often found in pond water of these colours, especially the first three species. Golden brown colour is quite difficult to achieve, and this colour of pond water usually related to a crop of healthy shrimp and fish, with brilliant body colour and is an indicator of expected good yield.

Diatoms+Sunlight+CO₂+Water+Nitrogen+Phosphorus=Diatoms+O₂+Reduced BOD+Clean water

Diatoms Energy value=3500–4500 Kcal/kg

Diatoms help in stabilizing the pond ecosystem and in minimizing the fluctuations of water quality parameters. As diatoms controls many oxidation reactions and maintains aerobic conditions in water. Dissolved Oxygen (DO) in the larvae/adult animals rearing water is an important factor for the respiration of aquatic organisms to maintain favourable chemical and hygienic environment of the water body.it has been found Diatomix improves DO level to 4.1 ± 6.8 vs. control 3.6 ± 5.2 mg/L. When oxygen level is very low and anaerobic conditions exist, nitrate is reduced into ammonia, which is toxic to larvae and adult, it also increases pH level. Low-level of oxygen hampers metabolic performances in shrimp larvae and it will reduce the growth and finally cause huge mortality.

High population of Diatoms with Diatomix results as follows–Diatoms maintain DO level in aquaculture pond and helps in the growth of beneficial microbes which decompose organic matters and reduce toxic gases and heavy metals. Diatoms also reduce toxic substances *viz* ammonia-nitrogen and heavy metals from pond water. Diatoms prevent the development of filamentous and toxic algae in pond water. A healthy diatom bloom provides proper turbidity and subsequently stabilizes shrimp and fish and reduces cannibalism. Diatoms compete for nutrients with other microbes and lowers pathogenic bacterial population.

A high diatom population will help exclude pathogenic or potentially pathogenic species, such as vibrio and cyanobacteria. A high diatom population will also minimize green algae as

well. Minimizing green algae helps moderate the daily oxygen cycle to create more consistent oxygen levels. This also results in more stable water chemistry in general. Diatoms are highly nutritious for aquatic species and they are quite easy “catch” allowing animals to feed with little to nil wasted energy. Diatomix contains more than ten specific compounds which make diatom proliferation possible in terms of growth, reproduction and survival. Diatoms are the most important components in aquaculture system, a thoughtful utilization of diatom community will in a pond eco system with proper management practices certainly enhance the level of fish and shrimp production.

Conclusion

By using the unique product Diatomix in shrimp and or fish pond of culture farmer will get better yield from with FCR 0.95 vs. control 1.51 his farm. The Diatomix is the only product which helps in growth of different species of diatoms which are useful of fish and shrimp culture. Already product is in the market and farmers are making use of it to minimize the cost of feed and to get better results.

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