ISSN: 0976-3031

*Available Online at http://www.recentscientific.com*

**CODEN: IJRSFP (USA)**

*International Journal of Recent Scientific Research*
*Vol. 8, Issue, 12, pp. 22435-22441, December, 2017*

**International Journal of Recent Scientific Research**

**DOI: 10.24327/IJRSR**

**Research Article**

# EFFICACY OF DIATOMIX™ IN GENERATION OF LIVE FEED DIATOMS IN COMMERCIAL AQUACULTURE PONDS

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**DOI: http://dx.doi.org/10.24327/ijrsr.2017.0812.1267**

**ARTICLE INFO**

***Article History:***

Received 17th September, 2017
Received in revised form 12th October, 2017
Accepted 04th November, 2017
Published online 28th December, 2017

***Key Words:***

*Litopenaeus vannamei,* Live feed, Diatoms, FCR, Water quality management

**ABSTRACT**

The present study is the report about the efficacy of Diatomix product on intensive farming systems with Pacific white shrimp (*Litopenaeusvannamei*), in the brackish water commercial aquaculture pond located at Tanjore District, Tamil Nadu, India. The study was conducted in two rectangular ponds, one used as control and one as experiment. The experiment was conducted for 120 days from 1st June to 28th September 2017. During the harvest time, the shrimp weight was 18.5 gm in control pond and 22.20 gm in experimental pond. Survival percentage was 82% in control pond and 94% in experimental pond. Production yield was 7585 kg yield in control pond and 10434 kg in experimental pond. The total feed usage was 11.5 tons in control pond and 10 tons in experimental pond. The results of this study clearly indicate that Diatoms produced by Diatomix improved FCR (0.95), increased survival rate (14.6%) and maintained all the water quality parameters as well. From the results, the study suggests that, the use of Diatomix in commercial aqua farms will enhance the shrimp and fish production and offer a great success to aquaculture farmers for sustainable practise and profits.



## INTRODUCTION

Success of Aquaculture production depends on suitable nutritious live feed for shrimp and fish from "Hatchery to Harvest". A disease free healthy shrimp and fish species can be maintained by feeding live feed along with supplemented artificial feed (Karthik *et al.,*2016). In fact, most early stages of shrimp and fish larvae do not react to dry pellet feeds and require live feeds that swims actively and stimulate their raptorial behaviour. Fish and shrimp larvae, have no functional stomach yet, but only a short digestive tract with only a few enzyme systems functional at the onset of exogenous feeding. Larval fish usually do not ingest or are not able to digest formulated feeds, hence during early post larval development stages of fish and shrimps, high mortality was noticed due to the formulated feed. Obviously, these larvae must rely on a food source, which contains large amounts of amino acids and proteins (for easy digestion), which contains enzyme systems which allow autolysing (self-digestion), which supplies all essential nutrients required by the larvae. Formulated feeds do not meet all these requirements and result in poor growth and survival of the larvae (Ashwitha *et al.,*2017).

Live feed, on the other hand, seems to be meeting most criteria and must be offered during the first-feeding period. To take up food, it should be detected by the shrimp and fish larvae. The degree of development of functional sense organs, including optical receptors (eyes), chemoreceptors (olfactory organs, taste buds) and mechanoreceptors (lateral line), is again crucial here. For example, the eyes of fish and shrimp larvae contain only cones in the retina resulting in a reduced visibility, juvenile fish and shrimp eyes contain also rods with more visual pigment in the retina. Live feed has a better contrast than a pellet feed and creates a triggering effect by its continuous movement, allowing a better perception by the feeding larva. Moreover, the swimming activity of the live feed assures a good distribution available live feed around the aquaculture pond (Karthik *et al.,* 2015).

The live feed provides the constituents of a complete and balanced diet. The demand of live feed varies from species to species and between age group of individuals. At a younger stage, the fish may feed on Diatoms. Live feeds have high protein and fat content, which promote the growth of fish and shrimp. Hence, it is necessary to increase the live food in the

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aquatic ecosystem to improve the growth of fish and shrimp. In a balanced ecosystem, diatoms provide food for a wide range of aquatic life since they are at the bottom of the food chain. Protein is the major component in the natural food of penaeids shrimps. Diatoms are natures live nutrients consists of Proteins, Lipids, Carbohydrates, DHA, Vitamins, Minerals, Fatty Acids & Amino Acids. Diatoms are the primary food source for the aquatic animal food chain. Depending on the species and culture conditions, benthic diatoms contain an average of 32 to 38% crude protein (Gordon *et al.,* 2006). Khatoon *et al.,* (2009) and other researchers found that Diatom contains 494 g of crude protein, 259 g of lipids and 111 g of carbohydrates, 82 g of fatty acids, 22 g of DHA and 32 gm of vitamins, minerals, enzymes and moisture per kilogram.

Several researchers also confirmed that, feeding shrimp and fish species with protein rich live feeds "Diatoms" will improve the activity of digestive enzymes (Xu *et al.,* 2012, Anonymous, 2000), reduces nutrient deficiency (Brito *et al.,* 2009a, 2009b; Asaduzzaman *et al.,* 2010; Lara-Anguiano *et al.,* 2013). In intensive farming systems with Pacific white shrimp (*Litopenaeusvannamei*), Diatoms (through photosynthesis) and the other constituents of the microbial community can play an important role in recycling nutrients (Audelo-Naranjo *et al.,,* 2012; Sánchez *et al.,,* 2012) decreasing the anoxic zones in ponds and alleviating the nutrient load in wastewater (Martínez-Porchas *et al.,,* 2010), while providing a nutrition source for shrimp in semi-intensive (Otoshi *et al.,,* 2011) and intensive systems (Sánchez *et al.,,* 2012). Developing a new technology oriented new product of aqua ponds will offer great hope for the future with a promise for blue revolution in the century to match the green revolution. Thus, Guybro Chemical Pvt Ltd (Mumbai, India), specially designed a novel research product DIATOMIX™ to improve and rejuvenate beneficial "Diatoms" in all kind of aqua ponds. DIATOMIX™ generates live fresh feed from pond water, which is rich in Diatoms and Oxygen to achieve maximum growth, disease free, healthy and survival of the shrimps and fish and to achieve maximum production.

## MATERIALS AND METHODS

The trial was conducted in commercial aqua farm located at Tanjore District, Tamil Nadu, India during June to September 2017 for experiments of commercial Diatoms growth promoter, DIATOMIX™(Generates Live Feed in Water) manufactured by Guybro Chemical Pvt Ltd., Mumbai, India.

### *Pond preparation*

A total two farms and a reservoir has a total water spread area of 3 ha (Pond I-1 ha; Pond II-1 ha, and Reservoir pond-1 ha) were prepared before stocking by the following methods. The ponds are rectangular, Pond 1 was control and pond 2 used as experimental.

### *Soil culture*

The initial pH of the soil found to be between 5.9 and 6.3, then lime applied at the rate of 500 kg/per pond respectively and the pH increased to 7.2, then the bottom tilled and dried. After a week of soil preparation, water pumped in with a help of a 10 HP (Kirloskar) pump.

### *Water culture*

Water pumped from estuary into the reservoir and disinfected with bleaching powder at the rate of 60 ppm/ha. The water left undisturbed for 10 days to remove the residual chlorine later the water was pumped to the culture ponds.

### *Application of DIATOMIX™*

The experimental pond fertilized with DIATOMIX™ (5 Kg/ Acre) by broadcasting the required quantity evenly over the ponds surface preferably during morning hours. The control pond fertilized with an organic mixture of rice bran and cow dung.

### *Stocking and Feeding*

The culture is semi intensive type with stocking densities of 50 PLs/$m^2$. According to that, the *L.vannamei* (PL15) seeds were stocked in both ponds. The feed ratio divided for 4 times in a day (25%, 20%, 30% and 25% for morning (6.00 AM), noon (12.00 PM), evening (6.00 PM) and night (1.00 AM) feeding respectively. The feed was broadcast from the dyke during the initial phase and boat feeding followed during the later stages. DIATOMIX™ was broadcasted in the experimental pond during the entire culture (every 10 days once) around the pond and the entire crop (Control and Experiment) harvested on 120$^{th}$ day.

### *Sampling*

Sampling done in all ponds every fortnight during early hours of the day with a cast net. Five hauls were made in each pond. The shrimps caught per haul and their individual weights were recorded. Feed conversion ratio (FCR) and Average daily growth (ADG) were calculated by the given formula below,

FCR = Total feed given / Total weight gain of shrimp
ADG = Total weight gained by the shrimps / Total days of culture

### *Water quality monitoring*

Water quality analysis has done using following standard methods. pH pen (Scan – 2- Eutech cybernetics PTE Ltd, Singapore) used to measure the water pH and handy refractometer (Atago, Japan) for estimating salinity. Dissolved oxygen and temperature together were measured with the help of handy D.O meter (YSI 55 model). Ammonia determined using the sea water method as described by Solarzano (1969) and Koroleft (1969) and recorded as parts per million (ppm). Nitrate and nitrite were estimated following the methods described by Strickland and Parsons (1972).

### *Diatom and plankton analysis*

Water samples were collected and preserved in 4% buffered formalin for diatom and planktonabundance and identification. Identification of diatom and plankton was done under a compound light microscope using keys and illustrations by Prescott (1962), Patrick and Reimer (1966), Round *et al.,*(1990), Tomas (1997), and other taxonomic literature. A Van veen grab was used for collecting bottom fauna. Benthic fauna was separated by passing the sediment through a 0.5 mm mesh sieve and the fauna was preserved for identification using 5% formalin-Rose Bengal solution.

## RESULTS AND DISCUSSION

Understanding the connection between the water quality and aquatic productivity is essential for optimum growth and production. The colour of pond water usually indicates the predominant species. Maintaining a stable water colour (Golden Brown) is the key factor in water quality management. Shrimp/Fish perform all their physical functions in water and aquatic species are totally dependent upon water to breathe, feed and grow, excrete wastes, to maintain salt balance and to reproduce, hence understanding the physical and chemical qualities of water is critical to successful aquaculture. The result is deteriorating water quality which stresses the culture species, and stress leads to poor growth, greater incidence of disease, increased mortality, and low production. The efficient and profitable production of shrimp and fish in aquaculture depends on a suitable environment. In general, shrimp ponds are enclosed cultivation systems, subject to periodic water renewal to compensate for volume changes (due to evaporation) and salinity changes (evaporation, precipitation) and to maintain water quality. The excess feed and faecal matter may result in bacterial decomposition of organic matter in the sediment and produce excess of toxic compounds like ammonia. In addition, abnormal algal growth (eutrophication) may cause stress to the animal and ultimately end with microbial diseases and high mortality.

***Diatoms for healthy ecosystem***

Diatoms are microscopic food power cells, converts carbon dioxide, nitrogen and phosphorus into oxygen rich organic compounds in a healthy ecosystem for shrimp and fish. Diatoms are one-celled aquatic microorganisms plays a significant role in stabilizing the whole pond ecosystem and in minimizing the fluctuations of water quality parameters. Diatoms utilize organic matter as food (carbon source) and biodegrades the organic matter (Excess feed, Fish/Shrimp faecal, Dead shrimps/fish/algae) and prevent the aquatic environment from undergoing eutrophication, accumulation of toxic gases and pathogens and mortality. Diatoms competes with available nutrients and minimizes the growth of harmful cyanobacteria and unwanted pathogenic microbes. Diatoms also produce anti-microbial substances and biochemical compounds and eliminates toxic cyanobacteria and pathogenic microbes. Diatoms utilize / oxidize the toxic gases as nutrient (nitrogen source) for their growth and multiplication during photosynthesis. Scientific studies also confirm that, all these gases are available in the form of soluble nutrient in pond water, hence it is very easy to utilize by Diatoms and planktons. Moreover, Diatoms has been proven to raise dissolved oxygen at the sediment interface, which helps beneficial microbes in pond bottom which to degrade organic matter and toxic compounds.

***Growth and production effectiveness of Diatomix in aqua pond***

To analyse the effectiveness of Diatoms the commercially available diatom generator product Diatomix was obtained from Guybro Chemical Pvt Ltd, Mumbai, India. A total two farms and a reservoir has a total water spread area of 3 ha (Pond I-1 ha; Pond II-1 ha, and Reservoir pond-1 ha) Pond 1 was control and pond 2 used as experimental. The experimental pond fertilized with DIATOMIX™ (5 Kg/ Acre) by broadcasting the required quantity evenly over the ponds surface preferably during morning hours. The control pond fertilized with an organic mixture of rice bran and cow dung. The culture is semi intensive type with stocking densities of 50 PLs/$m^2$. According to that, the *L.vannamei* (PL15) seeds were stocked in both control and experimental ponds. The experiment was conducted for 120 days from 1st June to 28th September 2017. At the harvest time the shrimp weight was found to be 22.20 gm in experimental pond and 18.5 gm in control pond. 94% survival percentage in experimental pond and 82% in control pond. Total final production yield was 10434 kg in experimental pond, 7585 kg yield in control pond(Table 1).

**Table 1** Growth and Production Analysis

| Particulars | Control Pond | DIATOMIX™ Pond |
|---|---|---|
| Area (h) | 1 Hectare | 1 Hectare |
| Initial Stocking (Numbers) | 5,00,000 | 5,00,000 |
| Density (Numbers / $M^2$) | 50 | 50 |
| Stocking Date | 01/06/17 | 01/06/17 |
| Harvest Date | 28/09/17 | 28/09/17 |
| Culture Period (Days) | 120 | 120 |
| Harvest Size (g) | 18.5 | 22.20 |
| Count (Numbers/Kg) | 54 | 45 |
| Survival percentage (%) | 82 | 94 |
| Shrimp Harvest (Kg) | 7585 | 10434 |
| Total feed used (Kg) | 11,500 | 10,000 |
| Feed Conversion Ratio (FCR) | 1.51 | 0.95 |
| Average Daily Growth (ADG) | 0.15 | 0.18 |

Using large quantities of formulated feed with high animal protein content can cause eutrophication in aquaculture systems, increasing the nutrient load in effluents (Tacon *et al.,* 2002). Their use increases production costs (Audelo-Naranjo *et al.,* 2012) and can result in an insufficient supply of some essential nutrients (Crab *et al.,* 2007), thus becoming a limiting factor in intensive systems. In this present study, the total feed usage in the control pond was 11.5 tons and whereas it decreased into 10 tons in the experimental pond. The results of this study prove that, the live feed Diatoms improved FCR from 1.51 to 0.95 in the experimental pond. The average daily growth also higher (0.18) in experimental pond compared to (0.15) control pond and its confirms the availability of live feeds in both of ponds.

Management and quality of feed play a major role in FCR (Feed Conversion Ratio) and production since over feeding leads to pond bottom deterioration (Sedgewick, 1979), Dall *et al.,* (1990) and Lovett and Felder (1990) proved that multiple feeding will improve growth rate, better FCR and minimize the accumulation of uneaten feed. Diatomix generates nutrition rich live feed diatoms aquaculture ponds. Diatoms plays a significant role in increasing the biological productivity in aquaculture ponds. Scientific study also confirms that, feeding the fish and shrimps with nutrition rich live diet “Diatoms” increase the gut associated enzymes, survival rate, growth and maintains water quality parameters in aqua pond. In the present study, the feeding ratio was noticed based on the monitoring of feeding trays. The FCR in the control pond 1.51 and whereas it improves into 0.95 in the experimental pond.

***Variations of Diatom and Plankton densities during L.vannamei culture***

Diatoms are microscopic food power cells, converts carbon dioxide, nitrogen and phosphorus into oxygen rich organic compounds in a healthy ecosystem for shrimp and fish. Diatoms are the primary food source for the aquatic animal food chain. Diatoms are unicellular organisms with different shapes and sizes. They are yellow or golden brown or olive green in colour. In this study Diatoms, Phytoplanktons and Zoopopulations population densities were monitored during the culture every 20 days once and mean values are summarized (Table 2). In experimental pond Diatoms *Bacillariophyceae* diversity was found between 229±0.3 (x $10^4$ cells $mL^{-1}$), Phytoplankton *Chlorophyceae* diversity was found between 176±0.9 (x $10^4$ cells $mL^{-1}$) and Zooplankton *Rotifera and Copepoda* 192±1.5 (x cells $L^{-1}$), whereas in control pond Diatoms *Bacillariophyceae* diversity was found between 26±0.6 (x $10^4$ cells $mL^{-1}$), Phytoplankton *Chlorophyceae* diversity was found between 46±1.3 (x $10^4$ cells $mL^{-1}$) and Zooplankton *Rotifera and Copepoda* 40±1.4 (x cells $L^{-1}$). The results of the study clearly show that Diatomix generated Diatoms as well as plankton communities in experimental pond, without any fertilizers.

**Table 2** Variations of Diatom and Plankton densities during *L.vannamei* culture (Mean±SD)

| Particulars | Control Pond | DIATOMIX™ Pond |
|---|---|---|
| **Diatoms** *Bacillariophyceae* (x $10^4$ cells $mL^{-1}$) | 26±0.6 | 229±0.3 |
| **Phytoplankton** *Chlorophyceae* (x $10^4$ cells $mL^{-1}$) | 46±1.3 | 176±0.9 |
| **Zooplankton** *Rotifera&Copepoda* (x cells $L^{-1}$) | 40±1.4 | 192±1.5 |

The diversity results clearly indicate that water quality parameters in optimum range and nutrient rich water influenced the growth of Diatoms and phyto and zoo plankton communities. Similar observation was reported by Hossain *et al.,*2007. Margalef (1964) also reported that the diatoms and plankton population in nutrient rich waters is more diverse than those in nutrient deficient waters. Hossain *et al.,*2006, recorded 38 genera of Diatoms and 13 genera of plankton during a three-month study period in earthen fish ponds in the Mymensingh region, Bangaladesh. Saraswathy *et al.,* 2013 also reported that, during their study, a total of 29 different species of phytoplankton belonging to six different classes (*Chlorophyceae, Bacillariophyceae, Cyanophyceae, Coscinodiscophyceae, Mediophyceae* and *Ciliata*) were observed in shrimp culture ponds, and they stated that diatoms and plankton's abundance was higher in summer than winter crop.

***Water Quality Parameters***

The technique of water quality management in shrimp ponds is less understood than other aspects of shrimp farming. If water quality is not maintained properly shrimps will not feed and become more susceptible to disease, which leads to poor survival. pH, Dissolve Oxygen (DO), Temperature, Ammonia, Nitrite ($NO_2$), Hydrogen Sulphide ($H_2S$), Transparency, Turbidity and Alkalinity are important water quality parameters to be maintained during the culture. Hence, during the culture period water quality parameters are observed in both the control and experimental pond and results are summarized (Table 3).

**Table 3** Variations in Water Quality Parameters

| Particulars | Control Pond | DIATOMIX™ Pond |
|---|---|---|
| Temperature | 25±35$^0$C | 25±35$^0$C |
| Salinity (ppt) | 20±25 | 20±25 |
| Water Colour | Green | Golden Brown |
| Transparency (cm) | 35±55 | 25-40 |
| pH | 8±9.5 | 7±9 |
| Ammonia (ppm) | 1.1±2.5 | 0.31 ± 0.68 |
| Nitrite (ppm) | 0.0076 ± 0.0105 | 0.0014 ± 0.0077 |
| Nitrate (ppm) | 0.0037 ± 0.0169 | 0.002± 0.0141 |
| DO (mg/l) | 3.6 ± 5.2 | 4.1 ± 6.8 |

Temperature plays a vital role in metabolism of shrimps. In culture pond the optimum temperature range is 25 to 30$^0$C and temperature beyond this range is lethal (Boyd and Fast, 1992) to shrimps. During the present study, the temperature ranged from 25 to 30$^0$C in both control and experimental pond. In general, shrimpsare euryhaline species which can adapt easily to wide variation in salinity. The salinity levels varied between 20 to 25 ppt.

The colour of pond water usually indicates the predominant species. Maintaining a stable water colour (Golden Brown) is the key factor in water quality management. Hence, aqua-farmers pay much attention to the colour of the pond water and place great importance on the promotion of Diatoms to maintain Golden Brown of aqua pond water. The "Golden Brown" water colour has a high probability of comprising diatoms in the pond. Diatom species such as *Chaetoceros, Navicula, Nirzschia, Skeleronema, Cyclotella, Synedia, Achnanthes, Amphora* and *Euglena* are often found in pond water of this colour, 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. During the entire culture the experimental pond colour was golden brown, and variations of green and dark green colour found in control pond. It's clearly confirms the experimental pond is enriched with the live feed Diatoms. The optimum level of transparency is from 25 to 40 cm (Clifford, 1992). According to Boyd and Fast (1992) secchi disc readings of 25 to 35 cm are considered desirable by most shrimp farmers and the measurements should be made 800 and 1000 hr or between 1400 and 1600 hr (Almazan and Boyd, 1978). In the present study, the transparency levels in the control pond ranged from 35 to 55 cm. This was due to unstable bloom in the control pond. In the experimental pond, the levels decreased gradually from 25 to 40 cm. From the results of the present study it is quite evident that diatoms are helpful in the maintenance of transparency in the experimental pond.

The pH of the culture medium is directly related with metabolism and other physiological process of shrimps. Low pH increases the toxicity of nitrite to cultured organism (Wedemeyer and Yasulake 1978) and the toxic form of sulfide (Chien, 1992) and high pH increases the unionized ammonia (Clot and Armstrong, 1981). It also reduces the natural pond production presumably by reducing the availability of nutrients (Alabaster and Lloyd, 1980) including phosphorus (Boyd, 1982). During the present study the water pH (mean value) ranged from 8 to 9.5 in the control pond. In the experimental pond the pH was found to be maintained in the optimum ranges

of 7 to 9 during the culture period. From the results of the present study it is evident that the diatoms are helpful in maintaining the pH at optimum levels, avoiding the otherwise possible fluctuations.

Ammonia is the product of protein catabolism in crustaceans and can account for 40 to 90 % of nitrogen excretion (Parry, 1960) and nitrite is an intermediate product of nitrification. However, ammonia is more toxic than nitrite. Generally, ammonia exists in water both in ionized and unionized forms. Among these two, ionized ammonia is more toxic than unionized form. Ammonia concentration depends on pH, temperature and to lesser extent salinity. In the present study, values of total ammonia were found varying from 1.1 to 2.5 ppm in the control pond and 0.31 to 0.68 ppm in the experimental pond. The nitrite levels ranged from 0.0076 to 0.0105 ppm in the control pond and 0.0014 to 0.0077 ppm in the experimental pond. The results confirm that, the controlled levels of ammonia and nitrite in the experimental pond may be attributed to the addition of diatoms.

Nitrate is the major nutrients, which commonly determine the phytoplankton production and abundance. There is no need to apply these nutrients as fertilizers in the later stages of culture. Sometimes, nutrients do not significantly increase in the water column due to rapid uptake by phytoplankton. Nitrate is a product of nitrification in pond water is dependent on the addition of fertilizers and feed. During the present study, the concentrations of the nutrients in the experimental pond were higher, than in the control pond. This can be attributed to mineralization of organic matter by the beneficial microbes. Nitrate concentration (mean value) varied from 0.0037 to 0.0169 ppm in the control pond. In the experimental pond, nitrate levels ranged between 0.0029 to 0.0141 ppm.

Dissolved Oxygen (DO) is an important water quality parameter for all aquatic species culture. The major factors that affect the solubility of dissolved oxygen in water are temperature, salinity, pressure and biological process. In normal, the concentration of dissolved oxygen is high in the afternoon due to photosynthetic activity of diatom and low in the early morning due to only respiration and no photosynthesis in the night. Boyd *et al.,* (1978) and Madenjian *et al.,* (1988) concluded that emergency measures must be taken if the dissolved oxygen concentration falls below 3 ppm. Law (1988) suggested that the dissolved oxygen levels should be kept above 2 ppm always. Liao and Murai (1980) reported that the rate of respiration in *Penaeus monodon* remained constant at dissolved oxygen concentration level of 3 to 4 ppm in water. Low dissolved oxygen level occurs in shrimp ponds due to algae die off and decomposition of the same (Chang and Ouyang, 1988) and can cause stress or even mortality of shrimps in ponds (Shigueno, 1975; Wickins, 1976 and Madenjian *et al.,* 1987). Low dissolved oxygen increases the ammonia concentration and decreases the pH levels (Boyd, 1982). In the present study, in the control pond the dissolved oxygen levels (mean value) ranged between 3.6 to 5.2 ppm. The dissolved oxygen level was always above 4 ppm in the experimental pond, favourable for the health of shrimps. This may be correlated with the stable bloom throughout the culture period. The dissolved oxygen concentration varied from 3.6 to 5.2 mg/l in the control pond and 4.1 to 6.8 in the experimental pond. The results of this study clearly indicate that Diatoms produced by Diatomix improved FCR (0.95), increased survival rate (14.6%) and maintained all the water quality parameters as well.

## CONCLUSION

Diatoms are highly nutritious for aquatic species and they are quite easy to "catch" allowing animals to feed with little wasted energy. Live feeds have high protein and fat content, which promote the growth of fish and shrimp. Diatoms (live nutrients) consists of Proteins, Lipids, Carbohydrates, Vitamins, Minerals, Fatty Acids & Amino Acids. Diatoms are the most important components in Aquaculture system, a thoughtful utilization of Diatom community in aquaculture ponds with proper management practices certainly enhance the level of fish and shrimp production. Diatomix (Live Feed Generator) is a novel research product (Micro-nutrient formula from Guybro Chemical Pvt Ltd, Mumbai, India) specially designed to improve and rejuvenate "Diatoms" in all kind of aqua ponds. From the results, the study suggests that, the use of Diatomixin commercial aqua farms will enhance the shrimp and fish production and offer a great success to aquaculture farmers for sustainable practise and profits.

## References


1. Ashwitha A, Thamizharasan K, Vithya V, Karthik Ramachandran and Vijaya Bharathi S, 2017. Effectiveness of Bacteriocin from *Bacillus Subtilis* (KY808492) and its Application in Biopreservation, *Journal of Fisheries Sciences*.com, 11(3): 036-042.
2. Alabaster J S and R Lloyd, 1980. Water quality criteria for freshwater fish. *Butterworths*, London, 297 pp.
3. Almazan C and C E Boyd, 1978. An evaluation of secchi disk visibility for estimating plankton density in fish ponds. *Hydrobiol*ogy, 65: 601-608.
4. Audelo-Naranjo, J.M., D. Voltolina& E. Romero-Beltrán. 2012. Cultural of white shrimp *Litopenaeusvannamei*(Boone, 1931) with zero water exchange and no food addition: an eco-friendly approach. *Lat. Am. J. Aquat. Res*., 40(2): 441-447.
5. Audelo-Naranjo JM, Voltolina D, Romero-BeltránM. Culture of white shrimp (*Litopenaeusvannamei* Boone, 1931) with zero water exchange and no food addition: an eco-friendly approach. Universidad Autónoma de Sinaloa, Facultad de Ciencias del Mar Mazatlán, Sinaloa, México. *Latin American Journal of Aquatic Research*. *Lat Am J Aquat.* 2012; 40(2):441-447. Culture of *Litopenaeusvannamei*with no food addition.
6. Asaduzzaman, M., S.M.S. Rahman, M.E. Azim, M.A. Islam, M.A. Wahab, M.C.J. Verdegem& J.A.J. Verreth. 2010. Effects of C/N ratio and substrate addition on natural food communities in freshwater prawn monoculture ponds. *Aquaculture*, 306: 127-136.
7. Boyd C E, 1982. Water Quality Management for Pond Fish Culture. *Elsevier Scientific Publishing Company, Amsterdam, Oxford*, New York, 318.
8. Boyd C E, Fast A W, 1992. Pond monitoring and management. In Fast, A.W. Lester, L.J. (Eds.), Marine shrimp culture: Principles and practices. Elsevier Science Publishers, *Amsterdam*, 497-513.

9. Boyd C E, Davis J A and Johnston, E, 1978. Dieoffs of the blue-green alga, *Anubuenuvuriubilis,* in fish ponds. *Hydrobiologia*, 6, 129-133.
10. Brito, L.O., D.M.M. Dantas, J.B. Pereira-Neto, R. Soares & A. Olivera. 2009a. Efeito de duasestratégias de fertilizaçãonacomposição do fitoplâncton no cultivo de *Litopenaeusvannamei.* Arq. Cienc. Mar. 42(1): 30-35.
11. Brito, L.O., L.F. Pimentel, S.C. Marcelino, V.F. Melo, W.M. Costa & A. Oliveira. 2009b. Efeito de duas estratégias de fertilizaçãonacomposição do zoo-plâncton no cultivo de *Litopenaeusvannamei. Rev. Bras. Enga. Pesca*, 4(1): 57-66.
12. Chien Y H, 1992. Water quality requirements and management for marine shrimp culture. In: Wyban, J. (Ed.), Proceedings of the Special Session on Shrimp Farming. *World Aquaculture Society*, Baton Rouge LA, 145-156.
13. Clifford, H C, 1992. Marine shrimp pond management: A review. In: Proceedings of the Special Session on Shrimp Farming, *World Aquaculture Society, Baton Rouge*, *LA,* 110-137.
14. Crab R, Avnimelech Y, Defoirdt T, Bossier P, Verstraete W (2007) Nitrogen removal techniques in aquaculture for a sustainable production. *Aquaculture* 270:1-14.
15. Dall W B J, Hill, P C Rothlisberg and D J Staples, 1990. The biology of penaeidae. In: Blaxter, J.H.S. and A.J. Southward (eds.) Advances in Marine Biology, *Academic Press,* New York, 27.
16. Decamp OE, Cody J, Conquest L, Delanoy G, Tacon AGJ (2003) Effect of salinity on natural community and production of Litopenaeusvannamei (Boone), within experimental zero-water Exchange culture systems. *Aquac Res* 34:345-355
17. Decamp OE, Conquest L, Cody J, Forster I (2007) Effect of shrimp stocking density on size-fractionated phytoplankton and ecological groups of ciliated protozoa within zero-water exchange shrimp culture systems. *J World AquacultSoc* 38:395-406.
18. Gordon, N., A. Neori, M. Shpigel, J. Lee & S. Harpaz. 2006. Effect of diatom diets on growth and survival of the abalone *Haliotis discus hannai* postlarvae. *Aquaculture*, 252: 225-233.
19. Hossain, M.Y., Begum, M., Ahmed, Z.F., Hoque, M.A., Karim, M.A., Wahab, M.A., 2006. A study of the effects of iso-phosphorus fertilizers on plankton production in fish ponds. *South Pacific Studies* 26, 101-110.
20. Hossain, M.Y., Jasmine, S., Ibrahim, A.H.M., Ahmed, Z.F., Ohtomi, J., Fulanda, B., Begum, M., Mamun, A., Ei-kady, M.A.H., Wahab, M., 2007. A preliminary observation on water quality and plankton of an earthen fish pond in Bangaladesh. Recommendations for future studies. *Pakistan Journal of Biological Sciences* 10(6), 868-873.
21. Karthik Ramachandran, GokulalakshmiElayaperumal, Sanjeev Mishra, Ramalingam K and Vanitha M.C 2016, Beneficial Microbes as Probiotics on Aquaculture to Bring Sustainability In Blue Revolution. *International Journal of Recent Scientific Research,* 7(12), 14606-14612.
22. Karthik Ramachandran, Angelin C Pushpam, K. Ramalingam, D. Yuvaraj and M. C. Vanitha, 2015. Attenuation of negative impacts by micro algae and enriched Artemiasalina on Penaeus monodon and Litopenaeusvannamei larval culture, *Journal of Fisheries and Aquatic Science,* 10 (5): 347-356.
23. Khatoon H, Yusoff F M, Banerjee S, *et al.,*2007. Use of periphytic cyanobacterium and mixed diatoms coated substrate for improving water quality, survival and growth of Penaeus monodon Fabriciuspostlarvae. *Aquaculture*, 271(1-4): 196-205.
24. Khatoon, H., S. Banerjee, F.M. Yusoff& M. Shariff. 2009. Evaluation of indigenous marine periphytic *Amphora, Navicula* and *Cymbella* grown on substrate as feed supplement in *Penaeus monodon* postlarvae hatchery systems. *Aquacult. Nutr.,* 15: 186-193.
25. Lara-Anguiano, G.F., H.M. Esparza-Leal, J.C. Sainz-Hernández, J.T. Ponce-Palafox, W. Valenzuela-Quiñónez, J.P. Apun-Molina & M.G. Klanian. 2013. Effects of inorganic and organic fertilization on physicochemical parameters, bacterial concentrations, and shrimp growth in *Litopenaeusvannamei* cultures with zero water exchange. *J. World. Aquacult. Soc.*, 44(4): 499-510.
26. Law A T, 1988. Water quality requirements for *Penaeus monodon* culture. Proceedings of the Seminar on Marine prawn farming in Malaysia: Present Problems, Future Prospects, Serdang, Malaysia, 53-65.
27. Liao I C and T Murai, 1980. Effects of dissolved oxygen, temperature and salinity on the oxygen consumption of grass shrimp, *Penaeus monodon*. In: Maclean, S.L. L.B. Dizon and L.V. Hosillos (eds.) The first Asian Fisheries Forum. *Asian Fish. Soc. Manila, Phillipines,* 641-646.
28. Lovett D L and Felder D L, 1990. Ontogeny of kinematics in the gut of the white shrimp *Penaeussetiferus*(*Decapods, Penaeida*). *Journal of Crustacean Biology*, 10, 53- 68.
29. Madenjian C P, G L Rodgers and A W Fast, 1988. Predicting nighttime dissolved oxygen loss in aquaculture ponds. *Can. J. Fish. Aquat. Sci.* 45: 1842-1847.
30. Madenjian C P, G L Rogers and A W Fast, 1987. Predicting nighttime dissolved oxygen loss in prawn ponds of Hawaii Part 1. Evaluation of traditional Methods, *Aquacult. Eng.* 6: 191-208.
31. Margalef, R., 1964. Correspondence between the classical types of lakes and structural and dynamic properties of their populations. Verh Intl. VerienTheor. Angew. *Limnology* 15, 169-375.
32. Martínez-Porchas, M., L.R. Martínez-Córdova, M.A. Porchas-Cornejo & J.A. López-Elías. 2010. Shrimp polyculture: a potentially profitable, sustainable, but uncommon aquacultural practice. *Rev. Aquacult*., 2: 73-85.
33. Moss, S.M. & G.D. Pruder. 1995. Characterization of organic particles associated with rapid growth in juvenile white shrimp, *Penaeusvannamei* Boone, reared under intensive culture conditions. *J. Exp. Mar. Biol. Ecol.*, 187(2): 175-191.

34. Otoshi, C.A., D. Moss & S.M. Moss. 2011. Growthenhancing effect of pond water on four size clases of Pacific white shrimp, *Litopenaeusvannamei*. J. *World Aquacult. Soc*., 42(3): 417-422.
35. Parry, G. 1960. Excretion. In: The Physiology of Crustacean, Volume 1, Waterman, T.H. (Ed.). Academic Press, New York, pp: 341-366.
36. Saraswathy R, M. Muralidhar, P. Ravichandran, N. Lalitha, V. KanagaSabapathy and A. Nagavel, 2013. Plankton Diversity in *Litopenaeusvannamei* Cultured Ponds, *International Journal of Bio-resource and Stress Management*, 4(2):114-118
37. Sanchez, D.R., J.M. Fox, D. Gatlin & A.L. Lawrence. 2012. Dietary effect of squid and fish meals on growth and survival of Pacific white shrimp *Litopenaeusvannamei* in the presence or absence of phytoplankton in an indoor tank system. *Aquaculture Research*, 43: 1880-1890.
38. Sedgewick R W, 1979. Effect of ration size and feeding frequency on the growth and food conversion of juvenile *Penaeusmerguiensis*, Deman. *Aquaculture,* 16, 279–298.
39. Shigueno, K. 1975. Shrimp culture in Japan. *Association for International Technical Promotion,* Tokyo, Japan, 153.
40. Tacon, A.G., J.J. Cody, L.D. Conquest, S. Divakaran, I.P. Forster & O.E. Decamp. 2002. Effect of culture system on the nutrition and growth performance of Pacific white shrimp *Litopenaeusvannamei* (Boone) fed different diets. *Aquacult. Nutr.,* 8: 121-137.
41. Wyban J, Walsh WA, Godin DM (1995) Temperature effects on growth, feeding rate and feed conversion of the Pacific white shrimp (Penaeusvannamei). *Aquaculture* 138:267-279.
42. Wedemeyer, G A and W T Yasulake, 1978. Prevention and treatment of nitrite toxicity in juvenile steelhead trout (*Salmo gairdneri*). *J. Fish Res. Br. Canada,* 35: 822-827.
43. Wickins J F, 1976. The tolerance of warm water pawns to re-circulating water, *Aquaculture,* 9, 19-37.
44. Xu, W.J., L.Q. Pan, D.H. Zhao & J. Huang. 2012. Preliminary investigation into the contribution of bioflocs on protein nutrition of *Litopenaeusvannamei* fed with different dietary protein levels in zero water exchange culture tanks. *Aquaculture*, 350-353: 147-153.



**How to cite this article:**

Karthik Ramachandran *et al*.2017, Efficacy of Diatomix$^{TM}$ In Generation of Live Feed Diatoms In Commercial Aquaculture Ponds. *Int J Recent Sci Res.* 8(12), pp. 22435-22441. DOI: http://dx.doi.org/10.24327/ijrsr.2017.0812.1267


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