India's National Monthly on Aquaculture

RNI Regn. No. 52899/93

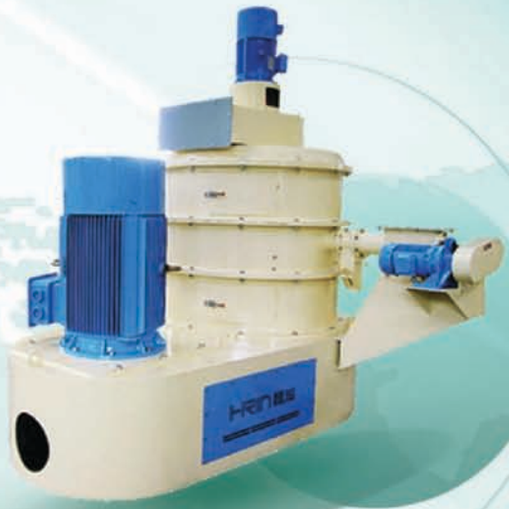
Aqua International

Estd. 1993

Annual Subscription: Rs 600 | Foreign $ 100 | Hyderabad | May 2019

Inside...

Professional Feed Machinery Manufacturer



Hengrun SWFL Series Vertical Pulverizer

Vertical shaft with no-screen grinding, Bearing no maintenance. The production is uniform and the fineness is adjustable (Range from 40~200 mesh.)

Hengrun HRYTZ Series Vacuum Sprayer

Totally enclosed spraying space, Precision & Efficient spraying proportion widely ranged from 2%-30%.

Aqua International

English Monthly Magazine
(Established in May 1993)

Volume 27 Number 1 May 2019

Editor & Publisher
M. A. Nazeer

Editorial & Business Office:
AQUA INTERNATIONAL
NRS Publications,
BG-4, Venkataramana Apartments,
11-4-634, A.C.Guards,
Hyderabad - 500 004, India.
Tel: 040 - 2330 3989, 96666 89554
E-mail: info@aquainternational.in
Website: www.aquainternational.com

Annual Subscription
India : Rs. 600
Foreign Countries : US $ 100
or its equivalent.

Aqua International will be sent to the subscribers in India by Book Post and to the foreign subscribers by AirMail.

Edited, printed, published and owned by M. A. Nazeer and published from BG-4, Venkataramana Apts., 11-4-634, A.C.Guards, Hyderabad - 500 004, India. Printed at Srinivasa Lithographics.

Registered with Registrar of Newspapers for India with Regn. No. 52899/93. Postal Regn. No. L II/ RNP/HD/1068/2018-2020.

NRS PUBLICATIONS
www.aquainternational.in

CONTENTS

ADVERTISERS' INDEX

Gentle Bio-Sciences Pvt. Ltd.

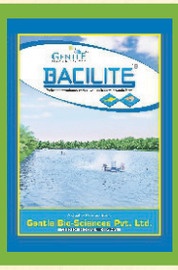
Excellence! Everyday In Every Way!!

SYNAMIN-FS®

CONCENTRATED LIQUID MINERALS ALONG WITH AMINO ACIDS AND GROWTH PROMOTERS

BACILITE®

Probiotic formulation with Zeolite as base in granule form



GENTLE™
LEADING THE WAY

BIOFLOC™

"High Density Water & Soil Probiotic specially designed for Vannamei culture"

MAXLIFE™

Natural Antibacterial Immuno-Modulator

CAA APPROVED PRODUCTS

Regd. Off: Unit No.7, V.S.P.Homes,
Road No.3 Madhavapuri Hills,
Hyderabad-500 050. Telangana.
Ph : +91 7680079990
E-mail: gentleho2013@gmail.com

Gentle Biosciences Pvt. Ltd. ISO 9001:2015 CERTIFIED COMPANY

Marketing Off: # 59A-15-28, 1st Floor,
Pantakaluva Road, Near NTR Circle,
Patamata, Vijayawada-520010, AP.
Ph : +91 7680079988
E-mail: gentledirector1@gmail.com

www.gentlebiosciences.com

Allow de-listed India seafood exporters who improved their practices, and reduce clearance time for exports

Dear Readers,

The May 2019 issue of *Aqua International* is in your hands.

In the News section, you may find news about Central Institute of Freshwater Aquaculture, a premier research institute in freshwater aquaculture in the country observed 32nd Annual Day at its Kausalyaganga campus, Bhubaneswar recently. Prof Suddhasatwa Basu, Director, CSIR-Institute of Minerals and Materials Technology, Bhubaneswar was Chief Guest on the occasion and gave away ICAR-CIFA annual awards.

An MoU has been signed between CMFRI and Space Applications Centre (SAC) of the ISRO to develop a mobile app and a centralised web portal with a complete database of wetlands that are smaller than 2.25 hectares in the country.

Such smaller wetlands cover an area of more than five lakh hectares across the country with Kerala having as many as 2592 smaller wetlands. The two scientific institutes aim to identify and demarcate wetlands and restore the degraded wetlands through suitable livelihood options like coastal aquaculture. The app will be used for real-time monitoring of the wetlands and giving advisories to stakeholders and coastal people.

'L. vannamei hatcheries will be in the comfort zone soon'. The decision to set up a world-class Aquatic Quarantine Facility and Brood-stock Multiplication Centre at Bangarammapeta in Nakkapalli mandal at a cost of Rs 68 crore will cheer to aquaculture farmers.

Andhra Pradesh being a major hub for shrimp production is home to 391 L. vannamei hatcheries producing surplus shrimp seed to meet the requirement from within and outside the State. The State ranks third in global shrimp production (with 0.3 million tonnes) and sixth in aquaculture production (1.57 million tonnes).

Mangrove red snapper being seen as an alternative to popular Vannamei Commercial production of mangrove red snapper (Lutjanus argentimaculatus) has begun in Krishna estuary, exploring possibilities for mass production in the brackish water aqua ponds in Andhra Pradesh. The high-valued fish has the potential to become the alternative species for Vannamei, which has been largely infected with white spot virus leading to bleak prospects for the brackish water aquaculture in recent years in Coastal Andhra Pradesh. In a bid to introduce an alternative species for Vannamei, the scientists of the Central Marine Fisheries Research Institute (CMFRI-Karwar in Karnataka) have started research a few years ago, intensifying their efforts to develop mangrove red snapper seed for commercial production.

India has asked the European Union (EU) to make its market friendlier for Indian exporters of fisheries by reducing the sampling frequency of exports to 10 per cent from 50 per cent, allowing the de-listed establishments that have improved their practices to be listed again and reducing the clearance time for marine exports at the Customs.

The Indian government intends to triple the country's aquaculture production with the intent to ramp up exports of black tiger shrimp to Japan ahead of the 2020 Olympic Games. India's shrimp exports to Japan have dropped off in the past seven years, shrinking by 60 % over this time. However, with a renewed focus on developing tiger shrimp farming in the regions of western Bengal, Kerala and Karnataka, the country aims to return to former levels.

You can see the special feature on Nandini Gears, the first Indian Aquaculture Equipment Company to import blow molding machinery for manufacturing float and cover for paddle wheel aerators. Nandini Gears started manufacturing Float and HDPE Covers in India from the machinery imported from Cheway Machinery, Taiwan. I happened to visit the newly constructed 65,000 sqr ft area factory near Coimbatore and interviewed Nandini's promoter Mr T. Saravanan.

Readers are invited to send their views and comments on the news, special feature and articles published in the magazine which would be published under "Readers Column".

M.A.Nazeer
Editor & Publisher
Aqua International

NRS GROUP
Aqua International

Our Mission

Aqua International will strive to be the reliable source of information to aquaculture industry in India.

AI will give its opinion and suggest the industry what is needed in the interest of the stakeholders of the industry.

AI will strive to be The Forum to the Stakeholders of the industry for development and self-regulation.

AI will recognize the efforts and contribution of individuals, institutions and organizations for the development of aquaculture industry in the country through annual Awards presentation.

AI will strive to maintain quality and standards at all times.

TALK TO US

SEND AN EMAIL:
info@aquainternational.in
Please do not send attachment.

FOLLOW US:
facebook.com/aquainternational.nrs
twitter.com/nrspublications

Send a letter: *Letters to the Editor must include writer's full name, address and personal telephone and mobile numbers. Letters may be edited for the purposes of clarity and space. Letters should be addressed to the Editor:*

AQUA INTERNATIONAL, BG-4, Venkataramana Apartments, 11-4-634, A.C.Guards, Near Income Tax Towers, Masab Tank, Hyderabad - 500 004, T.S, India.
Tel: +91 040 - 2330 3989, 96666 89554. Website: www.aquainternational.in

CIFA observes 32nd Annual Day

A view of CIFA 32nd Annual Day Celebration in Kausalyaganga, Bhubaneshwar.

Bhubaneswar: Central Institute of Freshwater Aquaculture a premier research institute in freshwater aquaculture in the country observed 32nd Annual Day at its Kausalyaganga campus on the outskirts of Bhubaneswar.

Prof Suddhasatwa Basu, Director, CSIR-Institute of Minerals and Materials Technology, Bhubaneswar, Chief Guest gave away CIFA annual awards. Dr C Gopal, Member Secretary, Coastal Aquaculture Authority, Chennai attended the function as Special guest. Mr Sanjib Chandra Hota, IAS (Retd.), Former State Election Commissioner and Member Board of Revenue, Odisha, Bhubaneswar was the Chief Speaker on the occasion and felicitated few retired employees for their contribution.

ICAR-CIFA began its journey as an independent institute under the administrative control of Indian Council of Agricultural Research, New Delhi on this very day in 1987. During last three decades it has contributed immensely towards growth and development of the freshwater aquaculture sector.

Besides research, the institute is also involved in livelihood development, empowerment of women, entrepreneurship development; training and skill development in aquaculture. The institute is operating several flagship schemes of Govt. of India viz., Mera Gaon Mera Gaurav; Farmer First Project; Swachh Bharat Abhiyan, Soil health card, Tribal Sub Plan, Scheduled Caste Sub Plan, Krishi Kalyan Aviyaan, NEH etc. informed Dr Bindu R. Pillai, Director, ICAR-CIFA.

Mr K. V. K. Khordha under the administrative control of the institute conducted technology assessment and refinement programmes benefitting over 1700 farmers and farm women added Dr Pillai. Mr I. B. Kumar, Senior Administrative Officer, ICAR-CIFA, Bhubaneswar also spoke on the occasion. The dignitaries released three publications of the institute to mark the annual day.

Representatives of ICAR-CIWA, ICAR-CHES Bhubaneswar, NFDB and retired employees of CIFA also attended the function. Dr S. Sarkar, Scientist proposed vote of thanks.

CMFRI, ISRO sign MoU for mapping smaller wetlands

An MoU has been signed between the CMFRI and ISRO's Space Applications Centre to develop a mobile app and a centralised web portal with a complete database of wetlands.

Kochi: The Central Marine Fisheries Research Institute (CMFRI) and the Indian Space Research Organisation (ISRO) have joined together to map, validate and protect smaller wetlands in coastal region aimed at restoring them through coastal livelihood programmes.

An MoU has been signed between the CMFRI and the Space Applications Centre (SAC) of the ISRO to develop a mobile app and a centralised web portal with a complete database of wetlands that are smaller than 2.25 hectares in the country.

Such smaller wetlands cover an area of more than five lakh hectares across the country, with Kerala having as many as 2592 smaller wetlands. The two scientific institutes aim to identify and demarcate wetlands, and restore the degraded wetlands through suitable livelihood options like coastal aquaculture. The app will be used for real-time monitoring of the wetlands and giving advisories to stakeholders and coastal people.

The collaborative move is part of a national framework for fisheries and wetlands recently developed by the national innovations in climate resilient agriculture (NICRA) project of CMFRI. The NICRA project aims to find ways and means to mitigate the impact of climate change in marine fisheries and coastal region.

Dr P. U. Zacharia, principal scientist and principal investigator, NICRA project of CMFRI said the real-time data of demarcated coastal wetlands would greatly help developing a conservation plan for degraded wetlands in the region besides utilising these resources for livelihood prospects such as shrimp and crab farming in the area. "Smaller wetlands across the country are highly in neglected state owing to multiple reasons.

Climate variability induced rainfall drastically changes the physio-chemical characteristics of such wetlands which was evidently seen during the last year's devastating flood in Kerala. The collaborative initiative will help develop a comprehensive wetland information system which could facilitate the village level wetland advisories to the local people by scientific communities", he said.

Kerala: Fishing in polluted waters

However, as per unofficial records, the exports dipped by over 25 per cent in the last quarter in Kerala region.

Kollam: The marine products exporters in Kerala are in troubled waters with discouraging trends on the export front due to various reasons, including the central government's policies and the poor quality of the products exported.

The processed marine products export from the state has dipped by nearly 40 per cent making it one of the worst -performing in the country, say exporters. The exports suffer due to the wrongly-implemented export codes for finished products as well as the strict sanitation checks employed at ports which lead to rejection of export consignments, they say.

According to the statistics with the Marine Products Export Development Authority (MPEDA), the total value of exports from Kochi port during 2017-18 was Rs. 5805.11 crore, a slight improvement from the previous Rs. 4860.98 crore. However, as per unofficial records, the exports dipped by over 25 per cent in the last quarter in Kerala region.

"The official records published might not reflect the actual picture as this is a seasonal business. The published values are average while the reality is a stark decline in our business," an exporter told DC.

The consignments shipped to the European Union (EU) are rejected during sanitation checks as the inspection process was recently intensified to cover over 50 per cent of the consignment from an earlier 10 per cent. This is owing to India's recent policy of hundred per cent sanitation check employed for the products imported from the EU.

The EU has intensified the sanitation checks apparently as a tit for tat to the Indian government's attitude of denying relaxation for imports from the EU.

The EU has intensified the sanitation checks apparently as a tit for tat to the Indian government's attitude of denying relaxation for imports from the EU. The free trade agreement between the EU and India has not come through either. The balance of trade in this case is favourable, but has not yet evolved into a complete form.

This has adversely affected the marine products exports from the country with high rejection rates of products, including shrimp, which used to earn the highest foreign exchange earlier.

"We have no control over what we get from the sea. We export the products after certifying them in government laboratories and the approved labs. These are getting rejected in foreign shores due to diehard standards imposed, though sanitation checks are done batch-wise and code-wise by us," a top exporter told DC.

The government is not ready to take the responsibility for these consignments being rejected. In foreign countries, they have research teams to identify spots in the sea where the concentration of heavy metals, including lead, is on a high. This is not done by the authorities here as they blame exporters for the flaws in sanitation checks instead of tackling it at the source. In aquaculture, use of antibiotics has turned out to be a menace due to lack of proper monitoring.

In marine exports, the cephalochordates sent to EU should get the clearance on the presence of heavy metals in its meat. The exporters demand that the government agencies conduct inspections at the source of these marine products, including the harbours, taking responsibility for the quality of marine products. Instead, they confine inspections to the processing centres, the exporters say. "The brunt of rejection is faced by the exporters with zero support from the government," they say.

Sea pollution a reason?

Kerala is experiencing a dip in exports due to the policy change and the strict sanitation checks abroad. If a consignment is once rejected, the company is listed in the internal chart and it cannot continue the exports further.

Another reason cited is an obvious increase in the presence of heavy metals in the seas due to pollution, which cannot be prevented by the exporters. In foreign countries, the quality of water is checked at the source which is reflected on the marine products. Identifying pollution-free zones in the sea could improve the quality of products which help exporters avoid rejection of their consignments.

The major cause for this rejection is the 50 per cent sanitation check on the export products in the EU, which is due to the wrong approach of the Indian government, according to the exporters.

The marine products, including squid and octopus, are exported from India to countries like China, Thailand and Vietnam. These are then reprocessed and exported to the EU without any rejection. Here, we have issues in exports of finished products from the country only due to diplomatic issues of the government.

Policy change also to blame

Until 2015, the marine exports were based on the foreign trade policy 'Vishesh Krishi and Gram Udyog Yojana' (VKGUY) which was replaced by the Merchandise Exports Incentive Scheme (MEIS). During the pre- MEIS period, the exporters were given

incentives as subsidies based on the chapter-wise criteria in the VKGUY. With the MEIS, the exports of marine items were made code-specific. This has unsubsidised a considerable number of marine products affecting the income generation of the exporters.

Ironically, after the introduction of MEIS, the exporters were even asked to repay the entire subsidy received by them for certain products like 'conch' under the VKGUY during pre-2015 period.

The exporters or the authorities are not yet clear on the ITC-HS codes or the Indian Trade Clarification based on Harmonized System of Coding adopted for import-export operations, the exporters say. With all these, the government, from its position of a facilitator, has become a dictator over foreign trade.

New aquaculture pharmaceutical firm launched

The Spanish company CZ Vaccines and Irish firm Marrinovak Ltd have launched the new aquaculture-focused pharmaceutical venture Aquatreck Animal Health.

Marrinnovak Chairman Mr Patrick Smith said: "The mission of Aquatreck is to fast track innovative fish and shrimp disease prevention strategies by building effective open collaboration alliances of top talented teams to serve the global aquaculture industry's sustainable future".

Aquatreck aims to support global aquaculture development providing autogenous, experimental and licensed vaccines and novel, innovative, reliable and accurate diagnostic services for the fish and shrimp farming industry.

Mr Andrés Fernández Álvarez-Santullano, CEO of CZ Vaccines SA mentioned: "We have long experience as CMO GMP producers of fish vaccines for the last 25 years and we decided to focus to accelerate the sustainable global aquaculture growth by preventing the major fish and shrimp diseases so we launch today Aquatreck a new dynamic open innovation aquatic health company".

Dr Panos Christofilogiannis Aquatreck Director indicated: "Aquatreck has long experience in fish vaccine development based on close collaboration and continuous interaction with fish farmers in order to develop comprehensive health management strategies. Aquatreck has top level viral vaccine research and development facilities in Cambridge, UK, sub-unit fish vaccine research and development facilities in Dortmund, Germany, state of the art GMP Fish vaccine manufacturing facilities in Spain and close links with a vibrant network of fish immunology and pathology scientists around the world."

The global fishmeal market was worth approximately US$6 billion (€5.3 billion) in 2017 and is forecast to reach US$10 billion (€8.9 billion) by 2027.

Kien Giang applies advanced technologies in large-scale shrimp farming

The Mekong Delta province of Kien Giang will promote the application of advanced technologies in shrimp farming on large scale until 2025.

The Mekong Delta province of Kien Giang will promote the application of advanced technologies in shrimp farming on large scale under its master plan on shrimp development until 2025.

Accordingly, the province will shift 5,000 hectares of extensive culture of shrimp to industrial and semi-industrial shrimp farming by 2020, of which 4,700 hectares are in the Long Xuyen Quadruple and 300 hectares in U Minh Thuong.

Automatic water environment monitoring stations will be set up serving both aquaculture and environmental protection in this period.

The total area of brackish water shrimp farming is projected at 127,850 ha in 2020.

Meanwhile, the 2021-2025 period will see the formation of a high-tech shrimp industry along with the development of shrimp-rice farming model and large-scale extensive shrimp cultivation. Total shrimp farming area will be expanded to 129,450 ha.

Advanced technologies will continue to be applied on a large scale to reduce chemicals and antibiotics during the entire shrimp production. Besides, the shrimp industry will be developed into a complete value chain, helping increase added value of the local staple.

More than 20,000 hectares of rice cultivation in areas hit by saline intrusion during dry season in U Minh Thuong and Tu Giac Long Xuyen will be switched to shrimp-rice farming.

The province will invest heavily in technical infrastructure to improve breeding production.

Kien Giang earned 213 million USD from the export of aquatic products in 2018.

Vegans call for compassion at India's first Animal Liberation March

Animal rights activists and vegans from the city headed to Shambaji Park in Pune on Sunday to join the protest against the exploitation of animals, at the Animal Liberation March India 2019. The protest, which witnessed participation from activists and animal lovers from across the country, had over contingent of nearly 20 activists from Hyderabad and Vijayawada, donning pro-animal liberation tees. The activists converged at the Fergusson College Road and walked a few kilometres shouting slogans and holding placards denouncing lifestyles that contribute towards animal cruelty.

"The idea behind the event was to make people realise that animals are not mere commodities and shouldn't be exploited for food, clothes, entertainment or experimentation. They are also artificially bred into existence which needs to stop. It's inspiring to see people taking the issue seriously. In fact, many passersbys at the park came up to us to enquire about the rally and they agreed that it is wrong to slaughter animals for our pleasure. We saw activists from around the world at the march," says Sowmya Lakshmi, a vegan activist from the city.

Slogans such as 'Animals deserve freedom. Just like us', 'Animals cherish families. Just like us' and 'Animal use is animal abuse!' resonated across streets of Pune as over 200 activists spread the message of avoiding choices that lead to animal exploitation. "People need to realise that every product that we consume, be it meat or any other by-product of animals, can be substituted with a vegan alternative. Every kind of protein and vitamins can be gained through a vegan lifestyle. Actually, the meat and milk that we consume is more harmful because of all the processing and adulteration they go through. So going vegan is in fact, healthier. We tried to spread this message across through this run," explains Sameer M, a Hyderabad-based vegan activist.

The march was also attended by actresses Kitu Gidwani and Anushka Manchanda, who delivered short impromptu speeches on the ethical responsibility to make vegan choices and the importance of speaking out against animal exploitation. The attendees also put up a demonstration of dropping dead on the ground, to highlight how thousands of animals are killed every second around the world.

"Anyone who has spent time with animals knows that each animal has an individual personality, just like us humans. They value their families, freedom and lives just like we do.

Yet, we separate animals from their loved ones, rob them off their freedom, and mutilate their bodies. Every day, hour and minute, animals are subjected to horrors that no human would knowingly support", said the volunteers while addressing the large crowds that had gathered.

Activists, who had travelled from different parts of the country to attend the march, are hopeful that the march will help spread awareness about the extent of animal cruelty that takes place. Says Ravi Keerthi, a vegan activist from Vijayawada, "This march in Pune was an encouragement to continue fighting for animal rights. People need to understand that animal lives matter, just as any other life. We have sessions every weekend, where we make people aware about the idea of veganism through videos, speeches and open discussions. Our community is growing and we hope events like these spread this message further."

Aquaculture set to get major boost in AP State

Visakhapatnam: 'L. vannamei hatcheries will be in the comfort zone soon'

The decision to set up a world-class Aquatic Quarantine Facility and Brood-stock Multiplication Centre at Bangarammapeta in Nakkapalli mandal at a cost of Rs 68 crore has brought cheer to aqua farmers of the State.

Vannamei shrmip at a hatchery.

Andhra Pradesh being a major hub for shrimp production is home to 391 L. vannamei hatcheries producing surplus shrimp seed to meet the requirement from within and outside the State.

The State ranks third in global shrimp production (0.3 million tonnes) and sixth in aquaculture production (1.57 million tonnes).

Society of Aquaculture Professionals vice-president Mr Yellanki Ravi Kumar told The Hindu that the twin projects would help in supplying superior quality L. vannamei (white-leg shrimp) brood-stock to hatchery operators and specific pathogen-free seeds, the most significant input for shrimp production.

At present, the hatchery producers spread across the coastal region are importing brood-stock and availing the quarantine facility at MPEDA-Rajiv Gandhi Centre for Aquaculture in Chennai. MPEDA-RGCA unit at Mangamarripeta near here gets specific pathogen-free post-larvae from Oceanic Institute, Hawaii and quarantine done in Chennai and rear for two months into brood-stock and supply to the hatchery operators.

The existing facility at Mangamarripeta is not able to meet the growing demand for vannamei brood-stock requirement of the hatcheries. The Bangarammapeta project will get technical support from MPEDA and RGCA.

Bright scope

According to Mr Ram Sankar Naik, Commissioner of Fisheries, there is bright scope for further expansion of brackish water aquaculture in the State in a sustainable way as the government has identified fisheries as one of the important growth engines.

A.P. ranks No. 1 in the country in total fish and prawn production and produces over 70% of cultured shrimp in India. During 2016-17, out of total export earnings of Rs 37,000 crore from India, the share of A.P. was about Rs 17,000 crore.

Joint Director of Fisheries Mr P. Sankara Rao said they had launched work on the twin projects on Monday and the projects would be completed in fast-track mode in an area of 30 acres allotted by the government.

New fish species being tried out for commercial output

Mangrove red snapper being seen as an alternative to popular Vannamei

Commercial production of mangrove red snapper (Lutjanus argentimaculatus) has begun in Krishna estuary, exploring possibilities for mass production in the brackish water aqua ponds in Andhra Pradesh.

The high-valued fish has the potential to become the alternative species for Vannamei, which has been largely infected with white spot virus leading to bleak prospects for the brackish water aquaculture in recent years in Coastal Andhra Pradesh.

High hopes: Mangrove red snapper found in the Krishna estuary in Krishna district.

In a bid to introduce an alternative species for Vannamei, the scientists of the Central Marine Fisheries Research Institute (CMFRI-Karwar in Karnataka) have started research a few years ago, intensifying their efforts to develop mangrove red snapper seed for commercial production.

Former CMFRI director Mr G. Saida Rao told The Hindu, "We have begun the research on mangrove red snapper in Karwar in Karnataka in the mid-2000s to develop the seed. However, the commercial production of the species is yet to begin in the country."

Mr Saida Rao opined that the species had high market value across India and speedy growth had been recorded.

Ryot takes initiative

Mr Lanka Raghu Sekhar, a progressive farmer from Nagayalanka village in Krishna district, has launched the commercial production in the floating cage in the Krishna estuary, examining the possibilities for mass cultivation in ponds. "At least 100 small-sized wild seed of mangrove red snapper has been collected from the Krishna estuary and its growth is impressive," Mr Raghu Sekhar said.

Mr Sekhar is experimenting on the species to share the results with his fellow farmers and waiting for harvesting in the coming rainy season.

"At least one kilogram of growth of the wild seed can be expected within eight months.

"Farmers will focus on commercial production when institutions like the CMFRI promote mass cultivation by supplying the seed," he said.

Fish farms to produce nearly two thirds of India's fish supply by 2030

Where do you think most of the fish we eat come from? The ocean. Wrong. Rivers and lakes? Wrong again. It's from fish farms. Like Y Nagendranath's green ponds at Konduru, a village in Krishna district in coastal Andhra Pradesh. Located 90 km east of Vijayawada, Konduru is near Pothumarru, which is credited with spawning commercial aquaculture in the state in 1980.

Nagendranath took to it two years later, catching young fish from a nearby lake to breed in his ponds. The region was filled with paddy fields, he reminisces at his home on a warm afternoon.

Now there isn't even a paddy stalk to be seen for miles. Instead, in and around Konduru, fish ponds of varying sizes glimmer on both sides of the road, with a row of palm trees marking every two ponds.

In Andhra, which accounts for a fourth of India's fish production, Krishna, West Godavari and East Godavari districts are the hub of aquaculture.

Flying Fish

In the early 1980s, when Nagendranath ventured into fish farming, aquaculture contributed less than a fifth to India's fish production.

But it grew to a third in 1996, and 20 years later, it was more than half. By 2030 aquaculture will be responsible for nearly two-thirds of India's fish production, according to projections by the Food and Agriculture Organization (FAO) of the United Nations.

Nagendranath now has 31 acres under aquaculture. He grows rohu and catla in 22 acres and shrimp in nine. Rohu, catla and mrigal, which are called Indian major carps, make up nearly 90% of India's freshwater aquaculture, according to one estimate.

Shrimp, especially whiteleg shrimp, is popular in brackish-water aquaculture, which forms just 5% of aquaculture in the country. "There is a minimum income guarantee in aquaculture," says Nagendranath.

India is World's Third Largest Fish Producer

	Production in 2016 (million tonnes)	Projected production in 2030 (million tonnes)
China	66.8	79.1
Indonesia	11.5	15.2
India	10.8	13.4
European Union	6.5	7
Vietnam	6.4	8.1

Source: Food and Agriculture Organization of the United Nations (FAO)

A farmer could earn around Rs 1 lakh from an acre annually, growing two batches of carps, says B Seshagiri, chief scientist at the Central Institute of Freshwater Aquaculture in Vijayawada.

A whole industry has cropped up around aquaculture, as can be seen at Akividu in West Godavari district, not far from Konduru.

The busiest road in that village is lined with shops selling a range of aquaculture-related products like probiotic pellets and oxygen generators.

India produced 10.8 million tonnes (mt) of fish in 2016, the third highest in the world, after China and Indonesia. India's share of global fish production was around 6%, according to the FAO. In aquaculture, India is second only to China, with a 7% share in global production. India exported a tenth of its fish in 2016.

Fish production also contributes around 1% to India's gross domestic product and over 5% to the agricultural GDP.

In the 1950s, fish from the seas accounted for more than 70% of India's fish production, but by 2016-17 its share had more than halved, and inland farming rose. However, there are limitations to growth in aquaculture as it is practised in most parts of the country. So the National Fisheries Development Board, set up in 2006, is pushing the culture of growing fish in cages and pens in reservoirs and lakes.

CIFT Celebrated 62nd Foundation Day

Dr Meenakumari inaugurating the 62nd Foundation Day Celebration

ICAR-CIFT, Cochin, commemorated its 62nd Foundation Day. The function was graced by Dr B. Meenakumari, former Chairperson of National Biodiversity Board, Chennai and former Deputy Director General (Fisheries), ICAR and also the former Director, CIFT as the Chief Guest. In his presidential address, Dr Ravishankar C.N., Director, CIFT highlighted the prominent contributions of the Institute during the last year (2018-19), which included the release of path breaking rapid test kit aptly named as 'CIFTest Kit' for detecting fish contamination by spurious chemicals like formaldehyde and ammonia in the fish markets, and its national level tremendous impact in controlling adulteration in fish preservation, CIFT's recognition by FSSAI as a *National Reference Laboratory* for fish and fish products as an additional feather to its status, collaborating with Cochin Shipyard Limited (CSL) for designing deep sea fishing vessels being built at Cochin Shipyard at Kochi for various coastal states and Lakshadweep, global accreditation as a major research partnership with FAO on anti-microbial resistance (AMR) mitigation linking more than 20 institutions across the country, active participation in formulation of KMFRA guidelines for the state of Kerala, major role in preparation of national 'Blue Economy' policy document and in addition also playing an active role in the recent flood relief measures during the massive flood havoc in Kerala during 2018 and conducting a post flood damage assessment in the fisheries sector as an after-math of the flood.

The Chief Guest Dr B. Meenakumari applauded the accomplishments of the Institute during it 62 years of fruitful >> existence during which the Institute has catered the requirement of harvest and post harvest sectors in fisheries immensely, that has been affirmed by the growth in fishery exports and trade. As part of the function, continuing its long tradition of honouring Institute's retired staff on the Foundation Day, CIFT honoured representatives of the different categories of the retired staff of the Institute, namely Dr T.K. Sivadas (Scientific), Dr P.J., Cecily (Technical), Mr Raveendran Nair (Administrative) and Mr C.A. Krishnan (Skilled Support). Dr Susheela Mathew, HOD, Biochemistry and Nutrition Division welcomed the gathering and Mr K.S. Sreekumaran, Finance and Accounts Officer proposed the vote of thanks. The function ended with a variety of entertainment programme performed by the staff and their wards.

Vietnam, India compete for Japanese shrimp market share

India's plans to boost exports of black tiger shrimp to Japan ahead of the 2020 Olympics will bring it into direct competition with Vietnamese exporters, for whom Japan represented their biggest source of revenue in the first quarter of 2019.

The Indian government intends to triple the country's aquaculture production, with the intent to ramp up exports of black tiger shrimp to Japan ahead of the 2020 Olympic Games.

India's shrimp exports to Japan have dropped off in the past seven years, shrinking by 60% over this time.

However, with a renewed focus on developing tiger shrimp farming in the regions of western Bengal, Kerala, and Karnataka, the country aims to return to former levels.

Meanwhile, for Vietnam, seafood exports in the first quarter of 2019 generated $1.8 billion, a small rise of 0.5% year-on-year.

The country's primary seafood markets for the first two months of the year have been Japan, the US, China, and South Korea, which when combined account for 52.8% of all exports. Elsewhere, the country has seen strong market growth in Mexico (up 35.6%), the Phillippines (+25%), and Malaysia (21.6%).

Vietnam's total seafood imports for Q1 came to $416m, an increase of 2% over the same period in 2018, according to *Vietnam Plus.*

UNI MAX - MAXIMUM PROFIT AQUACULTURE PROGRAM

With almost 20 years' experience in the field of aquaculture feed, prawn larvae, water treatment, aquatic health products and pond solutions, we are pioneer in prawn feed manufacturing and today, one of the world's leading aquaculture feed suppliers.

We would like to introduce our "Uni-Max program"- the best solution for aquaculture to help our Asian farmers achieve the highest profits.

UNI-PRESIDENT VIETNAM CO., LTD

No. 16-18-20, DT 743 Road, Song Than II Industrial Zone, Di An Ward, Di An Town, Binh Duong Province, Vietnam.
Tel: +84 274-3790811 | Fax: +84-274-3790819
Website: www.uni-president.com.vn | Email: aquafeed@upvn.com.vn

Nandini Gears, the first Indian Aquaculture Aerators / Equipment coy to make HDPE Float and Covers in India with imported machinery

Aims to reach Rs 25 Crore Turnover in 2019 – 20; To export products overseas

T. Saravanan, Promoter, Nandini Gears, Coimbatore

Although he constructed a modern factory with 65,000 sqr mtr built up area after 23 years of successful business experience, to manufacture HDPE float and HDPE covers for aquaculture ponds, Mr T. Saravanan first took *Aqua International* Editor M. A. Nazeer to show the small office of 200 sft area, where he started his career in 1996 at Neelikonam Palayam, 13 kms to Coimbatore city on April 12. Let us read the success story of Mr T. Saravanan, the humble and hardworking aquaculture equipment / Aerators businessman and the Promoter of Nandini Gears.

Coimbatore: Mr T. Saravanan, Managing Director, Nandini Gears, started in a small way in 1996 manufacturing gear boxes for aquaculture purpose initially in 4,200 sft factory area in Neelikonam Palayam. In the year 2000, he began manufacturing motors of 1 HP and 2 HP for aquaculture ponds. Later in 2003, he took up bearings stands and spiral stopper and glands. In 2010, Saravanan started manufacturing full set of Aerators with 1 HP 2 Paddles and 2 HP 4 Paddles.

In 2016, he started making 1 HP 4 Paddles and 2 HP 6 Paddles along with spiral aerators. In 2018, Saravanan started manufacturing HDPE Float and Covers in India from the imported machinery from Taiwan. The Blow molding machinery for manufacturing float and cover for paddle wheel aerators of 12 kg capacity was imported from Cheway Machinery,Taiwan, and was installed in November 2018. The production started in November 2018 and it can make 250 floats and around 600 covers a day in 3 shifts. He has got testing facilities in the factory premises itself for the whole paddle wheel aerators. It is first of its kind in India any Equipment manufacturer in aquaculture using such machinery for making float and covers for water aeration purpose in aquaculture, said Mr T. Saravanan, Managing Director, Nandini Gears.

Nandini Gears has all required different sections

Aqua International Editor M. A. Nazeer congratulating T. Saravanan at Nandini Gears new 65,000 sqr mtr factory located at Pothiyampalayam

The smiling Saravanan

Blow molding machinery to manufacture HDPE Float and covers for Paddle wheel Aerators imported from Cheway machinery, Taiwan

in an organised manner like Gear hobbing and thread milling section, Motor winding section, Vertical Milling Center (VMC) fully automatic. We have everything available in our factory premises. Only for raw material we depend outside, and all machinery and spare parts are manufactured in our factory itself, he said adding that after manufacturing the Roter, balancing is done before assembling of the motors. We are using 3 mm thickness 304 grade material for SS frame, for gear box bed for aquaculture aerators, he informed.

Nandini Gears has Injection molding machine for making paddle wheel aerators with 250 tonnes capacity making 120 wheels per day. The machine is from Farromatik Milacron.

The company has separate building for making gear box and motors assembling, packing and dispatch.

Spare parts are available for the customers at any time. Once we get the order, we can deliver from the headquarter within 2 to 3 days time from the date of receiving the order, he told.

Nandini Gears has 5 factory buildings in Neelikonam Palayam and another new factory with 65,000 sqr mtrs

T. Saravanan and his wife Ms Priya with their key staff members in Nandini Gears

A view of Nandini Gears factory facilities

at Pothiyampalayam, 13 kms to Coimbatore city.

Building 1: Cutting, Hobbing Machine, Thread milling machine and Motor winding section.

Building 2: Motor binding section with warm grinding section.

Building 3: Vertical Milling Center (VMC)

Building 4: CNC Section and Injection molding section.

Building 5: Assembling, Packing and Dispatching section.

Building 6: Located at Pothiyampalayam, 13 kms to Coimbatore city and 23 kms to the existing factory buildings and headquarters. Manufacturing HDPE Float and Covers.

We manufacture best quality products for aquaculture water aeration with prompt and timely delivery and service to the customers, informed Saravanan.

Mr Saravanan was born and bought up in Neelikonam Palayam. He did his diploma in Mechanical Engineering from Government Polytechnic, Ooty in 1994 and started his career in Shanthi Gears as Quality Control and Production Engineer at Coimbatore.

Saravanan started his own Textile spares manufacturing unit in the same place in 1996. He entered into Aquaculture sector in 1998 with warm shift and warm wheels and spares. In 2002, he started manufacturing full set of Gear boxes of Nandini brand. In 2004, he took up making motors for aquaculture purpose.

In 2010, he began making complete set of aerators of Nandini Brand except HDPE float and covers which were earlier imported from Taiwan.

A view of Nandini Gears factory

Today, we make every thing in our factory

Today, we manufacture all spare parts at our factory in India and we do not import anything now, he added.

We export our products to other countries. In 2018, we exported 1 HP 2 Paddle wheel aerators to Bangladesh and the response was good, the customers are very much satisfied, he stated.

Mr Saravanan stated that every month they manufacture 3,000 sets of Paddle wheel aerators. The manufacturing capacity of their factory is 36,000 sets

T. Saravanan and his wife Priya discussing a point

whereas they supply around 18,000 aerators. Half of their capacity is used. The total market of aerators in India according to him is estimated at 100,000 plus aerators.

Achieved Rs 20 cr and expecting to make it Rs 25 cr this year

Nandini Gears is very strong in Andhra Pradesh, Tamil Nadu and Kerala for aerators supply. We are working to develop export of aerators to different countries. In 2018, Nandini Gears achieved a turnover of Rs 20 crores and expecting to increase it to Rs 25 crores this year.

It's a first generation business for me. We worked very hard day and night and got established well in production and marketing of our products in Indian aquaculture sector. We struggled a lot financially and otherwise in the beginning. Then, Indian Overseas Bank, Peelamedu branch in Coimbatore helped us.

The entry of Vannamei into India in 2009 was the turning point to our growth, he stated.

The involvement of my wife, Ms Priya .S, who has done her Bachelor of Engineering, since 2005 was a great support to me. She looks after production and technical aspects of the company. I also got good staff members in the company, said Mr Saravanan adding that 'in the industry everybody likes our products and services, and gave us the opportunity to grow'.

Aerator with four paddle at Nandini's aerator testing facility

We always maintained quality and has never compromised with it. We fulfilled 90 % of our commitment to the customers so far and this year, 2019, we want to satisfy 100 % customers, said Saravanan. Last year we had 10 % difficulty in timely import of floats, now since we are manufacturing in India, we will ensure 100 % satisfaction to the customers. We think customer's satisfaction is our satisfaction, said Mr Saravanan.

It is only Nandini Gears in India which is manufacturing whole set of aerators, each and every part of Paddle wheel aerator is manufacture by Nandini Gears in the country, he added.

Vertical Milling Centre (VMC) is used to matching up gear boxes and it is fully automatic, provided by BFW, Bangalore. Only for raw material we depend outside, and all machinery and spare parts are manufactured in our factory at Coimbatore.

The average price of aerator is Rs 22,000 to 28,000 per set.

Mr Saravanan brought lot of nursery plants from East Godavri district of Andhra Pradesh to develop well the greenery in the newly constructed factory near Coimbatore.

Satya Narayana, Nanadini Gears Dealer in Andhra Pradesh

Srinivas of Amalapuram sells 2000 Aerators annually

Mr K. Srinivas, Proprietor, Sri Nandini Balaji & Co. of Amalapuram, East Godavari district in Andhra Pradesh, who sells 15,00 to 2,000 sets of aerators of Nandini Gears said that since Mr Saravanan has got long term target, he is maintaining good quality aerators along with spare parts. Once we complain of a problem, Saravanan rectifies any problem within a short time, said Mr Srinivas.

Sri Nandini Balaji & Co. are the exclusive distributors of Nandini Gears for over 6 years now.

We feed millions

Skretting is the global leader in providing innovative and sustainable nutritional solutions and services that best support the performance of fish and shrimp

Our mission

feeding the future

1
2
3
4
5
6
7
8
9

SKRETTING
a Nutreco company

1	Skretting Norway	10	Skretting Japan
2	Skretting UK	11	Skretting Australia
3	Skretting France	12	Skretting Canada
4	Skretting Spain	13	Skretting USA
5	Skretting Italy	14	Skretting Ecuador
6	Skretting Turkey	15	Skretting Chile
7	Skretting Egypt	16	Skretting Nigeria
8	Skretting Vietnam	17	Skretting Zambia
9	Skretting China	18	Skretting India

Skretting has production facilities in 18 countries on five continents, and manufactures and delivers high quality feeds from hatching to harvest for more than 60 species. The total annual production volume of feed is more than 2 million tonnes. The head office is located in Stavanger, Norway.

www.skretting.com

Application of Biofloc Technology in Aquaculture

Manoj Kumar[1]*, B.R. Honnananda[1] and Krishna Kumar Choudhary[1]

[1]Department of Aquaculture, College of Fisheries, Chhattisgarh Kamdhenu Vishwavidyalaya, Kawardha, Chhattisgarh.

Introduction:

Excessive accumulation of toxic inorganic nitrogen from feed, faeces and other external factors in the aquaculture ponds is always posing major threat to pond ecology, thus not only deteriorating pond environment but also the environment of the surrounding aquatic ecosystem (Kurup, 2010). In aquaculture, the accumulated waste must be removed continuously to maintain optimal growth conditions and the health of the cultured organism. In order to make aquaculture industry more successful, it is imperative to develop technology that will increase economic and environmental sustainability (Kuhn et al., 2010). Application of biofloc technology by the addition of suitable cheap carbohydrate source is found to be effective for the control of toxic metabolites from the culture system. Biofloc technology is the retention of waste and its conversion to biofloc as a natural food within the culture system (Avnimelech et al., 1986; Hargreaves, 2006). If carbon and nitrogen are well balanced in the solution, ammonium in addition to organic nitrogenous waste will be converted into bacterial biomass (Schneider et al., 2005). By adding carbohydrates to the pond, heterotrophic bacterial growth is stimulated and nitrogen uptake through the production of microbial proteins takes place (Avnimelech, 1999). Biofloc technology is a technique of enhancing water quality through the addition of extra carbon to the aquaculture system, through an external carbon source or elevated carbon content of the feed (Fig. 1). This promoted nitrogen uptake by bacterial growth decreases the ammonium concentration more rapidly than nitrification (Hargreaves, 2006).

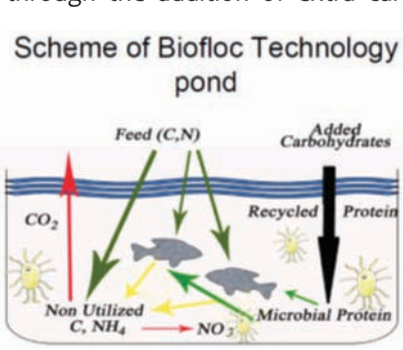


Fig. 1. Schematic representation of bioflocs in aquaculture systems

Carbon: Nitrogen Ratio To maintain a controlled environment in the Biofloc it is desirable to be able to remove the excessive ammonium and nitrite that risks being toxic to the fish (Colt et al., 1981; Lewis & Morris, 1986). Ammonium is assimilated into microbial protein in the water when adding some source of organic carbon which is increasing the ratio between carbon and nitrogen (C: N). When adding carbonaceous material to the pond, several things changes (Avnimelech et al., 1992):

1. The amount of inorganic nitrogen was reduces and organic nitrogen increases.
2. Utilization of protein improves.
3. Overall feed cost may get reduces.

To maintain a high C: N ratio there are two ways. Have a low protein content in the fish feed or have some kind of organic carbon input in the water (Crab *et al*., 2007; Hargreaves, 2006). When having available carbon and the C : N ratio is 15 or higher, an effective removal of nitrogen is reachable and protein production occurs (Diab & Avnimelech, unpublished results, in Avnimelech *et al*., 1992). Different carbohydrate sources which are available locally can also be used as input (Hargreaves, 2006). Studies have been conducted by using various carbohydrate sources such as: cellulose and sorghum meal (Avnimelech & Mokady, 1988), wheat flour and crushed sorghum (Avnimelech et al., 1992), glycerol (Crab *et al*., 2010), wheat and corn meal (Burford *et al*., 2004), sugar (glucose) and cassava meal (Avnimelech, 1999). A disadvantage when adding carbohydrates could be that it may increase the sedimentation to the bottom of the pond where the microbial biomass will not be utilised by the fish. That could result in negative organic load (Avnimelech, 1999). A schematic calculation of the amount of carbon needed for biofloc growth is presented in Fig. 2.

Daily feeding of 2 % of fish weight (Craig and Helfrich, 2002)
↓
20 g feed added per kg fish per day (25% protein)
↓
5 g protein added per kg fish per day
↓ 16% of protein is N (Craig and Helfrich, 2002)
0.8 g N added per kg fish per day
↓ On average 75% of the feed –N ends up in the water (ammonification of uneated feed + excretion) (Piedrahita, 2003)
0.6 g N per kg fish per day ends up in water
↓ Microorganisms need a C/N ratio of 10 (Avnimelech, 1999)
6g C per kg fish per day needed for biofloc production

Fig.2. Schematic calculation of the daily amount of carbon needed to remove the nitrogen wasted from uneaten feed and excretion from the animals by bioflocs. The amount of carbon source added will then depend on the carbon content of the carbon source. In case of acetate or glycerol (both containing 0.4 g C per g), 15 g of carbon source would be needed per kg fish per day. The assumption that 75% of the feed-N ends up in the water is based on Piedrahita (2003).

Highlight Points

- **Biofloc technology is the retention of waste and its conversion to biofloc as a natural food within the culture system.**
- **If carbon and nitrogen are well balanced in the solution, ammonium in addition to organic nitrogenous waste will be converted into bacterial biomass.**
- **This technology could result in higher productivity with less impact to the environment.**
- **Bioflocs could be considered as a good source of protein, bioactive compounds and immune-stimulants for shrimp, tilapia and mussel.**

Fig.3 Aeration in biofloc tank

Fig.4 Bioflocs: Imhoff cone

Application of Biofloc Technology:

Application of Biofloc technology facilitates the effective utilization of microbial food-web by the cultured organism. Biofloc technology (BFT) application offers benefits in improving aquaculture production that could contribute to the achievement of sustainable development goals. This technology could result in higher productivity with less impact to the environment. Furthermore, biofloc systems may be developed and performed in integration with other food production, thus promoting productive integrated systems, aiming at producing more food and feed from the same area of land with fewer input.

Biofloc technology could support the supply of good quality seeds by improving the reproductive performance of aquaculture animals and by enhancing the larvae immunity and robustness (Ekasari et al., 2015; Ekasari et al., 2016; Emerenciano et al., 2013).The application of biofloc technology in grow out systems of some aquaculture species could improve net productivity by 8–43%, relative to the non-biofloc control (traditional with water exchange, clear water system or recalculating aquaculture system) (Ekasari, 2014).

Biofloc technology, where nitrogenous waste generated by the cultivated organisms is converted into bacterial biomass (containing protein), in situ feed production is stimulated through the addition of an external carbon source (Schneider et al., 2005). In a study by Azim et al. (2008), the composition of the Biofloc did not depend on the composition of the feed that was applied. Analysing the Biofloc revealed that it had over 50 % crude protein (CP), 2.5 % crude lipid, 4 % fibre, 7 % ash and gave 22 KJ/g energy in dry matter (DM). It was suggested by Jauncey (2000) that Tilapia diets would contain 25-30 % CP and 6-8 % crude lipid for larger fish. This combination of nutritional values, together with a satisfying amount of Biofloc should be advantageous as fish feed to herbivorous and omnivorous fish species (Azim et al., 2008). As a protein source, bioflocs could be considered as a good protein source for shrimp and a useful protein source for tilapia and mussel (Ekasari et al., 2014a,b). Bioflocs also contain various bioactive compounds including essential fatty acids, carotenoids, free amino acids and chlorophylls (Ju et al., 2008), trace minerals (Tacon et al., 2002) and vitamin C (Crab et al., 2012) which are known to have positive effects on aquaculture animals including the enhancement of antioxidant status, growth, reproduction and immune response. Bioflocs also offers a lot of MAMPs (microbial associated molecular patterns), which may be recognized as immune-stimulants, resulting in higher resistance to diseases (Ekasari et al., 2014 a, b).

It was illustrated that, an intensive zero exchange lined shrimp pond only required 1– 2.26 m3 kg-1 shrimp, whereas a conventional system with regular water exchange may require water up to 80 m3 kg-1 (Hargreaves, 2006). In addition, Luo et al. (2014) noted that water consumption of biofloc-based tilapia culture system was 40% lower than that of recirculating aquaculture system (RAS). Most of the studies applying biofloc technology confirmed that the N and P waste in this system could be reduced, corroborating the role of this system on the improvement of aquaculture productivity and the reduction of environmental impact from aquaculture unit (among others, Perez-Fuentes et al., 2013; Luo et al., 2014).

A possible modification in biofloc-based aquaculture to maximize nutrient utilization efficiency is by the applying nutrient recycle principle in an integrated aquaculture system.

The faster conversion of nutrient by the microbes associated in bioflocs or periphyton may provide more digestible and nutritious additional food source for both main cultured organism and other species added into the system. In this way, utilization of the wasted nutrients is expected to be more efficient and less pollution is generated. Ekasari (2014) demonstrated that combining biofloc-based shrimp culture system with tilapia, mussel and seaweed resulted in higher production, higher feed N and P recovery by the shrimp and

the entire culture system, and simultaneously resulted in reduced waste nutrient and microbial biomass. Furthermore, the addition of seaweed or macrophytes (Brito et al., 2014; Liu et al., 2014; Pinho et al., 2017) in a biofloc-based integrated aquaculture system may also bring about the possibility to capture the excess CO2, which may result in an increase in C utilization efficiency and a reduction in the emission of GHG.

Biofloc technology constitutes a possible alternative measure to fight pathogenic bacteria in aquaculture. Due to the haphazard mishandling of antibiotics in aquaculture, pathogenic bacteria are now becoming resistant to numerous antibiotics and as a result, antibiotics are no longer effective in treating bacterial disease (Defoirdt et al., 2011). The disruption of quorum sensing, bacterial cell-to-cell communication with small signal molecules (Defoirdt et al., 2008), has been proposed as a new strategy to control bacterial infections in aquaculture as this cell-to-cell communication mechanism regulates the expression of virulence factors (Defoirdt et al., 2004). Interestingly, recently it was found that bioflocs grown on glycerol were able to protect gnotobiotic brine shrimp (Artemia franciscana) against pathogenic Vibrio harveyi, and that the beneficial effect was likely due to interference with the pathogen's quorum sensing system (Crab et al., 2010). Indeed, survival of challenged nauplii increased 3-fold after the addition of live bioflocs. The water of shrimp tanks fed bioflocs inoculated with Bacillus had an on average 5 times lower Vibrio load when compared to the shrimp tanks fed an artificial feed (Crab, 2010). Bioflocs might also contain immunostimulatory compounds since biofloc technology deals with bacteria and bacterial products, thus enhancing the innate immunity of cultured organisms may provide broad-spectrum resistance to infections.

Conclusions:

A variety of beneficial features can be ascribed to biofloc technology, from water quality control to in situ feed production and some possible extra features. Biofloc technology offers aquaculture a sustainable tool to simultaneously address its environmental, social and economical issues concurrent with its growth. The application of Biofloc technology in the culture system of giant freshwater prawn, *M. rosenbergii*, was useful in reducing the protein percentage from 32 to 24, without affecting the yield. So, farmers can adopt farming with 24% protein with Biofloc technology application. Toxic metabolite compounds like ammonia is shown to be get reduced by the bacterial metabolism. The reduced protein percentage in the feed is compensated by the consumption of flocculated microbial protein by the animal in effect, that results in conversion of more N inputs of the pond into harvestable products. Use of feed with lesser protein percentage will reduce the production cost. Biofloc technology is one of the futuristic technologies for increasing the ecological and environmental sustainability of aquaculture.

Role of Polyhydroxybutyrate as an Anti Infectious Agent in Aquaculture

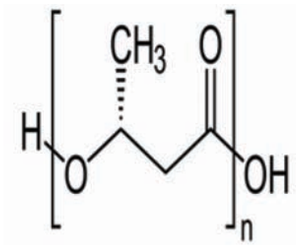
M.Menaga*, C. Mohanasundari & S. Felix

*PhD Scholar, Department of Aquaculture, Dr.MGR.Fisheries College and Research Institute, Ponneri.

Introduction

Polyhydroxybutyrate (PHB), a polymer belonging to the polyhydroxyalkanoate (PHA) to the polyesters class as bio-derived and biodegradable plastics. The poly-3-hydroxybutyrate (P3HB), a form of PHB is probably the most common type of polyhydroxyalkanoate, but other polymers of this class are produced by a variety of microorganisms. Some microorganisms produce PHB under some physiological conditions like stress, mainly when nutrients are limited. PHB is primarily a product of carbon assimilation (glucose and starch) and is used by micro organisms as a form of energy storage molecule when common energy sources are not available. These include poly-4-hydroxybutyrate (P4HB), polyhydroxyvalerate (PHV), polyhydroxyhexanoate (PHH), polyhydroxyoctanoate (PHO) and their copolymers. Microbial biosynthesis of PHB is enhanced by condensing two molecules of acetyl-CoA to give acetoacetyl-CoA which in turn is reduced to hydroxybutyryl-CoA. Hydroxybutyryl-CoA is used as a monomer to polymerize PHB. By disrupting the cells PHA granules are recovered. The empirical formula of PHB is $(C_4H_6O_2)_n$

Molecular structure of PHB does not depend on the features of the strain and conditions of carbon nutrition of microorganisms producing PHB.



Structure of poly-(*R*)-3-hydroxybutyrate (P3HB), a polyhydroxyalkanoate

Unique features of PHB

PHB is different from other biodegradable plastics since it has unique properties like insolubility in water, higher resistant to hydrolytic degradation, oxygen permeability, resistant to UV.

Some other biodegradable plastics are sensitive to moisture and it is water soluble. PHB has poor resistance activity towards acids and bases, solubility nature of chloroform and other chlorinated hydrocarbons and biocompatibility and hence it is best suited for its use in many medical applications.

PHB producing and degrading bacteria

Poly-β-hydroxybutyrate (PHB) is synthesized as an intracellular storage material and accumulates itself as distinct black granules during unbalanced growth in the cell. During harmful conditions, PHB is used by the cell as an internal reserve of carbon and energy. Many bacteria were isolated from soil and have the capacity to breakdown and produce PHB. Enzymes like synthetases or depolymerases are used for the biosynthesis and biodegradation of poly-β-hydroxybutyrates and also other polyhydroxyalkanoates. These biodegradable polyesters act as substitutes of common plastics because they are completely degraded by the microorganisms present in the environment and from regenerable carbon sources they can be produced. Alicaligens eutrophs H16 is an autotroph and can grow rapidly in simple media, for PHB production it requires anaerobic conditions with CO_2 and N source. Most of the PHB producing bacteria are nitrogen fixing microorganisms. The Azotobacter species when grown on different carbon sources like sucrose media fix the molecular nitrogen and have the capacity to accumulate poly-β-hydroxybutyrates.

Firmicutes and proteobacteria can degrade PHB. Species like Bacillus, *Pseudomonas* and *Streptomyces* can also degrade PHB. Pseudomonas lemoigne, Comamonas sp. *Acidovorax faecalis, Aspergillus fumigatus* and *Variovorax paradoxus* are soil microbes capable of PHB degradation. *Alcaligenes faecalis, Pseudomonas,* and *Illyobacter delafieldi*, were obtained from anaerobic sludge. *Comamonas testosteroni* and *Pseudomonas stutzeri* were the organisms obtained from sea water. Few of these are capable of degrading at higher temperatures; except thermophilic Streptomyces sp. and a thermophilic strain of *Aspergillus* sp.*Bacillus infantis, Exiguobacterium profundum, Bacillus subtilis, Bacillus megaterium, Klebsiella pneumoniae* and *Enterococcus hirae* obtained from biofloc cultured water were proved to be PHB producing bacteria.

Highlight Points

- **Poly hydroxybutyrate (PHB) is a strong anti-adhesive agent can be effectively used as an antimicrobial agent as safe economic alternate against the pathogens in aquaculture to replace conventional antibiotics. PHB a biodegradable polymer acts as an organic carbon substrate and helps**
- **In the reduction of nitrate to elementary nitrogen as a mode of maintaining ideal water quality parameters. This article discusses the types of PHB producing bacteria along with its application in aquaculture**

Enzymology of PHB production

The biosynthetic pathways of PHB consist of three

reactions catalyzed by three different enzymes. The first reaction consists of the condensation of two acetylcoenzyme A (acetyl-CoA) molecules in to acetoacetyl-CoA by β-ketoacyl CoA thiolase (encoded by phaA). The second reaction is the reduction by an NADPH dependent acetoacetyl–CoA dehydrogenase of acetoacetyl CoA to (R) -3- hydroxyl butyryl-CoA. Lastly, the (R)-3-hydroxybutyryl-CoA monomers are polymerized in to PHB by P (3HB) polymerase or synthase, encoded by phbC.

Extraction of PHB

The PHB producing bacterial isolates were harvested for the cell pellet after 48hrs of incubation in NDMM (nitrogen deficient minimal medium) broth by centrifugation at 5000 rpm for 15 minutes. The pellet was washed by using equal volume of acetone and ethanol. The cell pellet was added with 4% sodium hypochlorite and incubated at 37 °C for 45 mins. After incubation it was centrifuged at 5000 rpm for 25 min to obtain the pellet which was again washed with equal volume of acetone and ethanol. The final pellet was dissolved in 5mL of boiling chloroform and allowed to evaporate at 4 °C to obtain the PHB powder. The PHB producing ability of the organism can be confirmed by Nile blue A and Sudan black staining method.

Applications of PHB in aquaculture

- PHB is a strong anti-adhesive agent (80-95%) against all tested vibrio pathogens. It is inferred that the pathogenic vibrio in shrimp aquaculture can be effectively controlled by PHB. Therefore, PHB is used as feed additive in shrimps which can reduce the colonization capacity of vibrio on the farmed shrimp as well as in the farm environment. PHB in shrimp aquaculture could be biocompatible and elicit synergistic effect acts as anti adhesive as well as possibly as immune stimulant in treated shrimps. PHB was a potential anti adhesive agent which can be developed as a safe economic alternate to replace conventional antibiotics in shrimp aquaculture.
- PHB, the bacterial storage polymer has the potential to be used as an alternate to anti-infectious compound in aquaculture. Potentially, fish enzymes in the gastrointestinal tract(partially) degraded the PHB into β-hydroxybutyrateoligomers and monomers, which could be used as a growth source for the bacteria.
- A wide variety of microorganisms are known to produc epolymers of the fatty acid β-hydroxybutyrate as an intracellular energy and carbon storage compound. The ability to degrade extra cellular PHB depends on the secretion of extra cellular PHB depolymerase enzymes and is widely distributed among bacteria and fungi. Apart from microbial degradation, PHB has also been shown to be degraded in animal tissues and to be hydrolysed under acidic and alkaline conditions.
- The addition of PHBvia live feed increased survival of giant freshwater prawn(Macrobrachiumrosenbergii) larvae two fold after 15 days. Moreover, Vibrio counts in the gut of PHB-fed larvaewere significantly lower than normal larvae.
- The synergistic effectof PHB-degrading probiotic and PHB as a symbiotic elicits a strong protection against luminescent vibriosis .
- Luminescent vibrios can cause infections that are often hard to treat with antibiotics because of the spread of resistant strains and leads to dramatic losses in aquaculture. In these cases PHB can be used as an alternative to treat these infections. Hence in aquaculture PHB plays an efficient role in controlling the diseases.
- ibrios are one of the most important bacterial pathogens for animals reared in aquaculture. V. alginolyticus, V. salmonicida, V. parahaemolyticus and V. vulnificus are among the main bacterial pathogens of several fish spp. PHB, a Short-chain fatty acids showed a strong growth-inhibitory action against pathogenic V. campbellii.
- Nitrate removal is one of the major problems in aquaculture systems, which has not always found satisfactory solutions in practice. De nitrification can be achieved with biodegradable polymer where microorganisms use the biopolymer in the form of pellets and as water insoluble carbon source which is accessible only by enzymatic attack. The use of PHB a biodegradable polymer as organic carbon substrate, leads to simultaneous reduction of nitrate to elementaryn itrogen. Heterotrophic denitrification positively influences the pH of the water. If protein sare metabolized by fish, the end-products of respiration after hydrolysis to amino acids (e.g. glycine) are NH4and HCO3which is excreted via gills.
- A well balanced diet with PHB increases bacterial species richness in the fish GI tract. PHB degradation in Siberian sturgeon(Acipenserbaerii) gut alters GItract pH, most probably because of β-hydroxybutyrate(SCFA) production, inducing changes in the composition of the bacterial community. Inclusion of PHB in the fish diet can be used as microbial control agent in aquaculture and its effect on growth performance depends on both concentration and species.

References:

1. Ackermann, Jörg-uwe; Müller, Susann; Lösche, Andreas; Bley, Thomas; Babel, Wolfgang (1995). "Methylobacterium rhodesianum cells tend to double the DNA content under growth limitations and accumulate PHB". Journal of Biotechnology. 39 (1): 9–20.
2. Jacquel, Nicolas; Lo, Chi-Wei; Wei, Yu-Hong; Wu, Ho-Shing; Wang, Shaw S. (2008). "Isolation and purification of bacterial poly(3-hydroxyalkanoates)". Biochemical Engineering Journal. 39 (1): 15–27.
3. A.J. Anderson, E.A. Dawes, Microbiol. Rev, (1990), 450–472.
4. S. Khanna, A.K. Srivastava, Process Biochem, (2005), 40, 607–619.
5. Schlegal H, G, Gottashalk & Bartha RV, (1961), Nature (Land), 463-465, 191.
6. J.C. Quagliano, P. Alegre, S.S. Miyazaki, Rev. Argent. Microbiol, (1994), 2-26.
7. Tokiwa, Yutaka; Calabia, Buenaventurada P.; Ugwu, Charles U.; Aiba, Seiichi (2009). "Biodegradability of Plastics". International Journal of Molecular Sciences. 10 (9): 3722–42.

More References can be provided on request.

Role of Dopamine in Fish Reproduction

S. Selvaraj, N. Jayakumar, R. Durairaja, B. Ahilan and S. Felix

Fisheries College and Research Institute Tamil Nadu Dr J. Jayalalithaa Fisheries University, Ponneri, Thiruvallur, Tamil Nadu.

Introduction

Dopamine is a catecholaminergic neurotransmitter that is widely expressed in the fish brain and plays an important role in central functions and behaviours, such as cognition, perception, emotion, motivation, reward, memory and decision making. In the mammalian brain, the central dopaminergic system is comprised of four major pathways: the mesostriatial, mesolimbic, mesocortical and tuberoinfular systems (Missale et al., 1998). The mesostriatial pathway originates in the substantia nigra and projects to the striatum. This pathway is involved in extra pyramidal motor function. The mesolimbic pathway originates from the ventral tegmental area of the midbrain and projects to the nucleus accumbens and amygdala. This pathway is primarily involved in cognitive functions, memory, and emotion. The mesocortical pathway also projects from the ventral tegmental area to cortical structures and involved in motivation and reward. Tuberoinfundibular pathway projects from the hypothalamus to the hypophysis where it is involved in neuroendocrine regulation (Messias et al., 2016).

Peripheral dopamine is involved in diverse functions. In the kidney, dopamine increases the filtration rate and inhibits sodium re absorption. In the cardiovascular system, dopamine is involved in inhibiting norepinephrine release (Goldberg and Rajfer, 1985). In the adrenal cortex, dopamine found to stimulate and inhibit both epinephrine and norepinephrine release and regulate the secretion of aldosterone (Porter et al., 1992; Vizi et al., 1993; Missale et al., 1998).

Dopaminergic signalling is mediated by five distinct receptors that are organized in two separate clades based on their interaction with the enzyme adenylyl cyclase: D1-like receptors that include the D1 and D5 receptors; D2-like receptors including the D2, D3, and D4 receptors. D1-like receptors activate adenylyl cyclase while the D2-like receptors inhibits it. Moreover, two clades of dopamine receptors exhibit different affinities to the dopamine, with D2-like receptors exhibiting 10- to 100- fold greater affinity than the D1-like receptors. All of the receptors exhibit the typical seven-transmembrane domain α-helical G-protein coupled receptors structure, including an extracellular N-terminus and an intracellular C-terminus (Sibley et al., 1993; Jaber et al., 1996). D1-like receptors couple to stimulatory subsets of G-proteins to activate adenylyl cyclase, which leads to an increase in intracellular levels of cyclic adenosine monophosphate. The D2-like subfamily couples to inhibitory subsets of G-proteins, which inhibits adenylyl cyclase and decreases levels of intracellular cyclic adenosine monophosphate (Albert et al., 1990; Plug et al., 1992). The central dopaminergic system, acting through dopamine-D2-type receptors forms an important inhibitory component of the regulation of reproductive brain-pituitary-gonad axis (Yu and Peter, 1990).

There have been several studies on the neuroanatomical localization of the dopamine system in fish. Majority of dopamine neurons are localized to the diencephalon as opposed to the midbrain regions. Immunocytochemical studies indicate that the zebraf ish dopamine neurons send ascending projection pathways to the telencephalon. These ascending pathways represent homologous mammalian mesostriatal, mesolimbic and mesocortical pathways (Rink and Wullimann, 2002). Several studies in teleosts demonstrated that dopamine neurons responsible for the inhibitory control of reproduction originate in a specific nucleus of the preoptic area, and project directly to the region of the pituitary where gonadotrophic cells are localized (Dufour et al., 2010).

Dopamine in fish reproduction

The hypothalamus in fishes exerts its regulation on the release of the gonadotrophins via several neurohormones such as gonadotropin-releasing hormone (GnRH), dopamine, γ aminobutyric acid, kisspeptin, pituitary adenylate cyclase activating peptide, norepinephrine, neuropeptide Y, Insulin-like growth factor I, norepinephrine, leptin and ghrelin (Levavi-Sivan et al., 2010). In addition, gonadal sex steroids and peptides exert their effects on the gonadotropins either directly or via the hypothalamus. GnRH is considered as the major hypothalamic factor controlling pituitary gonadotrophins; however, its stimulatory action opposed by the potent inhibitory actions of dopamine in teleosts. This dual neuroendocrine control of reproduction by GnRH and dopamine has been demonstrated in several teleosts, where dopamine plays an inhibitory role in the neuroendocrine regulation of the last steps of gametogenesis.

Peter et al. (1978) were the first to unravel the existence of a dopaminergic inhibitory neuroendocrine control of reproduction in the goldfish. Subsequently, several studies indicated that the dopamine inhibits both basal and GnRH-stimulated luteinizing

Highlight Points

- **Dopamine is one of the major inhibitory factor in farmed fish reproduction.**
- **Dopamine inhibition is especially significant in cyprinid fish.**
- **Melatonin modulates the activity of dopamine in teleosts.**
- **Dopamine antagonists are included in the gonadotropin and other synthetic hormonal based preparations for captive breeding.**

hormone secretion in teleost fish. Both in vivo and *in vitro* experiments, as validated by molecular and biochemical studies indicate that the dopamine D2-like, but not D1-like, receptors inhibit gonadotropin secretion directly in the pituitary. This led to the development of methods to induce maturation and spawning in aquaculture, using a combined treatment with a GnRH agonist and a dopamine-D2 receptor antagonist such as domperidone. This method called LinPe is widely used in aquaculture as an alternative and reliable strategy to control reproduction in captivity when compared with other hormonal treatments, synthetic human chorionic gonadotropin (hCG) and pituitary extracts (called hypophysation) (Dufour et al., 2010).

Dopaminergic inhibition is especially significant in cyprinid fish. Hence, spawning induction in cyprinid fish in aquaculture requires the use of dopamine D2 receptor antagonists (pimozide, domperidone or metoclopramide) to promote a significant surge of LH, in response to GnRH that will lead to successful ovulation (Peter et al., 1988; Yaron, 1995; Levavi-Sivan et al., 2010). However, the dopaminergic inhibition does not operate in all fish and is lacking in few fish like Atlantic croaker and gilthead seabream (Copeland and Thomas, 1989; Zohar and Mylonas, 2001). Dopaminergic activity varies during the seasonal reproductive and spawning cycle. Sex steroids have been shown to regulate dopaminergic systems in several teleost species, affecting both dopamine synthesis and dopamine receptor expression. In females, sex steroids play a major role in the regulation of dopaminergic activity by increasing the inhibitory tone during vitellogenesis, as demonstarted in silurids, salmonids, and percomorphs (De Leeuw et al., 1986; Senthilkumaran and Joy, 1995; Linard et al., 1995; Saligaut et al., 1999; Yaron et al., 2003; Levavi-Sivan et al., 2005). Dopamine inhibition would be maximal at the end of gametogenesis and would decrease during induction of ovulation or spermiation, under the control of external and internal cues (Dufour et al., 2005). In grey mullet, dopamine inhibition was shown to have a role at two different stages of the reproductive cycle, not only at the stage of final oocyte maturation and ovulation but also at the early stages of vitellogenesis (Aizen et al., 2005). Dopamine is also involved in the inhibition of pubertal onset in fish. In the juvenile spade fish, a decrease in dopaminergic activity was observed in the hypothalamus at the time of puberty (Marcano et al., 1995). In the immature European eel, the pituitary luteinizing content is high, and a combined treatment with GnRH and dopamine antagonist induced luteinizing release and ovarian development (Dufour et al., 1988). In the grey mullet, a dopamine antagonist treatment is highly potent than GnRHa treatment in increasing circulating estradiol-17β levels and enhancing maturation and spawning (Aizen et al., 2005). Few studies have revealed that melatonin modulates the activity of dopamine systems in some teleosts, making the melatonin-dopamine pathway a prominent relay between environmental signals and control of reproductive activity in fish (Dufour et al., 2010).

Conclusion

Various studies revealed that dopamine and GnRH interactions on gonadotrophin release involve multiple cellular mechanisms, such as down-regulation of GnRH receptor, interference with GnRH intracellular pathways and influence of neurotransmitters and neuromodulators (Dufour et al., 2010). Recently, kisspeptin has been found to modulate the activity of reproductive BPG axis through GnRH pathway in some teleosts (Ohga et al., 2017, 2018), suggesting possible interaction of dopaminergic systems in modulating the seasonal reproductive cycle in teleost fish. Also, it was demonstrated that Prussian carp injected with human kisspeptin, in combination with dopamine antagonist elevated circulating LH levels, suggesting possibility of application of synthetic kisspeptin peptide as an inducing agent along with the dopamine antagonist in carps (Gosiewski et al., 2015; Sokolowska-Mikolajczyk et al., 2018).

References:

Aizen, J., Meiri, I., Tzchori, I., Levavi-Sivan, B., Rosenfeld, H., 2005. Enhancing spawning in the grey mullet (Mugil cephalus) by removal of dopaminergic inhibition. Gen. Comp. Endocrinol. 142: 212–221.

Albert, P.R., Neve, K.A., Bunzow, J.R., Civelli, O., 1990. Coupling of a cloned rat dopamine-D2 receptor to inhibition of adenylyl cyclase and prolactin secretion. J. Biol. Chem. 265: 2098–104.

Copeland, P.A., Thomas, P., 1989. Control of gonadotropin-release in the Atlantic croaker (Micropogonias undulatus) – evidence for lack of dopaminergic inhibition. Gen. Comp. Endocrinol. 74: 474–483.

De Leeuw, R., Goos, H.J., Van Oordt, P.G., 1986. The dopaminergic inhibition of the gonadotropin-releasing hormone-induced gonadotropin release: an in vitro study with fragments and cell suspensions from pituitaries of the African catfish, Clarias gariepinus (Burchell). Gen. Comp. Endocrinol. 63: 171–177.

Dufour, S., Sebert, M.E., Weltzien, F.A., Rousseau, K., Pasqualini, C., 2010. Neuroendocrine control by dopamine of teleost reproduction. J. Fish Biol. 76: 129–160

Gosiewski, G., Sokolowska-Mikolajczyk, M., Chyb, J., Socha, M., 2015. Preliminary results on the influence of human kisspeptin on LH secretion in Prussian carp (Carassius gibelio) female at the stage of ovarian recrudescence and spawning season. Folia Biologica 65: 25-33.

Jaber, M., Robinson, S.W., Missale, C., Caron, M.G., 1996. Dopamine receptors and brain function. Neuropharmacology 35: 1503-1519.

Levavi-Sivan, B., Bogerd J., Mañanós E.L. Gómez, A., Lareyre, J.J., 2010. Perspectives on fish gonadotropins and their receptors. Gen. Comp. Endocrinol. 165: 412–437.

Levavi-Sivan, B., Biran, J., Fierman, E., 2006. Sex steroids are involved in the regulation of gonadotropin-releasing hormone and dopamine D2 receptors in female tilapia pituitary. Biol. Reprod. 75: 642–650.

Linard, B., Bennani, S., Saligaut, C., 1995. Involvement of estradiol in a catecholamine inhibitory tone of gonadotropin release in rainbow trout (Oncorhynchus mykiss). Gen. Comp. Endocrinol. 99: 192–196.

More References can be provided on request.

MM Gears Pvt Ltd.
Delivering Innovation

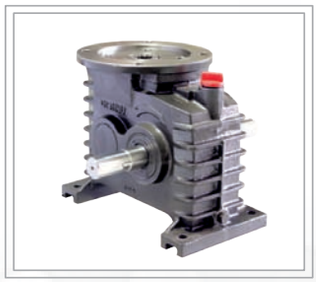
GISHNU GEARS
Transforming Innovation

SF No: 796/1B-1C-1D., Near Hotel Le Meridien, Neelambur,
Coimbatore - 641 062, Tamil Nadu.
T : 0422-262 7884 M : +91 99439-17774

E : sales@gishnugears.in / gmsales@mmgears.in
www.gishnugears.in I www.mmgearsindia.com

FLOATING BEVEL AERATOR GEARBOX

Type : A3 Aero (Aluminium)
Range: 1Hp to 3 Hp
O/p RPM: 105, 120, 140, 160
Pedals: 4, 6 & 8

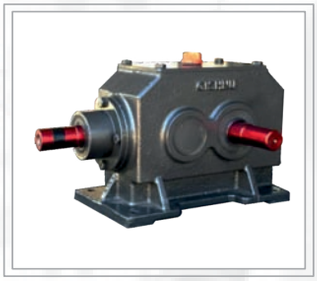


Type : A3 Power (Casting)
Range: 1Hp to 3 Hp
O/p RPM: 105, 120, 140, 160
Pedals: 4, 6 & 8

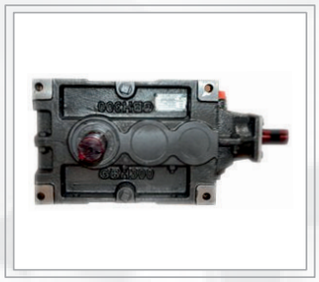
SPECIAL FEATURES

- 60% Power saving
- Highly Corrosion Resistance
- Aerodynamic design with Aluminum Housing
- Efficient Nylon and Steel spiral bevel Gears
- Weighs 50% lesser for ease of floating
- Highly reliable & noise free
- High Strength cast iron housing
- CNC Generated Spiral Bevel Gears
- Paddle Output shaft SS 304 for Corrosion free
- Heat Treated Steel Pinion Gears

BEVEL HELICAL GEAR BOX



Type : GBH 200 Long Arm
Range: 3 Hp
O/p RPM: 105, 120, 140, 160
Pedals: 8+8



Type : GBH 300 Long Arm
Range: 5 Hp
O/p RPM: 105, 120, 140, 160
Pedals: 16+16

OUR RANGE OF PRODUCTS
Worm Reduction Gear Boxes
Types : Adaptable, Underdriven, Overdriven, Vertical, Hollow Shaft And Double Reduction Models.
Spiral Bevel Aerator Gear Boxes
Bevel Helical Gear Boxes

HELICAL GEAR BOXES WITH HARDENED AND PROFILE GROUND GEARS
Geared Motors | Spur & Helical Gears | Non – Standard And Custom Build Gear Boxes | Cooling Tower Gear Boxes
Tyre Changer Gear Boxes | Rolling Shutter Gear Boxes

Aerator Gear Boxes | Standard Gear Boxes | Geared Motors | Bevel Gears

In India Different Waste Water *Fed* Aquaculture System

Tarang Kumar Shah[1], Avdhesh Kumar[1], Ritesh Tandel[2], Debajit Sarma[2], Adil Raja Bhat[2] and Parvaiz Ahmad Ganie[2]

[1]Department of Aquaculture, G.B.Pant University of Agriculture and Technology, Pantnagar

[2]ICAR-Directorate of Coldwater Fisheries Research, Bhimtal

1. Introduction

Sewage may be defined as a cloudy fluid arising out of domestic, municipal and industrial waste, containing mineral and organic matter in solution or having particles of solid matter floating, in suspension, or in colloidal and pseudo-colloidal form in a dispersed state **(Imhoff et al., 1956)** Wastewater is enormous problem in city as well as rural area. Germany was the first century to developed sewage fed fishery. Wastewater is utilized for fish culture is common practice in any part of Asia and was also known in Europe. Wastewater-fed aquaculture is an economical more attractive farming system in the world. This system developed mainly by farmers and local communities to use nutrients contained in wastes to produce aquatic food. West Bengal is leadingfor wastewater-fed aquaculture. Presently, More than 130 wastewater aquaculturetube units in India covering about 10,000 ha.This technology was first developed by Germany and then India independently in 1930. The early mainspring of utilizing the sewage for fish culture emerged from the waste. This technique is considered to be the largest operating system in the world to convert the waste in the consumable product.

2. Sewage Water *Fed* Aquaculture Methods:

The sewage water treatment process is not difficult but through aquaculture, this process treats water while additional income generated to the farmer. Different types of model can be used to treat the water while the cultureof aquatic animals.

2.1. Duckweed Fish Based treatment system at CIFA

The duckweed Fish Based treatment system was developed by the Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar, India. This system is Integration of duckweed cum fish culture. Duckweed Fish Based treatment system under construction of duckweed pond and fish pond separately. Wastewater passes through a series of duckweed ponds followed by the fish pond was developed at Matagajpur, Cuttack, Odisha under a project funded by Ministry of Environment and Forest, New Delhi during 1992-97 **(Source:Handbook of fisheries and aquaculture)**. This system is a biological wastewater treatment system. This system can be divided into three main component such as (1.) Duckweed pond (2.) Fish Pond and (3.) Depuration Pond. In duckweed pond, many types of duckweed species viz.Lemna, Spirodela, and Wolffia can be used for treating the water as well as the culture of duckweeds. Duckweeds act as absorption of heavy metal as well as nutrient sink absorbing from a wastewater. Fish Production level may be 3-4 tonne/ha/year. In this system construction of 18 duckweed pond (25m×8m×1m each), 2 fish pond (50m×20m×2m each) and 2 marketing/depuration pond (40m×20m×2m each). Firstly, the wastewater passes through a series of duckweed pond then this treated water can be transferred into the fish pond. Five different types of carps viz.Catla, Rohu, Mrigal, Silver carp and Common carp can be a culture in wastewater at a stocking density of 10000 fingerlings/ha.

2.2. Model of wastewater treatment with Aquaculture

This Model proposed by Bansal A.K. et al., 2007. The domestic wastewater collected from the inlet of oxidation pond and observations taken for nitrate, nitrite, ammonium and phosphate, fecal bacteria, dissolved oxygen, temperature, pH, biological oxygen demand (BOD) and chemical oxygen demand (COD). This wastewater can be transferred into the duckweed pond which acts the nutrient and heavy metal absorption in wastewater. This treated water can also be transferred into the fish pond. One such data set for each of the oxidation pondswere collected. Water analysis can be done for a lab scale oxidation pond filled with 40 liters of wastewater, treated with an algal concentration of 10 gm/l.

2.3. Aquaculture-based sewage treatment plant (ASTP):

Aquaculture-based sewage treatment plant (ASTP) designed in India has the cultivation of duckweed cum fish culture as well as treat the wastewater. Aquaculture-based sewage treatment plant (ASTP) can be divided into three main component such as (1.) Duckweed pond (2.) Fish Pond (3.) Depuration pond.

2.3.1 Sources: Firstly the sewage come from city/rural area then this sewage can be transfer into the receiving chamber. A receiving chamber for sewage feeds the effluent to the Aquaculture based sewage treatment plant (ASTP).

2.3.2 Duckweed pond: In this ponds, many types of duckweed species viz. Lemna, Spirodela, Wolffia culture can be done. Wastewater pass in different 18 duckweed ponds with a brick lining and the pond diameter can be used for scientific are 25m×8m×1m.

2.3.3 Fish Pond: Fish culture can be done in this pond. Two fish ponds receive the treated sewage from the duckweed ponds and retain it for 3 days.

2.3.4 Depuration Ponds: Two Freshwater depuration pondsare used as marketing ponds. In this pond, fish can be stock a week before marketing.

3. Advantages of waste water fed Aquaculture

1. To reduce the pollution load ofany aquatic ecosystem
2. It provides Animal protein to cheapest rate.
3. In culture time no need of manuring and supplementary feeding because high content of nutrients in Sewage.

Reference can be provided on request.

Highlight Points

- **Wastewater-fed aquaculture is an economical more attractive farming system in the world.**
- **Wastewater-fed aquaculture technology was first developed by Germany and then India independently in 1930.**
- **This article defined most important technology used for waste water aquaculture.**

Application of genetics and biotechnology in ornamental fish production

P. Yuvarajan[1*], B. Kannan[1], R. Somu Sunder Lingam[1] and Mahadevi[1]

[1] Dr. M.G.R Fisheries College and Research Institute, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Ponneri, Thiruvallur, Tamil Nadu.

Introduction

The significance of ornamental fish species depends on aesthetic value and demand. Which can be determined by colour, size and shape of the species (Olivier, K., 2001). Nowadays, gold fish and koi carp contributes major role in ornamental fish trade apart from that, neon and cardinal tetras, guppies, platy, sword tails, Siamese fighting fish, angel fish, danio and gouramies also considered next to those fishes. Most of the species are seasonal breeders, to overcome this condition - adopt multiple breeding (Andrews, C., 1990). Generally, inbreeding cause inbreeding depression which is replaced by genetic improvement through selective breeding, hybridization, polyploidy, gene and nuclear engineering. In that, selective breeding could be better and easier to produce new strain (with perfect appearance, shape and colour) among the scientific as well as farmers level.

Selective breeding

Selective breeding is the applied science of genetics which is done between two selected candidate species by natural or induction method (Kumar. A Y., 2009.).

Steps in selective breeding

- Tank preparation for breeding
- Selection of parents wisely for each generation
- Water quality
- Feeding
- Related Strains

Tank preparation for breeding

The following equipments required for tank preparation

- To maintain the water temperature, heater and thermometer required.
- A filter to ensure good water quality
- Aeration facility needed
- Aquarium plants act as hiding place, provide oxygen and create natural ecosystem.

Selection of parents

Selection plays important role is ornamental fish production. Best males and females are needed for selective breeding. There are different selection viz. mass selection, family selection and multiple trait selection from different generation to improve the quality of fish strain.

Water quality

Water should be exchanged every day. Tank should be maintained with pH range of 6.8 - 7.6 and temperature should be maintained according to the fish.

Feeding

Planktons, artemia and micro worms are given as food in fish hatchery. For example earth worm is the suitable food for gold fish.

Related Strains

Breeding of two related strain is called inter breeding which leads to possibilities of deformity. So, improving the quality of strains has achieved from generation to generation. Generally, more than 5 – 10% offsprings has potential than parents of each batch. Those offsprings grown upto parents then utilized for selective breeding.

Production of new variety of Guppy

Best parents are selected for the following three methods

A. Inbreeding,

B. Line breeding

C. Out crossing

A. Inbreeding

Inbreeding provides positive results in selecting particular colour for fins, fixing fin confirmation or colour patterns (A.S. Singh. 2010). In this method, closely related guppies bred. For example, best male guppy breed it with its sister or mother. This will produce fish which look alike in patterns and colours. This method is also used for mass production of particular strain. Fancy guppies are produced using this method.

B. Line breeding

Line breeding is slight modification of inbreeding program. This method is systematic and needs extensive documentation. To begin with, one male guppy and breed it with two sister female guppies. Keep separate resulting young guppies of each guppy female. This is first generation (generation-1). Next generation again breed a male guppy to two female guppies and keep each line separate. Continue to do this again and again till riches sixth generation. At this stage, take a male guppy from one line and cross it with female guppy from other line. This method is proven and gives quality fish for

Highlight Points

- **Gold fish and Koi carp contributes significant role in ornamental fish trade**
- **Selective breeding is the key to produce charming fish varieties**
- **Fancy guppy produced by using inbreeding technique**

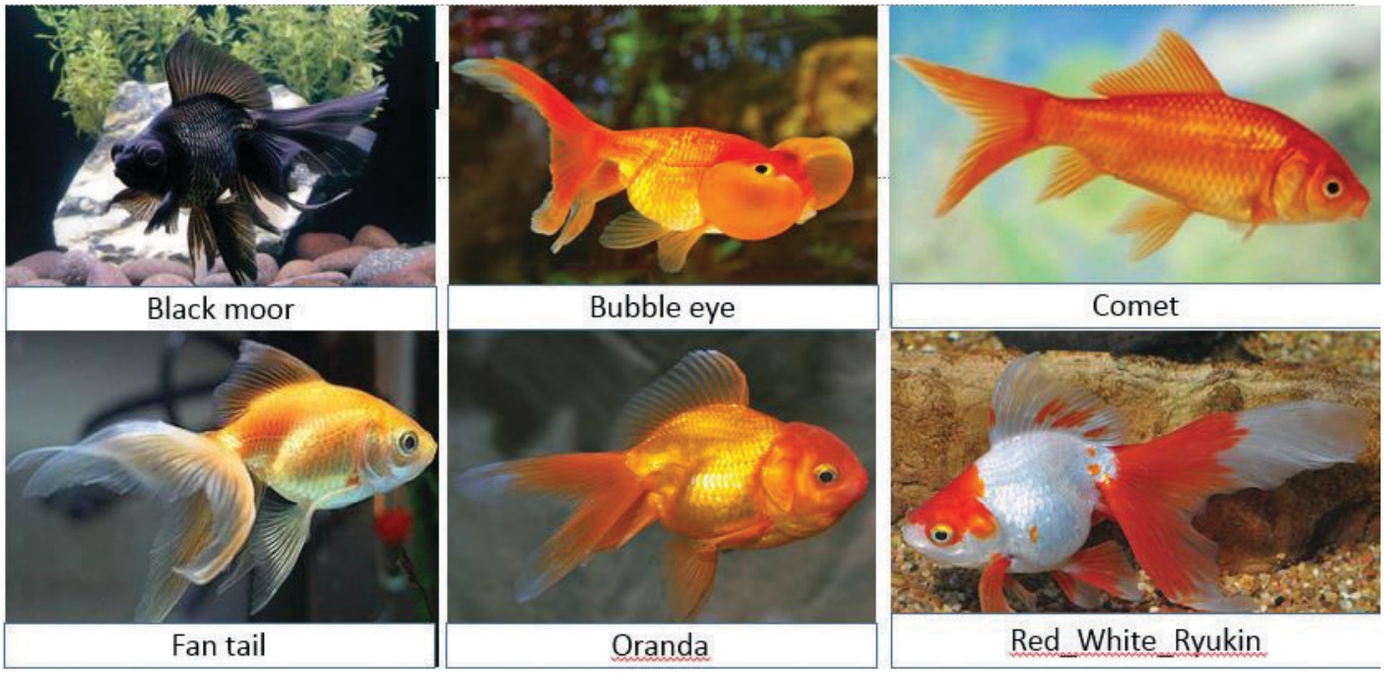


Figure 1. Gold fish varieties bred through selective breeding techniques

years to years provided chosen the best male for breeding guppies. Breeding male guppy from another line after few generations maintain better quality while strict inbreeding program improves particular feature of guppy (A.S. Singh. 2010)

C. Out crossing

Out crossing is breeding of two unrelated Guppies or even different strains. Most of breeders use this method to produce their fancy Guppies (A.S. Singh. 2010). Some people have developed beautiful new varieties by simply crossing everything they have together with the hope of finding the right combination. After this is done, the problem is getting the new line to produce the same type of fish.

Hormonal induction of sex reversal

Sexuality in fish plays vital role in aquaculture as there are differences in growth rate, body form and external characters between males and females in several species (Yamamoto and Kajishima, 1968). The sex determining mechanism of some of the ornamental fishes is given below:

A. Hermaphrodites – Guppy and sword-tail

B. Polygenic determination of sex – sword-tail

C. Sex chromosomal sex determination

- XX female – XY male – Goldfish
- ZZ male – WZ female – mosquito fish
- WXY – XY, YY – males – platy

XX, WX – females – platy

The process of sex differentiation in teleost is prolonged and labile rendering the hormonal induction of sex reversal possible in gonochoristic and hermaphroditic species. The induction involves administration of optimum dose of a sex steroid (e.g. 17α-methyl testosterone) during the labile period, which reverses the phenotypic expression of a genetic female into a male but the genetic male remains a male. Sex reversal comprises the entire sequence of differentiation, gametogenesis, ovulation / spermiation, courtship behaviour, secondary sexual characters and sex pheromone production are the process of endocrine system. In most teleosts males grow faster than female (e.g. cichlidae); males of most ornamental fish are more colourful than females and thus have a higher commercial value. In recent years, biotechnological research has led to the development of breeding programmes in aquaculture is the production of sex-reversed brood stock to produce mono sex populations for grow-out (Pandian and Sheela, 1995).

The production of sex-reversed broodstock is usually accomplished by feeding either estrogens or androgens (sex hormones) to sexually undifferentiated fry to sex-reversed them. Sex-reversed fish are individuals that are one sex phenotypically but the other genetically (XX O) is as example phenotypically male genitically female. If sex reversal is done properly, sex-reversed fish are capable of producing monosex populations for grow-out. The estrogens to produce sex reverse females or androgens to produce sex-reversed males depends on the sex determining system of the species and whether you want to produce an all-male or an all-female population.

Species used for genetic improvement

Goldfish

The goldfish is a domesticated in the form of crucian carp (Carassius carassius) which is still widely distributed in Asia as well as in Eastern Europe (Raicu et al., 1981). The wild fish are generally of a silver appearance. The colouration and other aspects of present-day goldfish are believed to have been developed almost 100 individual strains of goldfish through selective breeding viz. red-gold appearance, shubunkin, telescopic eye, oranda, lion head, fan tail, veil tail and ruykin etc

Koi-carp

Koi is the Japanese word for "Love" and is also used as

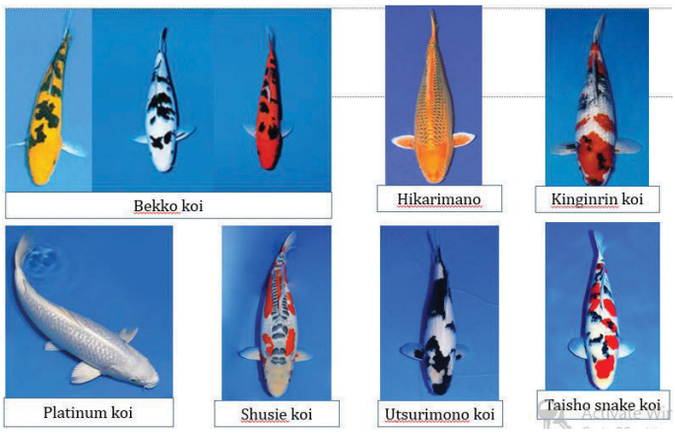


Figure 2. Koi carp varieties bred through selective breeding techniques

synonymous for the "fancy carps". Among the Chinese businessmen, fancy carps are often reared for "Good Luck". Through selective breeding, Japanese have created more than 100 varieties of nishikigoi that we see today in niigata in the north part of the island Honsu. The Japanese are generally recognized as the creators of nishikigoi (Kumar,A Y., 2009). Nishikigoi – called national fish of Japan. Koi carps varieties are developed through selective breeding as follows

- Asagi - Light blue on top, red or orange on bottom, blue scales bordered in white.
- Shusui - Similar to asagi, but with large scales in a dorsal row.
- Bekko - Primary color red orange yellow or white, with black patches.

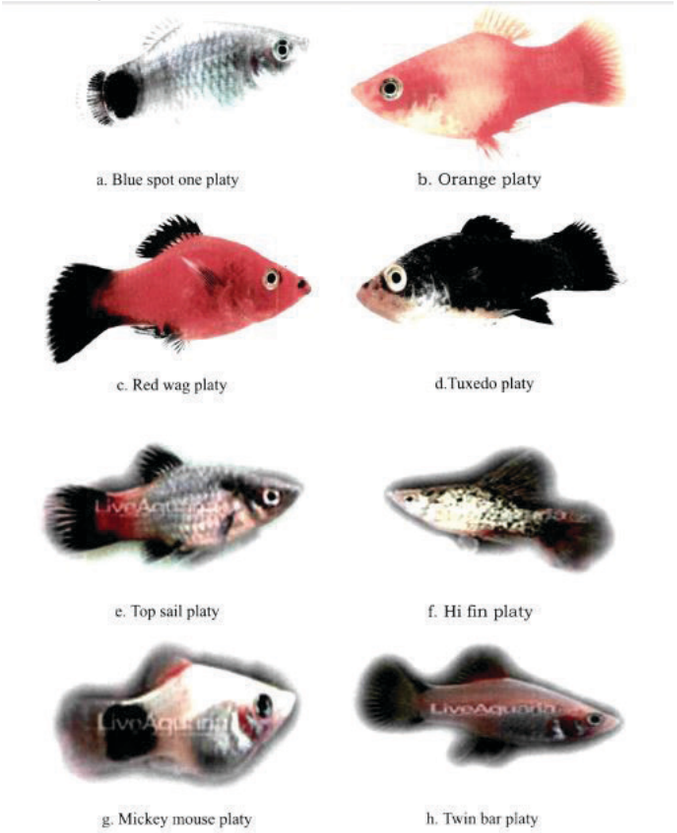


Figure 3. Platy varieties bred through selective breeding techniques

- Kinginrin - Bright metallic sheen, silver highlights.
- Platinum ogon - Pure white.
- Utsurimono - Uniformly black with red, white and yellow markings.
- Taisho sanke - Primarily white, with red and black markings.
- Tancho kohaku - Pure white roxmd red head patch.
- Hikari utsuri mono - Two metallic colors.
- Kawari mono - Miscellaneous.

Platy

Fish of the genus *Xiphophorus* which hybridize readily amongst themselves and thus provide the breeder with two sources of variation are inherited viz. macromelanophore and micromelanophore patterns are body ground colour or fin colours, fin shapes and sizes also developed in the fancy strains. The genetics of the fin shape may derive from hybridization between *X. maculates*, the common platy of aquarium fame, and *X. montezumae* or *X. xiphidium* followed by selection for enhanced expression (Basolo, A.L., 1990). The platy varieties produced through selective breeding viz. blue spot one platy, orange platy, red wag platy, tuxedo platy, top sail platy, hi fin platy, mickey mouse platy, twin barb.

Conclusion

Ornamental fish production is one of the important fish trade business. The lack of seed supply, seed quality, coloration, size and shape could be compromised by phenotypic and genotypic manipulation through application of genetics and biotechnological invention. This technologies should be transferred to the farmers to improve the aquariculture production as well as their welfare.

References

A.S. Singh. 2010. Selective breeding in ornamental fishes- A Step toward development in production of new variety. Aquaculture Europe. Vol. 35 (4) December 2010 (https://www.researchgate.net/publication/207409360)

Ananth Kumar, Y., 2009. Genetic manipulation in selected ornamental fishes.

Andrews, C., 1990. The ornamental fish trade and fish conservation. Journal of fish Biology, 37, pp.53-59.

Basolo, A.L., 1990. Female preference predates the evolution of the sword in swordtail fish. Science, 250(4982), pp.808-810.

Mc Andrew, B. and Napier, J., 2011. Application of genetics and genomics to aquaculture development: current and future directions. The Journal of Agricultural Science, 149(S1), pp.143-151.

Olivier, K., 2001. Ornamental fish trade-overview. Infofish International, pp.14-19.

Pandian, T.J. and Sheela, S.G., 1995. Hormonal induction of sex reversal in fish. Aquaculture, 138(1-4), pp.1-22.

Raicu, P., Taisescu, E. and Banarescu, P., 1981. Carassius carassius and C. auratus, a pair of diploid and tetraploid representative species (Pisces, Cyprinidae). Cytologia, 46(1-2), pp.233-240.

****More Reference can be provided on request.***

microbasia

Regd. Office: AJ 118, 9th Main Road, 1st Street, Anna Nagar, Chennai -600040.
Factory: Plot No. 4/328, Sivapatham Street, Mel Ayanambakkam, Chennai - 600 095 . INDIA. Customer Care: +91-9445211141 / customercare@microbasia.com

Designed to deliver maximum power

C R MOTORS

CR group is multi dimensional company in Coimbatore, with keen interests in infrastructure development and engineering industries.

CR Motors private limited is on a fast track growth and is emerging as one of the leader in the induction motor industry under the C R Motors banner.

CR Motors cater to the various segments of the industry with its wide product range from 0.25 HP to 20 HP motors best suited for industrial applications.

CR industry produces Three phase and Single phase induction motors that are elegant in style, rugged in performance with world class features.

CR Motors are specially designed to deliver maximum power and to last long for life

FEATURES - AERATOR MOTOR

Single phase and three phase applications

Product Range are 1 HP, 2 HP & 3HP in Three phase ,1HP & 2HP in Single phase Aerator motor

Our motor tested as per IS 325 & IS 12615 standards

90 L Frame size and continuous rating (S1)

'F' Class insulation

High efficiency results in saving of energy bills

Lower heat generation better heat dissipation

Extended motor life due to lower motor temperature

Totally enclosed fan cooled

Degree of protection-IP44

Double side shield high quality imported bearing for long life

Bearing : 6205 DE & NDE side

Shaft : Dynamically Balanced

CR Motors

C R Motors Pvt. Ltd.

(AN ISO 9001-2008 CERTIFIED COMPANY)

Off: No.79/2, II Floor, T.V. Samy Road East, R.S. Puram, Coimbatore 641 002
Factory: No. 1, Nanjappa Gounder Street, Therkku Thottam,
Linganur (P.O), P.N.Pudur, Coimbatore 641 041
Ph: 0422 2424509 Mobile: +91 98422 40009 / 98940 12581
E-Mail: crmotorspltdcbe@gmail.com / www.crmotors.co.in

Gassen Plus

Bon Ammonia and obnoxious Gasses

Shrimp / Fish performs all their body functions and growth in water. Good quality water and proper D.O. levels determines the success or failure. Good quality water, optimum D.O. level is of prime importance for health and growth of Shrimp / Fish.

Irregular water exchange, excess and leftout feed, dead algae, fecal matter, increases the organic load at the pond bottom. Accumulation of such waste absorbs available oxygen, creating anaerobic condition which leads to pollution of pond bottom. Polluted pond bottom and unhealthy environmental conditions triggers the release of toxic gasses like Ammonia, H_2S, Methane, etc, The toxicity of Ammonia, Hydrogen Sulphide, Methane attributed mainly due to unionized form. As the concentration in water increases, ammonia excretion by aquatic organism diminishes and the level of ammonia in blood and in other tissues increases. Ammonia increases oxygen consumption by tissues, damage gills and reduces the ability of blood to transport oxygen, and increases the disease susceptibility. To eliminate / overcome the above problems 'GASSEN PLUS' Yucca Schidigera, it contains Steroidal"Saponin" which help to reduce ammonia and other noxious gasses such as H_2S, Methane, etc., Microbial enzyme "Urease' Production inhibited by Saponin which leads to an increases D.O. and reduction of BODand COD levels.

Bacterial strains such as Bacillus Subtilis, Nitrobactor, Nitrasomonas, rapidly converts ammonia into Nitrates, Nitrites and finally non-toxic Nitrogen. Hydrogen Sulphide converts into Sulphates, Sulphites and finally non-toxic Sulphur, Methane into Non-toxic carbon. This conversion reduces the obnoxious gasses in the pond bottom. Reduction of this gasses improve the D.O. level in the water and bottom.

COMPOSITION:
YUCCA SCHIDIGERA
ALOEVERA
BACILLUS SUBTILIS
BACILLUS POLYMIXA
BACILLUS LICHENIFORMIS
NITRASOMONAS
NITROBACTOR
STABILIZERS

DOSAGE : 1 Kg per Acre or consult your Aqua Technician For Specific Usage & Dosage

PRESENTATION: 500 gms &1 kg

DOCTOR'S VET-PHARMA PVT. LTD

cG.M.P. Certified an ISO 9001:2008 Company
Survey No. 263/1, 264/1, P.R. Palem (V), Kovur (M),SPSR Nellore Dist.- 524137. A.P. INDIA.
Tel. 08622 - 210902. Email: dvpl33@yahoo.com, www.doctorlifesciences.com

ANTIBIOTIC FREE,
STEROIDAL FREE.