English Monthly from Hyderabad, India

RNI Regn. No. 52899/93

Aqua International

Estd. 1993

Health • Nutrition • Management • Processing

April 2022

Annual Subscription: Rs 800 Foreign $ 100

Inside...

Editorial:

SDC Solutions for optimizing your Aquaculture business performance

HEALTHY ANIMALS, HEALTHY FOOD, HEALTHY WORLD

Pervic-A™

Ultimate high level Disinfectant

SDC Biobac-N®

Water & Soil Probiotic

ODOCLEAR-A40®

Natural protection for super natural growth

For Details Contact:

SDC AGRO-VET (INDIA) PVT. LTD.,

#103 & 104, SDC HOUSE, D. NO. 12-13-97, Tara Tycoon,Tarnaka,
SECUNDERABAD-500 017. T.S. INDIA.
Ph: +91-40-27006075, Fax : +91-40-27006076.
email : info@sdcagrovet.com www.sdcagrovet.com

An ISO 9001 : 2015 Certified company

SDC Products Registered with CAA as Antibiotic-free product

Aqua International

English Monthly Magazine
(Established in May 1993)

Volume 29 Number 12 April 2022

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. 800
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/1068/2021-2023.

NRS PUBLICATIONS
www.aquainternational.in

CONTENTS

Editorial

News

Articles

ADVERTISERS' INDEX

Subscriptions for Aqua International, English monthly, should be sent to:
The Circulation Department, Poultry Fortune, BG-4, Venkataramana Apartments, 11-4-634, A.C.Guards, Near Income Tax Towers, Hyderabad - 500 004, India. Email: info@aquainternational.in

Seaweed farming project launched in Tamil Nadu; Cage Fish Farming Technology wins Recognition

Precision fish farming will be the better solution to the growing water crisis in the country as this can exactly utilize the natural resources. Industrial fish farming is a significant source of protein for human consumption

Dear Readers,

The April 2022 issue of ***Aqua International*** is in your hands. In the news section you may find news about ...

CLFMA in association with AICOSCA organized a webinar to discuss in detail the importance of cotton seed meal, which is a rich source of protein for milch cattle, poultry and aquaculture. AICOSCA is the premier body of the Cotton Seed processing industry in the Country. CLFMA Chairman Mr Neeraj Kumar Srivastava said that CLFMA's endeavour has always been to support the members and industry associates by bringing efficiency and improving performance at farm leval thus contributing to sustainable livestock farming. Welcoming the speakers Dr Devender Hooda said that India is producing about 25% of the world's cotton seed and it is a key ingredient for animal protein.

United States-based The Fishin' Company announced an investment of Rs 1,000 crore in Telangana's Rajanna Sircilla district, a note from the office of Industries, IT, and Commerce Minister K.T. Rama Rao said. The company is the largest importer of Tilapia variety of fish in the world and that of frozen food into the US. A delegation led by minister Rao recently had a week-long visit to the United States to attract global investments to the state. The delegation also met corporate companies in Los Angeles, San Diego, San Jose, Boston and New York.

A three-day Non-Residential Training and Capacity Building Programme under Pradhan Mantri Matsya Sampada Yojana (PMMSY) on 'Advanced Aquaculture Technologies for Doubling Farmers Income' commenced recently at Chandel District Fishery Office Multipurpose hall.

Regal Springs, the world's largest vertically integrated tilapia producer and aquatech veteran aqua Manager are joining forces to accelerate the development of digital automation to enhance the predictability and productivity of eco-friendly, sustainable fish farming. The two companies have confirmed their long-term strategic collaboration to achieve intelligent and efficient automation in Regal Springs' tilapia farming operations, which take place in net pens in Indonesia, Honduras and Mexico.

A new seaweed farming project has been launched in a bid to provide Tamil Nadu's struggling fishing communities with alternative, sustainable livelihoods. Launched by non-profit Grow-Trees, it aims to improve the lives of fishers, at a time when global seaweed production is set to double in value, to reach $26 billion by 2025. José Ramón Gutiérrez, chairman of Multiexport Foods SA, a pioneer and leader of salmon farming in Chile, announced that Cargill, the global food and agriculture company, has agreed to purchase 24.5 percent of the shares of Multi X, the subsidiary of Multi export Foods SA.

The efforts of the ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi to popularise its cage fish farming technology has won recognition with a cage fish farmer associated with the Institute bagging the prestigious 'Thozhil Shreshta' award instituted by the Kerala Government. P.M. Dinil Prasad, from Kerala's Kannur district, who won the award for his excellent performance in the fisheries sector, adopted ICAR-CMFRI's technology and has been undertaking the cage fish farming since 2018. He received the award from Kerala Labour Minister V. Sivankutty on 25 March 2022. Mr Prasad was bestowed with the award that carried a purse of Rs 1 lakh and a certificate for his tremendous achievement in cage fish farming with good harvest of pearl spot within a short span of three and half years. This was made possible with

Contd on next page

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

regular training and guidance imparted by the Mariculture Division of CMFRI headed by Dr Imelda Joseph.

In the Articles section – *Precision Fish Farming (PFF): A revolutionary concept in aquaculture for doubling farmers' income,* *authored by* Hino Fernando E., ICAR- Krishi Vigyan Kendra, Nagapattinam, Rajeshwaran M., Central Institute of Fisheries Education, Mumbai and Green Sea K., Fisheries College and Research Institute, Thoothukudi discussed that Precision fish farming will be the better solution to the growing water crisis in the country as this can exactly utilize the natural resources. Industrial fish farming is a significant source of protein for human consumption. Due to the growing population, people can meet the rising demand for seafood.

The factors such as increasing scarcity of feed raw materials, limited availability of farming locations, increasing focus and needs concerning eco-friendliness, and space use conflict with other industries (e.g., fisheries, oil and gas, tourism, shipping), this challenge is not possible to counter by simply upscaling production volumes and applying present production regimes. The future scope for fish farming should be more advanced and precise, and the industry needs to shift from experience-driven to knowledge-driven approaches to optimize production better. The present trends within the farms' sector are producing more significant volumes and output per worker increasing on each fish farm, highlighting the need to monitor and control the production process. The aquatic environment has pushed the industry to adopt new technologies to observe the fish. The future of aquaculture farms depends mainly on the ICT innovations IoT (Internet of Things), AI (Artificial Intelligence), etc., prevailing to monitor the systems by reducing human dependency.

Another article titled ***Fish Protein Powder: A High Value Product as Nutritional Supplement*** authored by Dr Elavarasan K., Scientist; Dr C.O. Mohan, Senior Scientist and Dr C.N. Ravishankar, Director, ICAR-Central Institute of Fisheries Technology, Kochi, Kerala said that Fish protein powder (FPP) is a dried and stable fish product, brown to off-white in colour, prepared from prime quality edible fish muscle. Protein in FPP is in highly concentrated form with most of the essential amino acids, and is highly digestible. Many varieties of Indian food fishes are suitable for the production of FPP. FPP finds its application in food as functional food ingredients, beverages, as sports and dietary supplements and in cosmetics, personal care, pharmaceutical industry. ICAR-CIFT has the know-how to produce FPP in industrial scale.

Article titled ***Anaesthesia Used in Aquaculture*** authored by Devati; Rohitash Yadav, Tameshwar and Niranjan, Sarang Fisheries Polytechnic, Dau Shri Chandrakar Kamdhenu Vishwavidyalaya, Durg, Chhattisgarh discussed that Fish has become a popular aquatic animal and experimental model and is farming and harvesting for food. As a concern, surgical and invasive procedures are widespread in this animal group, and this review will focus on the fish anesthetic. Fish are frequently immersed method used in a variety of anaesthetic drugs. The number of correct doses can lead to effective anaesthetic for acute operations and loss of consciousness during surgical procedures. Dose and anaesthetic agents differ amongst fish species and are further complicated by physiological factors (e.g., body weight, physiological stress) and environmental factors (e.g., water temperature).Combination anaesthesia, which involves the use of two anaesthetic drugs, has been shown to be effective in fish, but it is not widely utilized due to a lack of experimental confirmation. In the field of fish medicine, analgesia is a largely unexplored topic. Recent investigate has observed into the effectiveness of opioids, non-steroidal anti-inflammatory medicines and local anaesthetics in reducing pain and discomfort.

Another article titled ***Organic Feed for Production of Organic Fish*** authored by Chetan Kumar Garg; Manas Kumar Maiti; Manish Jayant and Sikendra Kumar, Department of Fish Nutrition and Feed Technology, Central Institute of Fisheries Education, Mumbai, said that in recent years more attention is being paid to organic fish production. For organic aquaculture, feed should be prepared following organic production standards. Feed ingredients and additives used in organic feed must be derived from natural sources and produced without the use of chemical substances.

Article titled ***The plastic Used in Aquaculture*** authored by Jham Lal and Shivbhajan Chandravanshi, College of Fisheries, Lembucherra, Central Agricultural University, Imphal, Tameshwar, College of Fisheries, Mangalore, Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar and Shatrupa, College of Fisheries, Dholi, Dr. Rajendra Prasad Central Agricultural University, Samastipur informed that at present, the use of plastic is increasing day by day. Why plastic is very durable, strong and lasts for a longer period. Plastic is used in aquaculture sector for different purposes. Plastics used as transportation facilities as well as beneficial in another area.

Plastics / polythene used in rearing facilitate, poly houses, pipes, water filter, small feeding boat, automated feeder and hand nets.The rapid expansion of the application of plastics has been experienced in all walks of life. It has been observed that the use of plastics is directly and positively related to the development of the economy. It has many applications in agriculture so also in fisheries and aquaculture. The traditional system followed "trapping and holding" of fish seeds and raising them to table size, and thus this marked the beginning of aquaculture in India.

Another article titled ***Dietary Nucleotides - Functional Feed Additive in Aquafeed*** authored by Satheesh M; Gour Hari Pailan; Parimal Sardar; Mritunjoy Paul and Prasanta Jana, ICAR-Central Institute of Fisheries Education, Mumbai, Subashini M, Dr MGR Fisheries college and Research Institute, Ponneri, TNJFU, Tamil Nadu and Akhilesh Kumar Singh, College of Fisheries Science, Gumla, Birsa Agricultural University, Jharkhand informed that Dietary nucleotides are important emerging functional feed additives having major role in all the biological processes in fish and crustaceans. Fish soluble, animal meat soluble, bacterial and yeast derivatives are considered as primary sources of dietary nucleotides. Fortification with dietary nucleotides in aqua feeds enhances growth, maturation, immunity, stress tolerance and gut health of aquatic animals thus increases the profit of fish farmers in a cost effective manner.

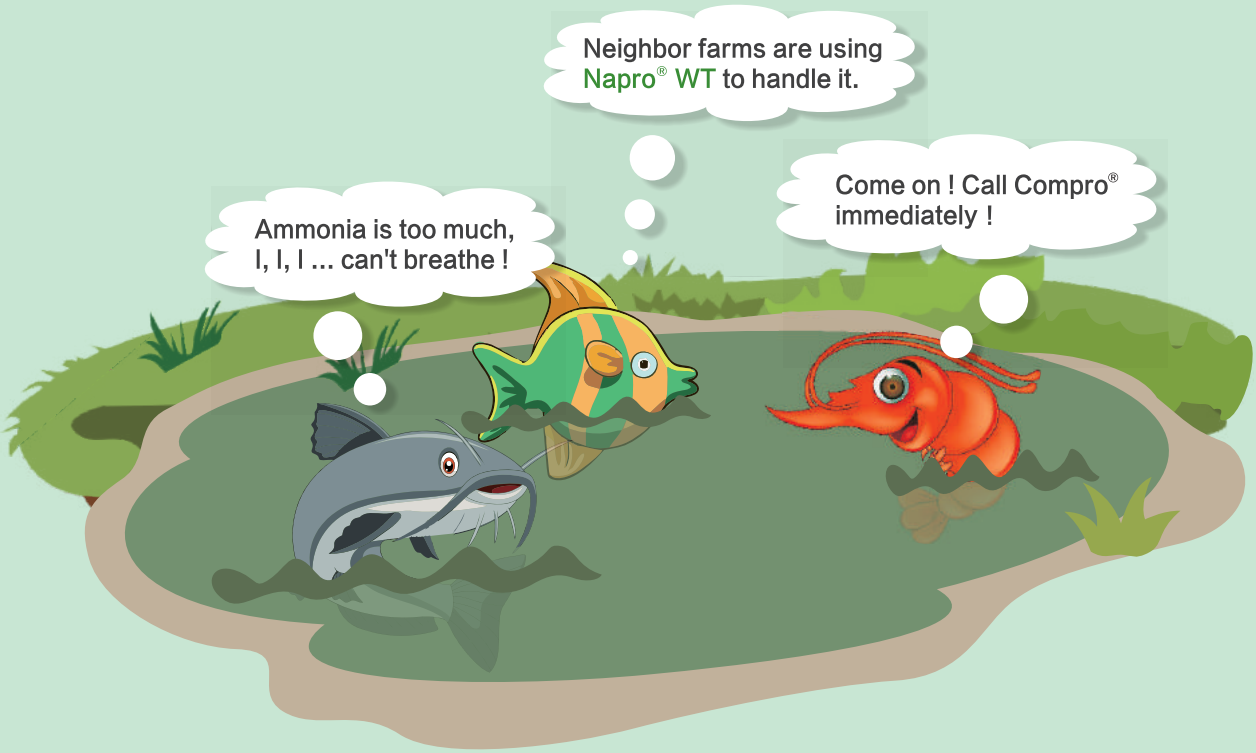
Readers are invited to send their views and comments on the news, special feature and articles published in the magazine which would be published under "Readers Column". Time to time, we shall try to update you on various aspects of Aquaculture sector. Keep reading the magazine Aqua International regularly and update yourself. Wish you all fruitful results in your efforts.

M.A.Nazeer
Editor & Publisher
Aqua International

Compro®

Welcome Distributor to Join us

Recruitment of Sales Representative



Napro® WT (Probiotics)

- Improve water quality & clarity
- Remove odors like ammonia & nitrite & nitrate
- Boost immune system of aquatic animals
- Strengthen resistance against diseases
- Enhance digestion & absorption of nutrients in aqua feeds

Compro (China) Limited
China Bio-Medicine Park, Beijing 102600 China
+86 10 5952 8253
info@compro.cn
www.compro.cn

WhatsApp WeChat

CLFMA Webinar held in association with AICOSCA on 'Decorticated Cottonseed Meal (A Rich Source of Protein) for Milch Cattle, Poultry and Aquaculture'

Mumbai: The webinar was moderated by Dr Devender Hooda. On behalf of CLFMA and AICOSCA, Dr Hooda welcomed all the speakers and the participants to the webinar.

He said that, India is producing about 25% of the worlds cotton seed and it is a key ingredient for animal protein. The purpose of this webinar was to discuss in detail the importance of cottonseed meal, which is a rich source of protein for milch cattle, poultry and aqua.

CLFMA Chairman Mr Neeraj Kumar Srivastava delivered the Opening Remarks. He thanked all the participants, industry colleagues, CLFMA Members and eminent speakers for joining the webinar, which was jointly organized by CLFMA and AICOSCA. AICOSCA is the premier body of the Cotton Seed processing industry in the Country. CLFMA's endeavour has always been to support the members and industry associates by bringing efficiency and improving performance at farm leval thus contributing to sustainable livestock farming.

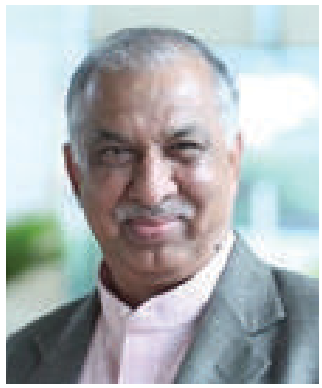
Mr Srivastava highlighted that, our industry is facing severe protein challenges both in terms of quality and availability at right prices. Soya prices are on the higher trend and hence creating a huge impact on the cost of production of animal feeds thus incurring huge losses to the customers. He said that it is important to look into the possibilities of the using Cotton Seed Meal as feed for milch cattle, poultry and aqua. He thanked all the eminent speakers and the participants for joining the seminar.

AICOSCA Chairman Shri. Sandeep Bajoria delivered the Opening Remarks and thanked all the participants for joining the Webinar. He also thanked the Speakers, all CLFMA eminent office bearers, CLFMA Members and participants. He explained in detail cotton seed meal, its yield, its importance in feed as alternate source of protein.

He also talked about its production status of this year and scope of increasing availability of cotton seed meal. He insisted to use cotton seed meal as alternate raw material for reducing feeding cost and increasing efficiency. He said that, AICOSCA would answer all the queries related to usage of cotton seed meal as animal feed.

The First Speaker of the Webinar was Shri. R. D. Bohra, Hon. Treasurer, AICOSCA, who has been associated with the cotton seed industry for the last 50 years. He gave very good insights about **"Use of Cotton Seed Meal as a Protein Rich and Economical Feed Ingredient for Milch Cattle, Aqua and Poultry"**. He said cotton seed industry has survived due to its' large usage as fish feed.

Second Speaker of the Webinar was Dr S. V. Rama Rao, Principal Scientist (Nutrition), Directorate of Poultry Research, ICAR Directorate of Poultry Research, Hyderabad. He is a knowledgeable scientist in Poultry Science. Dr S. V. Rama Rao delivered presentation on **"Cottonseed Meal in Poultry Diet – A Potential Alternate to Soybean Meal"**, which was appreciated by all. He discussed about - What is protein? what is the ideal protein source that is available? what is the practical feasibility and limitations of using cotton seed meal in poultry? and how best we can make use of Cotton Seed Meal as a protein source in Poultry Diet. Some of the nutritional limitations of Cotton Seed Meal was also covered in his presentation. Overall it was a very informative session which was appreciated by all.



Third Speaker of the Webinar was Dr R. H. Balasubramanya, Retd. Principal Scientist, Central Institute for Research on Cotton Technology (CIRCOT-ICAR). He presented on the topic, 'Value Addition to

FAMSUN

Integrated Solution Provider

Vacuum coater

Exceptional design & Flexible operation

Vacuum coater for the application of oil or fat, pigments, flavors, functional improver, vitamins, etc. onto pellets after drying and/or cooling. Aquafeed and pet food in particular.

FAMSUN Co., Ltd.

Add: No.1 Huasheng Road, Yangzhou, Jiangsu, China 225127
T:+86-514-87848880
E-mail:mypublic@famsungroup.com
www.famsungroup.com

India Office

Add: No 401 , Dega Towers , Raj Bhavan Road , Somajiguda , Hyderebad , Telangana - 500082
T: +62-21-30027458; 30027459
Contact: Arun Kumar K
E-mail : arunkumar@famsungroup.com
Mob: +91 9901916554

Contact: Shelby
E-mail: lxb@famsungroup.com
Mob: +91 9100436652

Cottonseed By-Products" with emphasis on "Cottonseed Meal". He explained in detail tray culture, fermentation, separate room for storage, sterilization process, feed mixture method to be adopted by small players, etc.

Fourth and the last speaker of the Webinar was Dr D. Srinivas Kumar, Professor and Head, Department of Animal Nutrition, College of Veterinary Science, Sri Venkateswara Veterinary University, Garividi, Vizianagaram (Dist) and he delivered a presentation on **"The Potential of Cottonseed Meal as Cattle Feed Ingredient"** in detail. He presented that, Cotton is the fourth largest oil crop in the world after soybean, rapeseed and oil palm and India is the largest cotton

producer in the world followed by China and USA. He presented the state-wise area production, productivity of cotton seed, major trading centre of cotton seed in India and

explained in detail cotton seed meal, production status in India, advantages of cotton seed meal, it's nutritive value in detail, nutrient composition and its by products from the cotton seed crushing, proximate principle and gossypol of Cotton Seed Meal(CSM) in comparison with Soybean Meal(SBM) , mineral profile of CSM in comparison with SBM, Amino Acid Profile of CSM in comparison with SBM, Proximate principles and gossypol of cotton seed meal in comparison with cotton seed cake and he insisted that, CSM is a cheaper source of protein. He also discussed the comparisons of Cotton seed meal v/s other cotton seed by products, etc.

After completion of the

presentation by Dr D. Srinivas Kumar, Forum was opened for the Q & A Session, questions asked by the participants were satisfactorily answered by the Speakers very well.

Fisheries Protection Committee formed

Kochi: Kerala Fisheries Protection Committeehas been constituted to formulate organized programs to address the issues facing the workers in the fisheries sector, including new legislation. The new conservation committee was formed by representatives of various organizations working in the fisheries sector. The committee vowed to work for the welfare of the fisheries sector beyond party politics.

A common minimum program was formulated for the protection of the fisheries sector. It called for the withdrawal of the KMFR Act Amendment Act of 2018, the Fisheries Procurement, Marketing and Quality Management Act of 2021, the Inland Fisheries and Aquaculture Act of 2021 and making new laws respecting the views of the fisheries trade unions and stakeholders. The committee has nominated former MLA V Dinakaran as chairman and Sherry Thomas as convenor. It sought the strengthening of the cooperative movement in the sector and an increase in full benefits under the fishermen's welfare fund.

The fisheries sector should be exempted from the Coastal Regulation Act and the tourism projects should be implemented with participation of the fishermen community, it said.

Uni-President

AQUACULTURE PROBIOTICS EXPERT

Nu Ri

NET 200 g **BSL**

Probiotics for water treatment

1. WATER QUALITY CONDITIONING

Best choice of *Bacillus* spp. that rapidly decompose uneaten feed, feces and other organic substances in pond water, keeps water quality optimal

2. HIGH ACTIVITY OF SPORES

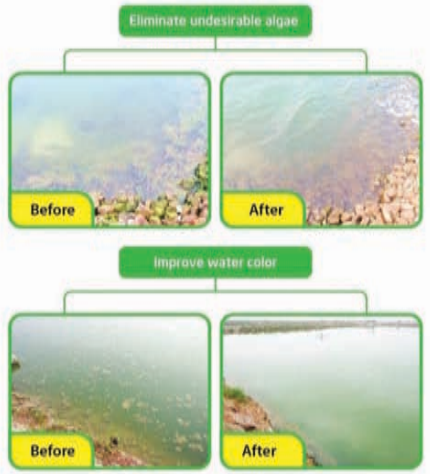
No cultivation is needed. Easily adapt to the changes of surroundings and grow fast in freshwater or seawater culture farming, even under low oxygen environment

3. DECREASE AMMONIA CONTENT

Prevent the accumulation of toxic substances such as NH_3, NO_2, etc.

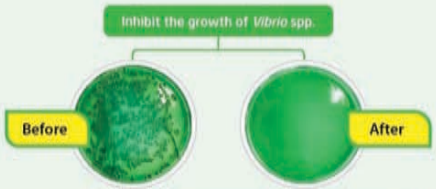
4. IMPROVE WATER COLOR

Improve water color regulate the algae and bacteria balance in water, turning your pond from green to clear



5. ESTABLISH BALANCED POND BACTERIA SYSTEM

Compete nutrition with vibrio and inhibit them to grow. Provide nutrition for probiotics in the pond, to establish a well-balanced farming system.



6. INCREASE AQUACULTURE PRODUCTION

Good quality of water prevents fish/prawn infections, making high profit of production

* COMPOSITION:

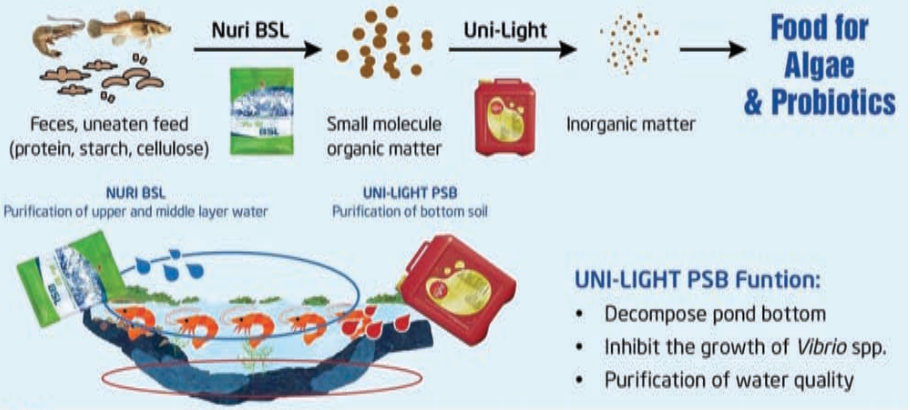
Bacillus spp. > 1x 10^{11} cfu/kg	15%
(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)	
Carrier (rice bran, corn gluten)	75%
Moisture	10%

* STORAGE:

Keep at dry, well-ventilated condition. Avoid direct sunlight exposure and use as soon as possible once opened for best quality.

* DIRECTION OF USE:

No cultivation is needed. Apply Nuri BSL with water-soluble bag near to the working water wheel or pour into the pond evenly. Recommend apply Uni-Light PSB together with Nuri-BSL on sunny day to achieve a clear pond more efficiently.



UNI-LIGHT PSB Funtion:

- Decompose pond bottom
- Inhibit the growth of *Vibrio* spp.
- Purification of water quality

BSL Dosage:

/10,000 m³ Quantity	10 - 30 pl/m² tiger prawn or < 80 pl/m² Vannamei	For >30 pl/m² tiger prawn or > 80 pl/m² Vannamei	For > 150 pl/m² Vannamei
7 days before stocking	800 g - 1,000 g	1,200 - 1,500 g	1,200 - 1,500 g
Day of stocking	300 g - 500 g	800 g - 1,000 g	800 g - 1,000 g
Every 7 - 10 days after stocking	300 g - 500 g	800 g - 1,000 g	3 - 5 days / use 1,000g - 2,000g

****Dosages can be adjusted according to the water conditions and practices.*

UNI-PRESIDENT VIETNAM CO., LTD

No. 16-18-20, DT 743 Road, Song Than II Ind Zone, Di An Ward, Di An City, Binh Duong Province, Vietnam.

aquafeed@upvn.com.vn

www.uni-president.com.vn

US Aquaculture firm to invest Rs 1,000 crore in Telangana

A delegation led by Telangana Minister K.T. Rama Rao had a week-long visit to the United States to attract global investments to the Telangana state.

United States-based The Fishin' Company Thursday announced an investment of Rs 1,000 crore in Telangana's Rajanna Sircilla district, a note from the office of Industries, IT, and Commerce Minister KT Rama Rao said. The company is the largest importer of Tilapia variety of fish in the world and that of frozen food into the US.

A delegation led by minister Rao is currently on a week-long visit to the United States to attract global investments to the state. The delegation is scheduled to meet corporate companies in Los Angeles, San Diego, San Jose, Boston and New York.

The company will invest in a fully integrated freshwater fish culture ecosystem, including hatcheries, feed manufacturing, cage culture, processing and exports, said officials. This is expected to generate direct employment for 3,000 people and another 2,000 will benefit by way of indirect employment, added officials.

The latest announcement comes after the minister and his team met with CEO Manish Kumar and the team of The Fishin' Company in San Jose. Company chairman and CEO Manish Kumar stated that the project will be the largest freshwater aquaculture project in the world.

"The project will be located at the Mid Manair reservoir in Rajanna Sircilla district and will produce 85,000 metric tonnes of Tilapia fish per year using cage culture methodology. Minister KTR appealed to Fishin' to give preference to the local fishermen community and those displaced due to the Mid Manair project while hiring," it said.

The company was assured of all cooperation from the state government in the meeting in which principal secretary (industries) Jayesh Ranjan and director, (food processing) Akhil Gawar were present.

In other announcements, American multinational corporation Qualcomm will be investing Rs 3,904.55 crore to expand their Hyderabad operations. They plan to inaugurate their second-largest campus outside the US in October 2022. The investment would be made over five years and lead to the creation of 8.700 software jobs, said officials.

According to the minister's office, American global sports equipment manufacturing company Callaway Golf has agreed to set up DigiTech Center in Hyderabad promising initial employment of 300 software professionals.

Arizona-based global medical devices manufacturer Confluent Medical has announced the setting up of a pilot manufacturing facility in Hyderabad. Chemveda Life Sciences announced an investment of Rs 150 crore to add a state-of-the-art research and development centre in Hyderabad creating employment for 500 scientists, the note added.

Training on Aquaculture Commences

Imphal, March 29 2022: A three-day Non-Residential Training and Capacity Building Programme under Pradhan Mantri Matsya Sampada Yojana (PMMSY) on 'Advanced Aquaculture Technologies for Doubling Farmers Income' commenced from Monday at Chandel District Fishery Office Multipurpose hall, Chandel DC Complex.

According to a release, the inaugural function was attended by Chandel DC Mayanglambam Rajkumar, district fishery officer K Jenishing Tarao and Directorate of Fisheries Imphal FI Lamdinlu Gangmei as chief guest, president and special guest respectively.

A training manual prepared by the DFO was released by the dignitaries prior to the inaugural speech by the chief guest who said that as it is not possible for the government to give employment to all the citizens and for this reason, it is very important for all the line departments for imparting skill development.

He also encouraged the trainees to take the profession of fishery and fish culture as a serious entrepreneurship in order to make an alternative livelihood and enhance the production of fish in the state.

Fisheries, Aquaculture department established

The government has expanded the ministry of Agriculture to include a standalone department of Fisheries and Aquaculture, to deal with fish production in order to meet a growing national demand.

This was revealed by Agriculture deputy minister, Douglas Karoro yesterday at a FISH4ACP Zimbabwe validation workshop on farmed tilapia value chain in the capital.

Karoro said the sector was struggling to meet the country's fish demand despite being endowed with various water bodies.

"The key issue is the fragmented approach in addressing these challenges. As a major step towards addressing this key challenge; we now have a stand-alone department of Fisheries and Aquaculture, housed in the ministry of Lands.

"The department is mandated to spearhead fisheries and aquaculture production in the country, and tasked to coordinate amongst other issues the development of a dedicated, stand-alone fisheries and aquaculture policy framework aligned to international best practices," Karoro said.

He said Zimbabwe's fish quality was the lowest in the region and emphasised the need to urgently put in place measures to address the situation.

"The government notes with concern the low levels of fish consumption in the country, due to low production and productivity within the sector, at around two kgs per capita compared to the Sadc region's average of six kgs.

"This is despite the country having over 10,000 dams which can be utilised for fish production through both capture fisheries and aquaculture.

"However, sustainable development of the aquaculture sub-sector is of paramount importance as the country's major dams are recording decline in catches due to overexploitation and climate change induced challenges," Karoro further said.

Food and Agriculture Organisation (FAO) sub-regional coordinator for Southern Africa and representative to Zimbabwe, Patrice Talla said FAO has targeted 30-40 percent growth of the global aquaculture by 2030.

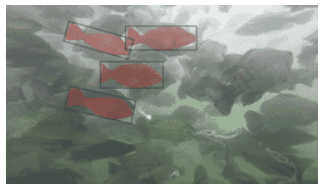
Talla however, said high cost of feed and supply remained a major concern for artisanal farmers.

"Feed accounts for 60-70 percent of the total cost of production. Any intervention in this area will significantly improve the sector's viability. The programme explored possible alternative and affordable protein sources for small livestock.

"The FISH4ACP will follow up on the findings, building on that experience, and adapt some of the findings to the Tilapia value chain with a view of bringing down the cost of feed".

Regal Springs steps up Tilapia farming technology

Regal Springs, the world's largest vertically integrated tilapia producer, and aquatech veteran aquaManager, are joining forces to accelerate the development of digital automation to enhance the predictability and productivity of eco-friendly, sustainable fish farming.



AquaManager's cameras capture the tilapias as they swim in their pens, recording key data, enabling waste reduction and improving sustainability

The two companies have confirmed this week their long-term strategic collaboration this week to achieve intelligent and efficient automation in Regal Springs' tilapia farming operations, which take place in net pens in Indonesia, Honduras and Mexico.

Based on artificial intelligence, machine-learning and advanced algorithms, the projects encompass data management and modelling, business intelligence, real-time data collection, and the latest smart devices and equipment – such as data-reading camera tracking systems – and have been successfully applied on more established species in marine environments.

Regal Springs aims to be the first company to introduce these advanced technologies into tilapia farming in inland lakes.

"This collaboration aligns perfectly with Regal Springs' strategy for environmental, social and economic sustainability (ESG), and is a building-block in our passionate commitment to the all-important blue foods movement. As we create a sustainable fish farming industry for the future, we need to adopt cutting-edge technology, so that we can farm fish more efficiently and sustainably, but at the same time continue to safeguard our waters, now and for the future. We are excited to collaborate with such an enterprising and innovative partner as aquaManager, and as blue food movement pioneers, to create the fish farms of tomorrow," said Alois Hofbauer, CEO of Regal Springs, in a press release.

"We have been working with Regal Springs for many years, and we enjoy a long-lasting partnership with them. We regard Regal Springs as a visionary company, always keen to innovate in this industry that thrives on improving sustainability efforts. We look forward to many happy years working together, to turn into reality the dream of automated fish farming with a high degree of predictability," said Kostas Seferis, founder of aquaManager.

AQUACULTURE WATER TREATMENT

A sustainable solution in sea farm hatcheries for productive growth and protection against Waterborne infection and disease

V-200
No Lines Valve

Pacific Ozone™ MG Series Ozone Generators

Wafer™ UV Generator

For more information on disinfection performance & validation, please visit: https://www.evoqua.com/en-GB/articles/disinfection-performance-and-validation/

UV	VAF™ Filter	Ozone
• *NVI approved UV means Supreme Disinfection performance • Improves Water Quality and subsequently reduces water consumption • Chemical free disinfection	• Improves fish health • Reduces organic load • VAF™ System provides cost-effective, efficient and space saving solutions • Reduces water waste and limit maintenance	• Strong oxidizer • Reduces microbes by 5-6 logs within just 2-3 minutes • Reduces off-flavors of fish and shellfish

*NVI - Norwegian Veterinary Approved, required for use in aquaculture applications.
*NSF approved .

Application	Recirculating Aquaculture Systems	Fish Hatcheries	Well Boats	Shellfish Depuration
Medium Pressure Wafer UV System	•	•	•	
Low Pressure VX UV System	•	•		
MG Series Ozone Generators	•	•		
PC Series Portable Ozone Cart	•	•	•	
Monitoring & Control	•	•	•	•
VAF V-Series Screen Filters	•	•	•	

Evoqua Water Technologies
For any product Enquiries, please contact us at:
Sales Mob. No. +91-8925141666
E-Mail Id- sales.in@evoqua.com,
www.evoqua.com

Transforming Water. Enriching Life.®

EVOQUA WATER TECHNOLOGIES

Evoqua UV disinfection generator systems undergo third-party validation testing in accordance with the UVDGM (USEPA, 2006). Validated products are tested to confirm a minimum inactivation equivalent of 3 log (99.9%) for microorganisms in accordance with NSF/ANSI 50 and the UVDGM. Performance is not claimed nor implied for any product not yet validated; unvalidated products use single point summation calculations to provide delivered dose recommendations. Performance limitations depend on feed conditions, overall installed system design, and operation and maintenance processes; please refer to Operations Manuals. For more information: Contactus@evoqua.com

Ozone: Evoqua Ozone Generation systems undergo factory acceptance testing to ensure they are capable of producing the desired ozone concentration, based on operational parameters outline in the Operating Manual. System performance of microorganism inactivation depends on the CT value, pH, and temperature of water. Performance limitations depend on feed conditions, overall installed system design, and operation and maintenance processes; please refer to Operations Manuals. For more information: Contactus@evoqua.com

'The world's first real-time AI-based analytics solution for shrimp farming' launched by Umitron

Called Umitron Eagle, the Singaporean firm says that the system "uses advanced AI detection to track multiple real-time biological conditions and other factors in highly turbid and intensive production environments".

In recent decades, the global industry has been primarily centred around the Pacific white shrimp (Litopenaeus vannamei). However, despite seeing exceptional growth in the sector, Umitron notes that the industry is still plagued by many issues – including disease outbreaks, general health management and poor environmental management protocols that can lead to mass mortality events and disrupt the supply chain.

According to Umitron, the poor uptake and adoption of digital technology by shrimp producers has also been one of the limiting factors stunting the sector's growth, both economically and sustainably.

While solutions exist to remotely control feeding (via timer-based automatic feeders) and monitor environmental parameters using sensors, they are currently unable to analyse the real-time conditions of the shrimp. This is further exacerbated by the fact that most farming environments have poor visibility (ie high turbidity) and that digital transformations have been slower and more limited for shrimp than their fish counterparts.

The turbidity of the water in many shrimp farms means that low tech sampling methods are still the industry norm for assessing health levels and growth rates

Umitron says it has spent a couple of years developing a solution to assess shrimp production conditions in real-time using customised AI algorithms. These include, but are not limited to, real-time appetite analysis, health and growth conditions, and biomass. While important, these metrics are not always actively charted and monitored, due to a lack of available resources and solutions on the market, be it manpower or automation-wise.

"With Umitron Eagle, producers can now optimise their feeding protocols easily and automatically using real-time analytics. In addition to the current partnership with Charoen Pokphand Foods (CPF), Umitron would also like to extend this solution to other shrimp farmers to improve the operations at their production sites," the company notes.

According to Umitron, shrimp producers using the product can expect to achieve:

- Improvements in FCR, growth and harvest amounts for each crop.
- Improved biosecurity measures and work protocols.
- A reduction in feed waste, which may contribute to undesirable environmental conditions such as poor water quality and highly-turbid conditions and require frequent water changes.
- Better long-term farming management protocols and optimised operations using the accumulated production data.

"In this way, Umitron will help strengthen the resilience and growth of the shrimp production landscape, and achieve a more sustainable production environment and footprint in super-intensive farming conditions. The company is keen on connecting with producers who operate intensive and advanced shrimp farms and are interested in implementing digitisation technologies to take their production to a higher level," they add.

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.

Seaweed farming initiative launched in India

A new seaweed farming project has been launched in a bid to provide Tamil Nadu's struggling fishing communities with alternative, sustainable livelihoods.

Launched by non-profit Grow-Trees, it aims to improve the lives of fishers, at a time when global seaweed production is set to double in value, to reach $26 billion by 2025.

"We are providing equipment and expertise to fishing communities via a seaweed cultivation project in Munaikkadu, Mandapam Camp, Ramnad District, Tamil Nadu. This is being done to increase the income and self-sufficiency of the coastal community and subsequently, these women can train more marginalised communities to augment their earnings. We will of course fund the training and equipment and will leverage this experience to expand this module to other marginalised communities along the coast of India," said Bikrant Tiwary, CEO of Grow-Trees, in a press release.

One of the women who is benefiting from the Grow-Trees seaweed farming initiative

Over 750 people are set to benefit from the project, according to Grow-Trees.

"Only 15 families right now own seaweed cultivation equipment while the others earn a meagre livelihood. Empowering this community is the long-term goal of Grow-Trees.com," the organisation notes.

Hanifa Begum from Munaikkadu is one such beneficiary, who said: "My husband is a fisherman but his income is not sufficient to sustain the family. Grow-Trees.com gave us two rafts and also taught us how to cultivate seaweed in an efficient way. We are hopeful that a good harvest will help us lead a better life and also educate our children. I thank Grow-Trees.com and the Annai Theresa Trust."

Muthulakshmi is another resident of Munaikkadu who has now started seaweed cultivation.

"My husband is an auto-driver and we were struggling to make two ends meet. Now two rafts from Grow-Trees.com have really helped us augment our income and educate our children comfortably," she said.

"These livelihood issues can be solved very simply. A single bamboo raft priced at Rs 2000 can be used to plant over 70 kg of seaweed seedlings and after 45 days, almost 230 kg of seaweed can be harvested and sold for Rs.65 to 70 per kg. Hence if a family has 40 to 45 such bamboo rafts, it can earn over Rs.800 per day and become self-sufficient. We call this scheme, the 'Blue Revolution' as it can help fishing communities to earn even when the fishing output becomes sporadic and unreliable. It can also help communities in need to supply much-in-demand raw material to industries manufacturing agar, agarose, carrageenan and alginates," said Tiwary.

Aquaconnect raises $8 million funding

The funds will also be used to enhance Aquaconnect's post-harvest market linkage solutions, allowing farmers to reach out to a broader range of potential buyers.

Commenting on the fund raise, Rajamanohar Somasundaram, founder and CEO of Aquaconnect, said in a press release: "Our aim is to make the aquaculture value chain more efficient and transparent while increasing value realisation through tech intervention.

One of the women who is benefiting from the Grow-Trees seaweed farming initiative

The fresh round of capital will help us achieve this goal by paving the way for expansion of our AquaPartners network in India and help the aquaculture farmers reach more buyers by strengthening our post-harvest market linkage solutions."

Nilesh Kothari, managing partner at Trifecta Capital, said: "Aquaconnect is a pioneer in the aquaculture sector and is digitising the entire value chain, connecting farmers with input manufacturers and institutional buyers. In the process, they are facilitating aquaculture farmers to realise better prices for their produce, and providing access to high quality inputs at fair prices. India is among the top three seafood producing countries [in the world] and yet the sector is largely unorganised. Trifecta Capital is proud to partner with Aquaconnect which -with its wide aqua-farmers network, strong tech-stack and experienced team - will be able to solve the multiple challenges that the Indian aquaculture sector faces today."

Aquaconnect was founded in 2017 and the recent funding follows on from a $4 million raise the company achieved in 2021.

Cargill secures 24.5 percent of shares in Chilean Salmon company

A new seaweed farming project has been launched in a bid to provide Tamil Nadu's struggling fishing communities with alternative, sustainable livelihoods.

This partnership is also an important signal of our companies' long-term commitment and confidence in Chile and the future of the salmon industry in the country

José Ramón Gutiérrez, chairman of Multiexport Foods SA, a pioneer and leader of salmon farming in Chile, announced that Cargill, the global food and agriculture company, has agreed to purchase 24.5 percent of the shares of Multi X, the subsidiary of Multiexport Foods SA.

In turn, Mitsui, a shareholder of Multi X since 2015, will increase its shareholding by 1.13 percent, to 24.5 percent. Multiexport Foods SA maintains control of Multi X with 51 percent of the total shares. The transaction is subject to certain regulatory approvals and the fulfilment of conditions agreed by the parties.

"Adding Cargill as a new partner of Multi X will be a strategic and decisive step in the next stage of development of the company and its purpose to win over the world's consumers with high-quality, value-added, sustainable products sold under our brands 'Multi X', 'Arka' and 'Latitude 45'," said Gutiérrez.

Global consumption of salmon is expected to continue growing, driven by an increase in population and heightened consumer awareness of its health and sustainability benefits. Responsible aquaculture will play an important role in meeting that increasing demand for salmon while helping address the critical challenge of climate change. Cargill shares Multi X's commitment to provide the world with delicious, healthy products that are good for consumers and the planet.

This partnership is also an important signal of our companies' long-term commitment and confidence in Chile and the future of the salmon industry in the country.

José Ramón Gutiérrez, chairman of Multiexport Foods

"We welcome Cargill, with their 156-year track record of growth and

José Ramón Gutiérrez, chairman of Multiexport Foods

success, as well as a purpose and values that align with ours," Gutiérrez stated. "Together with Cargill and Mitsui, and our talented and passionate collaborators, we will combine capabilities and strengths for a sustainable development of Multi X and deepen our commitment to the southern regions of Chile," he emphasised.

"At Cargill, we seek to be a differentiated leader in the seafood industry, combining innovation with operational excellence to enable greater affordability and integrity of supply chains for our customers and consumers," said Tim Noonan, managing director for Cargill's seafood business. "This partnership is an important next step in the development of our seafood strategy and will leverage our capabilities across the value chain, including consumer insights, culinary innovation, value-added processing know-how, risk management, and fish nutrition and health solutions. As a result, we hope to provide more customers and consumers with access to Multi X's high-quality portfolio of private label and branded salmon products."

ICAR-CMFRI's efforts to popularize Cage fish farming win recognition

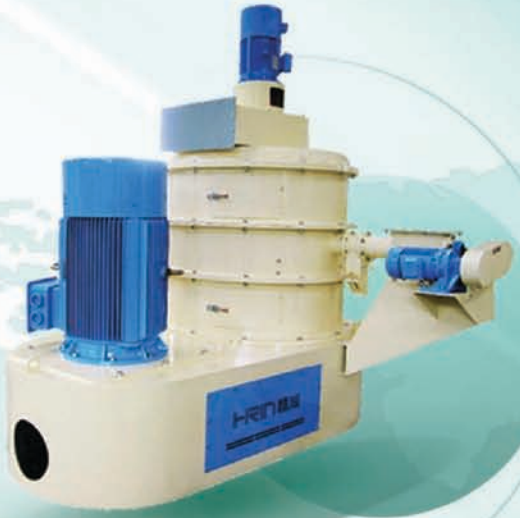
Cage fish farmer associated with ICAR-CMFRI bags prestigious 'Thozhil Shreshta' award of Kerala Government

The efforts of the ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi popularise its cage fish farming technology has won recognition with a cage fish farmer associated with the Institute bagging the prestigious 'Thozhil Shreshta' award instituted by the Kerala Government. P M Dinil Prasad, 28, from Kerala's Kannur district, who won the award for his excellent performance in the fisheries sector, adopted ICAR-CMFRI's technology and has been undertaking the cage fish farming since 2018. He received the award from Kerala Labour Minister Shri. V Sivankutty on 25th March 2022. Mr Prasad was bestowed with the award that carried a purse of Rs. 1 lakh and a certificate for his tremendous achievement in cage fish farming with good harvest of pearl spot within a short span of three and half years. This was made possible with regular training and guidance imparted by the Mariculture Division of CMFRI headed by Dr Imelda Joseph.

While the CMFRI introduced a 15-cr project funded by the National Fisheries Development Board (NFDB) to set up 500 cage farming units in Kerala in 2018, Dinil Prasad was the first to receive a unit under the project and upon CMFRI's guidance he launched the farming in Anjarakandi river in Kannur. Presently, he undertakes farming of 7000 pearl spots in seven cages with a size four metre each width and length. At least 150 kg of yield is expected from each cage.Along with cage fish farming, Dinil Prasad also runs a seed production unit of pearl spot and mussel farming. In addition, he provides consultancy service, including cage fabrication, site selection, species identification, etc. to those desiring to start cage fish farming. Around 75 cage culture units were launched in many parts of the Malabar region under Dinil's consultancy. The young fish farmer said that his strong passion toward cage fish farming and determination were the secrets of his success. "At the initial stage, many people discouraged me for starting an aquaculture enterprise. But, with the success of the venture, they lauded my efforts and willpower and more youngsters started approaching me to emulate this model", he said adding that he is indebted to ICAR-CMFRI's support that was crucial to adopt this technology at its best and to secure his livelihood.

COVID restrictions never dampened his spirit as he took to social media to market his harvested crops. "Social media helped me a lot during the lockdown to reach the targeted consumers and sell the fish at a good price", Dinil said.Dr A Gopalakrishan, Director, ICAR-CMFRI Director expressed his happiness over popularisation of its technology in a way that is highly beneficial to the society. "Cage fish farming is helping to increase domestic fish production across the coastal states of the country. It is hopeful that youngsters are increasingly taking up cage fish farming as their entrepreneurial initiative", he said.

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%.

Precision Fish farming: A revolutionary concept in Aquaculture for doubling farmers' income

Email: hinofdo@gmail.com

Hino Fernando E[1], Rajeshwaran M[2] and Green Sea K[3]
[1]ICAR- Krishi Vigyan Kendra, Nagapattinam
[2]Central Institute of Fisheries Education, Mumbai
[3]Fisheries College and Research Institute, Thoothukudi

Introduction

The growing global population and the necessity for nutritious food demand to discover innovative pathways for improved farming methods in confined environments for doubling the income of the fish production system. India is the second-largest country in aquaculture production, which produces 14.1 million tons for the year (DoF, GoI). This sector will rule the country to suffice the protein requirement of the population through these farming practices. With vast freshwater resources available in the country, the potential to double the fish production is unfathomable. Inland freshwater aquaculture, which has shown a noticeable growth of fish production in the last decade, needs immediate attention for species diversification for increasing fish production. Indeed, water usage in aquaculture is the most important thing when speaking about its depleting resources in the country. So the aquaculture production needs to be intensified from the earlier extensive culture. Attaining maximum output with minimum water, many developed countries like Egypt, Israel, and South Africa adopt advanced water savings techniques in fish culture practices, leading to sustainable usage of water resources. In line with this, Precision fish farming, a prevailing technology in agriculture, is being replicated in aquaculture with AI integration to improve fish production. This article consolidates the various aspects involved in the Precision fish farming system.

Defining Precision Fish Farming

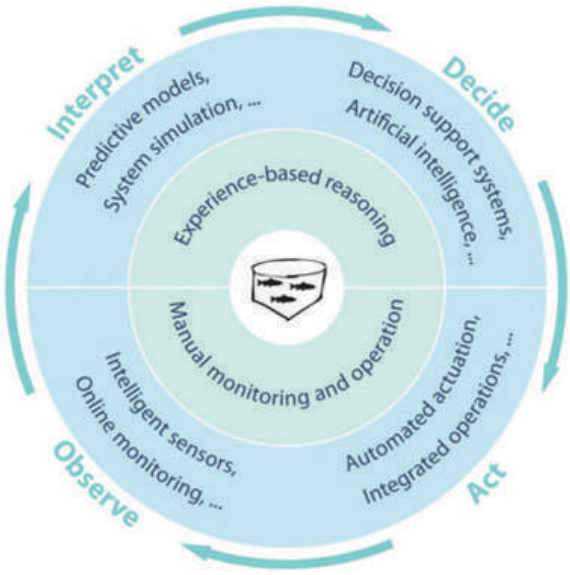
Precision fish farming technology has developed from the concepts used in precision livestock farming and introduced an approach engineered to fish production. Through this accuracy and precision, the farmer can monitor the individual fish efficiently to achieve higher productivity. This technology can save time and labor significantly. It will help the farmers improve their ability to control feeding and water quality parameters like Dissolved Oxygen, pH, Ammonia, and Nitrite, monitor and document real-time data from their fish farms, and reduce the need for and dependency on manual labor. Moreover, the data will be available for traceability whenever there is an outbreak of diseases on the farm. Precision fish farming, as the name suggests, water usage in this fish farming technology will be exact and need-based.

Different Components of Precision Fish farming

The main objective/intention of Precision Fish Farming involves:

1) To improve accuracy, precision, and repeatability in farming operations
2) To facilitate more autonomous and continuous monitoring of biomass/animal stocked in the system
3) To provide more reliable decision support to run the aquaculture, especially water quality parameters and;
4) To reduce dependencies on manual labor and subjective assessments, and thus improve staff safety.

A commercial aquaculture system, intensive culture was followed by Precision fish farming is more suitable. This system will improve an animal's biological health and welfare while increasing the productivity, yield, and environmental sustainability in the system.



Precision Fish Farming is helpful to visualize fish farming as cyclical processes held in four phases where observe bio-responses in the cages (Observe stage) and interpreted (Interpret phase); this result will help make decisions (Decide step) on which actions to enforce (Act phase) that in turn elicit a bio-response in the fish. Many functions are conducted manually in different stages. Firstly, the farmer observes the fish via direct visual observation or data acquisition tools such as cameras. The outcome of which is qualitative or quantitative information on the bio-responses of the fish. The farmer then uses this data through subjective experience to interpret this information, which tells about the current status and condition of the fish. These interpretations will be a foundation for deciding on farming operations and management, then put into action by manually induced actions on the cage. The farmer may make such decisions based on the estimated present states or expected future conditions of the system, representing manual versions of the feedback and feed-forward principles in control engineering. Methods and tools for fish farming that apply technological solutions and automation principles to one, several, or all the different phases of farming operations may be considered PFF approaches. The ultimate result of using PFF to a particular process will therefore be that the elements in that operation belonging to the different phases of fish farming operations shifted from an experience-based to a knowledge-based regime.

Industrial usage of Precision Fish Farming

To make PFF an industrial value it should positively affect the day-to-day farming situation. This methods must therefore be randomly evaluated to test their contribution in improving the health of the fish, thereby reducing fish mortality (e.g. through handling, stress, escapes and disease), improving production efficiency and product quality, and/or reducing environmental impacts of the farming operation, prior to launching innovative actions with the intent of commercialization. Although it would be more practical to conduct proof of concept studies for PFF methods in controlled laboratory conditions, demonstrating their effects under full scale farming conditions is critical, as culture scale effects modify fish performance. Furthermore, as fish culture operations are carried out mainly in outdoors, any piece of equipment or system located at the farming site will be exposed to the elements. PFF equipment and units should thus be tested for durability to prevent malfunction when used on commercial sites as this may create chaos in the system. To illustrate the implementation of PFF methods, we outline four concrete examples of PFF applications that are realistic to implement given present technology readiness levels, and could have a large impact within industrial fish farming. The cases cover important areas in the salmon industry, ranging from biomass monitoring and feeding to parasite management. Moreover, the examples illustrate how PFF principles can be applied to continuous (i.e. throughout the production cycle), regular (i.e. daily) or transient (i.e. occasionally, on demand) time scales.

Major Challenges in industrialisation

Many of the technical principles that are potential tools for industrial PFF applications have been used industrially and commercially in other market segments. Several have also seen some use within aquaculture. However, for many of these, specific technical challenges related to the fundamental physics of the subsurface environment, properties of the selected sensing methods, or limitations of communication protocols when used in a fish farm setting. These challenges need to be solved before a complete step towards commercial exploitation in aquaculture. Potential methods to handle such challenges may range from implementing system settings to more strategic equipment placement.

Conclusion and future prospects

Precision fish farming will be the better solution to the growing water crisis in the country as this can exactly utilize the natural resources. Industrial fish farming is a significant source of protein for human consumption. Due to the growing population, people can meet the rising demand for seafood. The factors such as increasing scarcity of feed raw materials, limited availability of farming locations, increasing focus and needs concerning eco-friendliness, and space use conflict with other industries (e.g., fisheries, oil and gas, tourism, shipping), this challenge is maybe not possible to counter by simply up scaling production volumes and applying present production regimes. The future scope for fish farming should be more advanced and precise, and the industry needs to shift from experience-driven to knowledge-driven approaches to optimize production better. The present trends within the farms' sector are producing more significant volumes and output per worker increasing on each fish farm, highlighting the need to monitor and control the production process. The aquatic environment has pushed the industry to adopt new technologies to observe the fish. The future of aquaculture farms depends mainly on the ICT innovations IoT (Internet of Things), AI (Artificial Intelligence), etc., prevailing to monitor the systems by reducing human dependency.

FISH PROTEIN POWDER: A HIGH VALUE PRODUCT AS NUTRITIONAL SUPPLEMENT

Elavarasan, K., Mohan, C.O., Ravishankar, C.N.
ICAR-Central Institute of Fisheries Technology, Kochi, Kerala
Email: comohan@gmail.com

Highlight Points

- Fish protein powder (FPP) is a dried and stable fish product, brown to off-white in colour, prepared from prime quality edible fish muscle.
- Protein in FPP is in highly concentrated form with most of the essential amino acids and is highly digestible.
- Many varieties of Indian food fishes are suitable for the production of FPP.
- FPP finds its application in food as functional food ingredients, beverages, as sports and dietary supplements & in cosmetics, personal care, pharmaceutical industry.
- ICAR-CIFT has the know-how to produce FPP in industrial scale.

INTRODUCTION

The awareness on the health benefits of fish as food is growing steadily. As a result, the demand for fish and fish products has grown globally. Indian protein industry in India has witnessed a rapid growth in recent past. The major fraction of the growth in Indian protein industry is accounted by the protein dietary supplements industry followed by food processing and beverage industry. Indian fish protein industry currently shares around 7% of total fish protein market of the Asia-Pacific region. Being India as a huge country in size of the population and opportunities available for protein based ingredients, the fish protein market is very small. Due to increasing demand across various industrial segments for fish proteins there expected to be a reasonable growth in fish protein based industry in near future.

Fish has been recognized as a functional food commodity as it offers array of health promoting substances other than the major nutrients. On account of this, fish and fishery products are second most preferred food commodities next to agricultural products. Seafood product diversification by effective processing and value addition of main and rest raw material can augment marketing of these commodities in the food and nutraceutical sector. Simultaneously, it leads to reduced post-harvest losses contributing to global economic growth and nutritional security.

FISH POWDER/FISH PROTEIN POWDER

Fish protein powder (FPP) is a dried and stable fish product, brown to off-white in colour. It is prepared from prime quality edible fish muscle. It is mainly intended for human food uses. The protein is in more concentrated form (more than 65% to 90%) than the protein content found in the respective raw material (fish flesh-15-24%). Protein content of FPP depends on the protein content in raw materials; extent of loss during the processing; amount of other ingredients added; amount of additives and the presence of residual moisture content. It has a huge potential in domestic and international market mainly in Europe. The proteins present in fish powder are highly digestible (90-98%). However, the digestibility may be impaired by the processing severity and storage period. It can supply all the dietary essential as well as non-essential amino acids. In addition, depend on the processing operation, fish powder is also a good source of functional bio-minerals including heme form of iron, selenium and zinc.

WHY SHOULD WE PRODUCE FISH PROTEIN POWDER?

- To use glut of fish catch, underutilized fishes, low value fishes, small indigenous fishes and processing discards
- To fight protein deficiency and malnutrition (Fish protein can provide all the essential and non-essential amino

acids; cysteine and methionine are limited.)

- To make use of the richness of high quality proteins available in aquatic animal for human nutrition and wellness
- To offer a better shelf stable protein dense product
- To avoid consuming bulk
- To provide the protein in convenient form
- To use fish protein as an intermediate for products diversification
- To utilize the available fishery resource available in abundance during the peak season
- To provide protein rich product for fighting protein deficiency and support the food and nutritional security
- To provide customized fish protein based nutrients to various populations
- To harvest the health benefits embedded in fish proteins
- To secure the market position in international market
- As an alternative to other animal and plant based protein supplement

TYPE OF PRODUCTS

ICAR-Central Institute of fisheries technology has conducted extensive research on the process and application (product formulations) which can be scaled up. ICAR-CIFT has expertise in the following categories of fish powder intended for human consumption

i) Type-1: Whole nutrients dense fish powder (WND-FP) which has fish flavour and taste (preferable mainly by fish eating population)

ii) Type-2: Fish powder in the form of isolate (FPI)/ concentrate (FPC) /flour having less of fish smell and taste to tasteless/odourless powder. This product is indented to be used as food ingredient, muscle mass boosting protein supplement and as a protein additive

iii) Type-3: Peptide rich fish powder (FPH) like collagen peptide (gelatin hydrolysates), fish protein hydrolysates. This is intended as a nutraceutical ingredient with various health claims. This product possesses the protein nutrients in the simple and digested form. So very much suitable for infants, elderly people and for the people who have specific protein digestion issues.

UNIT OPERATION FOR TYPE-1, TYPE-2 AND TYPE-3 FISH PROTEIN POWDERS

Processing operations	Type-1 (WND-FP)	Type-II (FPI/FPC)	Type-III (FPH)
Raw material	Non-fatty fishes and some of the fresh water fishes are more preferable (Pink perch / Croaker / IMC / Common carp / Tilapia)	Fatty /non-fatty and processing discards can be used. Process involves the chemicals and organic solvents. Non-chemical based green process also available with CIFT (more preferable).	Any type of fish and processing discards can be used. Process uses food grade commercial enzymes of plant, and microbial origin as well as digestive enzymes of animal origin.
Pre-processing	Operations mainly involve dressing of fish, cutting, slicing or filleting. Small fishes used as whole.	Operations mainly involves dressing of fish, meat bone separation	Operations mainly involves dressing of fish, meat bone separation and homogenization with water
Processing	Major operation is drying followed by size reduction and stabilization	Treating with various food grade organic/inorganic solvents to enrich the protein and to remove other chemical constituents which affect the stability. Operations involves steps like centrifugation, filter pressing, drying, size reduction and stabilization with other additives	Major operation include cooking, enzymatic hydrolysis, filtration, ion exchange (optional), centrifugation and drying
Other ingredients	Formulated with seasonings. Dried vegetables and other plant proteins. Additives for preventing fat oxidation and protein stabilizations are used	Formulated with flavouring agents and other plant proteins. Additives for preventing fat oxidation and protein stabilizations are used	Formulated with flavouring agents and additives like anticaking agents.
Packaging	Bottles and pouch packaging	Bottles and pouch packaging	Bottles and pouch packaging
Storage	Ambient storage	Ambient storage	Ambient storage under inert gas filled head to avoid hygroscopic issues.
Shelf life	6-12 months depends on the raw material used and storage conditions maintenance	12 months	12 months (Tend to form cake upon standing for long period

Note: The products can be packed in metalized polyester laminated with polyethylene and HDPE containers, glass bottles etc.

FISHES SUITABLE FOR FISH POWDER PREPARATION

Non-fatty fishes of marine origin and fresh water fishes of low value are preferable for fish powder production. Fatty fishes are not suitable for fish powder process due their poor stability as marine lipids are highly prone to oxidation. Fish powder can be prepared from even small varieties. Low economic value fishes and processing discards can be used.

LIST OF SOME OF THE SUITABLE FISHES AND THEIR APPROXIMATE COST

S.No	Marine fish/prawns/ fresh water price	Cost in Rs (Average landing centre /farm gate price)
1	Pink Perch	125-150
2	Croaker	150-180
3	Ribbon fishes	140-271*
4	Tilapia	90-150
5	Indian major carps/ exotic carps	160-220
6	Pangasius	90-160

Note: The cost varies with location, season and demand supply. For the purpose of business, lower the cost of fish better the return and viability.

OTHER INGREDIENTS USED IN FISH POWDER FORMULATIONS

Flavourings, stabilizers, vitamin and mineral mix, anti-caking agents, preservatives, omega-3 concentrates, carbohydrates and fibres are other ingredients commonly used in fish powder formulations. Ingredients inclusion needs customization based on the consumer targeted and functions.

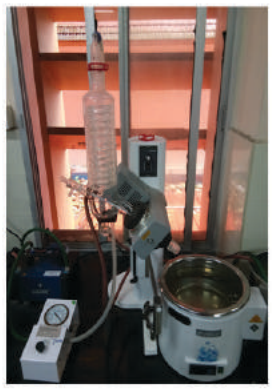
MAJOR EQUIPMENTS/MACHINERY REQUIRED

- Chiller
- Meat bone separator
- Meat mincer
- Meat washing machine
- Reactor
- Cooker Dryer
- Pulverizer
- Ribbon blender
- Vacuum dryer
- Decanter
- Industrial centrifuge
- Filtration unit (Type-III)
- Spray Dryer (Type-III)
- Powder filling and packing machine for bottle filling / pouch packing

Meat bone separator

Reactor (Pilot Scale)

Clarifier (Pilot scale)



Vacuum Evaporator (Lab Scale)

Freeze dryer (Lab scale)

Vacuum Dryer (Lab scale)

Spray Dryer (Pilot Scale)

MAJOR QUALITY ISSUE

Keeping the quality of fish powder up to the mark is a key challenge to the manufacturer. To ensure acceptance, it is important that powders appeal to dietary preferences and flavours appreciated by the local populations. Customization of the colour, aroma, texture, and taste of the products are crucial for their acceptance. Quality and acceptability of fish protein powder depend on several factors. The fat content is a critical parameter as lipid oxidation is highly progressive in low moisture foods and also oxidation leads to the development of a strong and often rancid flavour. Spray drying and microencapsulation using other materials are optional for enhancing the shelf life of type III fish protein powder.

SCALABILITY

There is a high up-scaling possibility for protein powder from seafood sources. The profit margin may vary depending on the process/protocol adopted as well as scale of operation. However, a high up-gradation is projected for the final product in comparison to the initial raw material used.

BUSINESS AND COMMERCIAL POTENTIAL

On account of the rising demand amongst both the modern customers for health promoting food commodities, a huge potential is expected for products like protein powder in the internal as well as export market. Small scale business ventures focusing on the local market as well as established ventures targeting the domestic and export market can be potential investors to this technology for exploring its commercial possibilities.

MAIN TARGET CUSTOMER

- Infants, geriatric population, sports nutrition, fitness nutrition, arthrites patients, etc.

COMPARISON OF AMINO ACID COMPOSITION OF FISH PROTEIN POWDER WITH OTHER REFERENCE SOURCES

AMINO ACIDS	FISH	EGG	MILK	HUMAN MUSCLE	FAO/WHO/UN ADULT (INFANT)
Essential amino acids					
Threonine	4.01	2.0	3.5	2.9	2.3 (2.5)
Methionine	2.77	1.4	2.1	1.7	2.2 (2.4)
Phenyalanine	3.57	2.3	3.5	3.8	3.8 (4.1)
Histidine	6.22	0.9	1.9	2.8	1.5 (1.6)
Lysine	9.20	2.7	5.9	6.6	4.5 (4.8)
Valine	4.27	2.0	3.6	4.3	3.9 (4.0)
Isoleucine	3.33	1.6	2.9	3.4	3.0 (3.1)
Leucine	7.02	3.6	7.0	6.3	5.9 (6.1)
ΣEAA	**45.48**	**16.5**	**30.3**	**31.8**	**27.1 (28.6)**
Non-Essential amino acids					
serine	3.82	3.3	4.0	2.3	
Glycine	4.06	1.4	1.5	3.1	
Glutamic acid	12.74	5.1	16.7	13.1	
Proline	2.79	1.8	7.3	ND	
Cycteine	0.58	0.4	0.2	ND	
Alanine	5.39	2.6	2.6	4.1	
Tyrosine	2.12	1.8	3.8	2.0	
Arginine	5.04	2.6	2.6	4.4	
ΣNEAA	36.54	19.0	38.6	29.0	

Values are presented in g per 100 g protein concentrate/ powder.

Tryptophan, aspartic acid, asparagine, and glutamine were not measured.

ΣEAA - sum of all essential amino acids.

ΣNEAA- sum of all non-essential amino acids. ND-Not Detected

What is future prospect for the Fish Protein Powder segment?

The global fish protein powder market is expected to grow at a rapid pace in Asia Pacific region due to the increasing consumption of sea food and its products in convenient forms.

How to boost the growth of fish powder market?

Globally fish protein powder is still at an introductory phase, therefore, more promotions and advertisement are required to spread awareness about its health benefits.

SKRETTING
a Nutreco company

OUR PURPOSE

Feeding ***the Future***

GLOBAL LEADER
in providing
INNOVATIVE and
SUSTAINABLE
nutritional
SOLUTIONS that
best support the
PERFORMANCE
of shrimp and fish

We feed millions

In 2020, Skretting globally produced 2.3 million MT of shrimp and fish feed customized to local species. This lead to Skretting providing feed to support 21.5 million seafood meals every day around the world. To enquire and purchase our feed contact us on: +91 73047 95555

SKRETTING INDIA
Unit No. L4 04, SLN Terminus, Survey No. 133, Besides Botanical Gardens Gachibowli, Hyderabad - 500032, Telangana
contact.india@skretting.com | www.skretting.in | Skretting-India | Skretting India

Connect with us

TECHNICAL REQUIREMENT FOR FISH POWDER PREPARED BY SOLVENT EXTRACTION METHOD (TYPE II-FISH PROTEIN POWDER) AS PER IS 9808

PARAMETERS	REQUIREMENT
Moisture Max	10
Crude protein (N*6.25) (On dry basis), Min	70
Available lysine (On dry basis), Max	6.5
Fat (on dry basis)	0.75
Ash (On dry basis), Max	20
Acid insoluble ash, (On dry basis), Max	0.5
Flourine (mg/kg), Max	250
Mercury (mg/kg), Max	0.5
Lead, (mg/kg), Max	2.5
TPC, Max	15000/g
E. coli and pathogens including *Salmonella*	Nil

Note: The fish powder of all the three types should be of in such a quality to facilitate the incorporation in cookies, baby food formulations, cakes, cereals, pastries and extruded snacks without altering the sensory attributes of the formulated foods. The type III fish powder should be checked for free amino nitrogen to total nitrogen ratio as an indication of peptide richness.

General Uses

- Used in the food industry for developing re-structured and ready-to-eat food products.
- Used as a functional ingredient for developing formulated ready-to-eat products.
- Food & Beverages formulations
- Sports Nutrition & Dietary Supplements and formulations
- As ingredient in cosmetics & Personal Care
- As functionally active compounds in pharmaceuticals

USE OF WHOLE PROTEIN FISH POWDER (TYPE I & TYPE II)

- Source of nutrients like amino acids
- Binder
- Dispersing agent
- Emulsifier
- Ingredient in restructured products (gelling agent)
- Protein fortification
- Thickening agent

USE OF HYDROLYSED PROTEIN RICH FISH POWDER (Type-III)

Hydrolysed fish proteins including collagen peptides are rich in bioactive peptides possess various health promoting properties depends on the process employed and enzymes used. Application specific biologically active ingredient can be produced in the form hydrolysates. Following are the well-established health properties of hydrolysed fish protein powder:

- Antioxidant
- Anti-inflammatory
- Anti-hypertensive
- Antimicrobial
- Immune-modulator
- Appetite suppressor
- Cholesterol lowering agents
- Anti-obese, etc.

NATIONAL AND INTERNATIONAL MARKET

- Domestic market (urban markets-super markets and malls; fitness centres; Health care centres; food ingredient suppliers; retail and online shops)
- Europe
- North America
- Latin America
- East Asia
- South Asia
- Oceania
- Middle East & Africa

MARKET CHANNEL

- Business firm to business firm
- Business firm to consumer
- Selling through retail shops
- Online marketing

SOCIAL IMPACT OF THE TECHNOLOGY

The product diversification and value addition by upgradation of less utilized fishery raw material will help in generating better revenue, employment and entrepreneurship development.

INVESTMENT REQUIRED

- Fixed Capital
- Land & Building : Rs. 35 lakh
- Machinery & Equipment : Rs. 70 lakh
- Working Capital(per day) : Rs. 0.75 Lakh (for 100 kg paste)
- Average cost of Production capacity (for 100 kg powder) : Rs.850/kg at 100 %
- Expected average Selling Price : Rs.900/kg

SERVICES OFFERED BY ICAR CIFT FOR TECHNOLOGY TRANSFER & COMMERCIALIZATION

ICAR-CIFT has established an Agribusiness Incubation (ABI) Centre to support the growth of business enterprises through IPR enabled ICAR technologies. The major facilities offered by the Institute to handhold entrepreneurs are listed below:

1) Provides technology know-how backed up with scientific results
2) Initial assessment of product and business, providing Detailed Project Report (DPR)
   - Assess the commercial viability of the business plan
   - Benchmark against best practices in the industry
   - Identify technology gaps and requirements
3) Regulatory, compliance and standards support
   - Training in quality regulations and related aspects
   - On-site inspections and formulate remedial measures
   - Provides assistance to secure regulatory and standards certifications
4) Infrastructure and production unit
   - State-of-the- art pilot level production facility
   - Well-furnished office space at prime business location
5) Training and skill development
6) Product development and testing
7) Support in Market testing
8) Setting up of new facilities / laboratories and technology up-scaling.

ANAESTHESIA USED IN AQUACULTURE

Email: sarangfish@gmail.com

Devati, Rohitash Yadav, Tameshwar and Niranjan Sarang
Fisheries Polytechnic,
Dau Shri Chandrakar Kamdhenu Vishwavidyalaya, Durg, Chhattisgarh, India

Abstract: Fish has become a popular aquatic animal and experimental model and is farming and harvesting for food. As a concern, surgical and invasive procedures are widespread in this animal group, and this review will focus on the fish anesthetic. Fish are frequently immersed method used in a variety of anaesthetic drugs. The number of correct doses can lead to effective anaesthetic for acute operations and loss of consciousness during surgical procedures. Dose and anaesthetic agents differ amongst fish species and are further complicated by physiological factors (e.g., body weight, physiological stress) and environmental factors (e.g., water temperature).Combination anaesthesia, which involves the use of two anaesthetic drugs, has been shown to be effective in fish, but it is not widely utilized due to a lack of experimental confirmation. In the field of fish medicine, analgesia is a largely unexplored topic. Recent investigate has observed into the effectiveness of opioids, nonsteroidal anti-inflammatory medicines, and local anaesthetics in reducing pain and discomfort.

Introduction: Anaesthesia is a condition that occurs when an external agent is used to create a lack of sensation by depressing the nerve system. In fisheries and aquaculture research, anaesthetics substantially improve processes such as induction of breeding, handling during stripping, and shippingbroodstock. To prevent stress and physical injury when handling the fish for regular operations, anaesthesia and sedation are frequently required. Although anaesthetics are primarily used to keep fish immobile while they are handled for samples, they are also utilized to reduce the stress associated with such treatments.When choosing an anaesthetic, a number of considerations are significant, such as effectiveness, rate, accessibility, and ease of use, as well as poisonousness to fish, humans, and the environment (Soto and Burhanuddin 1995; Akbulut et al. 2010), and the choice may also depend on the nature of the experiment and species of fish (Summerfelt and Smith 1990; Munday and Wilson 1997). Different agents may produce anaesthesia in fish, mainly (MS-222, benzocaine, quinaldine, chlorobutanol, phenoxyethanol, metomidate, and others) have been used. Induction, maintenance, and recovery were the stages of anaesthesia.

How do anaesthetic agents work in fish?
Anaesthetic agents are inhaled through the gills and quickly enter the blood. From there, they are transported to the central nervous system and excreted via the gills upon the fish's return to freshwater. They work by generating a calming impact followed by a successive loss of equilibrium balance, mobility, consciousness, and reflex action. Respiratory and cardiac failure follows overdose or exposure. Before sedation or general anaesthesia, fish should be fasted for at least 12 to 24 hours or until one can ensure that the stomach is empty of food to avoid regurgitation. Anaesthesia and recovery (without anaesthetic agent) tanks must be prepared ahead of time.

Measures of Anaesthesia: Induction, maintenance, and recovery are the stages of anaesthesia. The time it takes to get from initial anaesthetic exposure to induction (stage IV) is usually determined by the dose and duration of acquaintance. In general, an ideal anaesthetic should produce anaesthesia quickly (e.g., in less than 3 or 5 minutes), allow for quick recovery, be toxic to fish and users, leave low tissue residues, and be affordable. The anesthetic induction time is the interval from the moment an experimental fish is placed in the anaesthetic tank until it does not respond to external stimuli. The lowest effective concentration induces general anaesthesia in three minutes and allows recovery in ten minutes.

Stages of anaesthesia and recovery:

Stages of Anaesthesia	Description
I	Loss of equilibrium
II	Loss of gross body movements but with continued opercular movements
III	As in Stage II with cessation of opercular movements

Stages of Recovery	Description
I	Body immobilized but opercular movements just starting
II	Regular opercular movements and gross body movements beginning
III	Equilibrium regained and pre anaesthetic appearance

Recovery of anesthesia: Recovery occurs when the fish is placed in anesthetic-free water after induction. In most cases, the fish will be treated near the tank or pond and returned to its home for recovery. A well-aerated recovery tank should be prepared in advance if this is not the case. The recovery time is the period from the time when an anesthetized fish is placed in a recovery tank to the time it recovers from anesthetization with full equilibrium motion. Initial recovery took a few seconds to minutes, depending on the concentration of anesthetic administered.

After the induction process, the fish is placed in anesthetic-free water for recovery. In the majority of cases, the fish will be treated close to the tank or pond and will be able to return home to heal. If it's not possible, a well-aerated recovery tank should be set up ahead of time. The recapture time is distinct as the time it takes for an anaesthetized fish to return to full equilibrium motion after being placed in a recovery tank. The initial recovery time ranged from seconds to minutes depending on the anesthetic concentration used.

Commonly used anaesthetics

1. Tricaine methanesulfonate: TMS (MS-222), also known as [3-aminobenzoic acidethyl ester methanesulfonate], is the most commonly used fish anaesthetic. It is also very effective for inducing profound anaesthesia quickly. It's sold as a powder that dissolves easily in water. It's a good knowledge to check the pH of the water after adding MS-222 to make sure there's enough buffering. It's a white crystalline powder that dissolves easily in water at 20 ° C, with 1.25 g/mL water solubility. The dose be subject toon the category, size, and density of the fish and the temperature and hardness of the water, but anaesthetic doses typically range from 25 to 100 mg/L. TMS is also called MS-222, TM18Finquel, Tricaine, tricaine methanesulfonate, and Metacaine.

2. Benzocaine: Benzocaine [p-aminobenzoic acid ethyl ester] comes in two different forms: a crystalline salt with a water solubility of 0.4 g/L and a freebase. The efficacy of benzocaine is influenced by the size of the fish, with the youngest fish requiring the lowest dose and the water temperature. The reported quantities vary from 25 to 100 mg/L, with salmonid amounts ranging from 25 to 45 mg/L. Benzocaine must first be dissolved in ethyl alcohol at a concentration of 0.2 g/mL. Benzocaine's other names include TM1Anesthesin, TM14Anesthone, TM2Americaine, ethyl aminobenzoate, Orthesin, and Parathesin.

3. 2-Phenoxyethanol: 2-Phenoxyethanol (2-PE) [1-hydroxy-2-phenoxyethane] is a colourless, oily, aromatic liquid with a burning flavour that dissolves in water at a rate of 27 g/L at 20 ° C. (Merck and Company, 1989). The effect of 2-PE varies depending on the size of the fish and the water temperature. While the effective dose for salmonids is between 200 and 300 µL/L, the lethal dose is as low as 500 µL/L, leaving little margin for safety. Phenylcellosolve, phenoxyethanol, phenoxetol, ethylene glycol monophenyl ether, and beta-hydroxyethyl phenyl ether are names for 2-phenoxyethanol.

4. Isoflurane: Isoflurane can be dissolved in water by injecting the solution underwater and mixing it. In vaporised form, isoflurane is used for human anaesthesia. It's incredibly safe and has been used for a variety of koi surgical procedures. It is a controlled substance and expensive. While safe and effective, there are less expensive ways to immobilize koi for venepuncture.

5. Clove oil: It is generally sold, clove oil varies in intensity and composition of its constituents from lot to lot. The main active element is eugenol, which provides 85-95 percent of the total, with isoeugenol and methyleugenol accounting for the rest. It's cheap and easy to come by without a prescription. An initial dose of 0.5 ml per gallon of water could be used. Because clove oil does not mix well with water, special precautions must be taken to ensure that the oil is evenly combined with the water in the anaesthetic solution. Some people put a specific amount of clove oil in a vinyl bag, fill it with water, and shake it briskly. This is then mixed with the rest of the water in the anaesthesia tub.

6. Propoxate: Propoxate [propyl-DL-1-(phenylmethyl) imidazole-5-carboxylate hydrochloride] is a crystalline powder structurally similar to metomidate, and etomidate is soluble in both fresh and saltwater. It has a long shelf life in solution and is 100 times more soluble than TMS (Thienpont&Niemegeers, 1965). Propoxate has ten times the potency of TMS. Concentrations of 0.5 mg/L to 10 mg/L are effective. Anesthesia extending up to 16 hours is safe with a dose of 0.25 mg/L. To anesthetize fish, Ross & Ross (1984) recommend a dose of 1 to 4 mg/L, with induction periods ranging from 30 seconds for higher doses.

7. Metomidate and Etomidate: Metomidate [1-(1-phenylethyl)-1H-imidazole-5-carboxylic acid methyl ester] is a watersoluble powder with hypnotic (sleep-inducing) characteristics. Etomidate [1-(1-phenylethyl)-1H-imidazole-5-carboxylic acid ethyl ester] is a crystalline counterpart of metomidate and propoxate that is colourless and odourless (Merck and Company, 1989). It has been used as a hypnotic drug on people, however it is extremely costly and difficult to obtain (Bell, 1987). Doses as little as 1 B and as high as 10 mg/L are effective (Olsen et al., 1995).

8. Lidocaine: Lidocaine [2-(diethylamino)-N-(2, 6-dimethylphenyl) acetimide] is insoluble in water but easily soluble in acetone or alcohol in its freebase form. It is most commonly used in the hydrochloride salt form, which is water-soluble (Merck and Company, 1989). Lidocaine has been used to anaesthetize carp (Cyprinus carpio), tilapia (Oreochromis/Tilapia mossambica), and catfish (Oreochromis/Tilapia mossambica) in combination with sodium bicarbonate (Ictalurus punctatus). Lidocaine's anaesthetic effects have been shown to be enhanced by the addition of sodium bicarbonate at a concentration of 1 g/L. There are large variances in needed doses without the use of bicarbonate. In the absence of sodium bicarbonate, tilapia required more than 800 % more lidocaine than carp.

Conclusion: Anesthetics are chemical or physical agents that cause animals to lose their mobility, equilibrium, consciousness, and, finally, their reflex action. Anesthetics

are useful in fisheries and aquaculture for minimizing the stress induced by handling and transport. Many factors can influence anesthetic treatment efficacy; as a result, experimental dosages should be tested on a small sample of non-critical animals before any large-scale anesthesiais performed. For environmental and human safety, the manufacturing, marketing, and use of chemicals were regulated by government authorities.

References:

Bell G. 198) An outline of anesthetic and anesthesia for salmonids, a guide for fish culturists in British Columbia. 16pp. Canadian Technical Report of Fisheries Aquatic Sciences No. 534.

Donald L., Neiffer., Andrew Stamper M. 2009. Fish Sedation, Anesthesia, Analgesia, and Euthanasia: Considerations, Methods, and Types of Drugs. Institute for Laboratory Animal Research Journal. 50(4): 343-360.

Gilderhus P.A., Marking L.L. 1987. Comparative efficacy of 16 anesthetic chemicals on rainbow trout. North American Journal of Fisheries Management. 7: 288-292. DOI: 10.1577/1548-8659(1987)7<288:CEOACO>2.0.CO;2.

Gilderhus P.A. 1989 Efficacy of benzocaine as an anesthetic for salmonid fishes. North American Journal of Fisheries Management 9:150-153.

Gilderhus P. A. 1990. Benzocaine as a fish aneshetic: efficacy and safety for spawning phase salmon. Progressive Fish-Culturist 52(3): 189-191. DOI: 10.1577/1548-8640(1990)052

Harms C.A. 1999. Anesthesia in fish. Pp.158-163. In: Fowler ME, Miller RE. (ed) Zoo and Wild Animal Medicine. WB Saunders. Current Therapy 4. Philadelphia.

Hicks B. 1989. Anaesthetics: sweet dreams for fragile fish. Canadian Aquaculture. 89: 29-31.

Iwama G.K, Pickering A.D., Sumpter J.P., Schreck C.B. 1997. Fish stress and health in aquaculture. Pp 278. Cambridge University Press, UK.

Marking L.L., Meyer F.P. 1985. A better fish anaesthetics needed in fisheries. Fisheries. lo (6): 2-5.

Merck and Company 1989 The Merck Index, 11th ed. 1606pp. Rahway, New Jersey: Merck and Company.

Olsen Y.A., Einarsdottir I.E. Nilssen K.J. 1995 Metomidate anaesthesia in Atlantic salmon, *Salmo salar*, prevents plasma cortisol increase during stress. Aquaculture 134(1-2):155-168.

Ross L.G., Ross B. 1999. Anesthetic and sedative techniques for aquatic animals. Institute of Aquaculture, Univ of Stirling. 58: 145-155.

Sehdev H.S., McBride J.R. Fagerland U.H.M. 1963. 2-phenoxyethanol as a general anaesthetic for sockeye salmon. Journal of the Fisheries Research Board of Canada 20(6):1435-1440.

Summer felt R.C., Smith L.S. 1990. Anaesthesia, Surgery and related techniques. Pp 213- 272. In: C. B. Scherelk and P.B. Moyle (ed) Methods for fish biology. American Fisheries Society, Bethesda, Maryland.

Thienpont D. Niemegeers C.J.E. 1965. Propoxate (R7467): a new potent agent in cold blooded vertebrates. Nature 25:1018-1019.

More can references can be provide on request.

Team Agrotech

YOUR STEPPING STONES IN SUCCESS!!

Country Representative
CPM ASIA

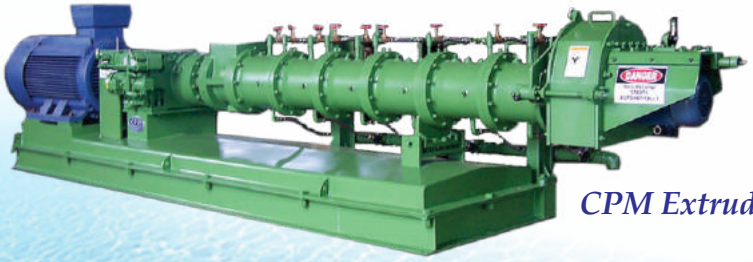
Your Single Stop Source for

Complete Project management of Turnkey Solutions in the following areas:

1. Integrated Feed plants for Poultry, Floating Fish, Sinking Fish, Shrimps, Cattle etc.
2. Balance of plant eqpuipments for Pre/Post processing
3. Complete Plant Automation Solution, on **GATE In to GATE Out concept.**
4. In-house design and manufacturing of Pre Fabricated steel structures for Plants, Warehouses etc.

CPM Dryer

CPM Pellet Mill



CPM Extruder

Contact Today

Team Agrotech Pvt. Ltd.

1- 4, 249, Hill Road, Gandhi Nagar, Nagpur-10 , Maharashtra, India.
M. : +91 9422803386, +91 9650559095
Ph. : +91 712 2222142
e-mail : teamagrotech@yahoo.com
Website : www.teamagrotech.com

For Queries Contact

Scan me

Organic Feed for Production of Organic Fish

Chetan Kumar Garg, Manas Kumar Maiti, Manish Jayant and Sikendra Kumar
Department of Fish Nutrition and Feed Technology, Central Institute of Fisheries Education, Mumbai.
Email: chetan.fishlove7736@gmail.com

Highlight Points

- In recent years more attention is being paid to organic fish production.
- For organic aquaculture, feed should be prepared following organic production standards.
- Feed ingredients and additives used in organic feed must be derived from natural sources and produced without the use of chemical substances.

Introduction

Aquaculture is one of the fastest growing food producing industry sectors globally as its growth rate is higher than all other animal food-producing sectors. The decline in wild stock fish production in recent years has led to a rapid increase in demand for aquaculture products. The development of aquaculture brings more income and benefits to the farmer, but it also has many undesirable effects on the environment and food security. For the past few years, awareness of consumer health, food safety, and environmental protection have increased worldwide, creating significant demand for healthy organic foods. As a result, organic aquaculture is showing strong growth worldwide. Organic aquaculture's primary goal is to address the food, health, and environmental problems conventional aquaculture systems face (Xie et al., 2013).

Organic aquaculture refers to fish culture processes that encourage the reduction of external inputs by restricting the use of synthetic chemicals, pharmaceuticals, fertilizers and feed additives while encouraging reliance on internal agricultural resources using natural ecological processes to maintain the yield of aquaculture with emphasis on disease preventive measures by building fish immunity (Ahmed et al., 2020). A fundamental principle in organic aquaculture is producing healthy food for human consumption while minimizing negative impacts on the environment by developing a valuable and sustainable aquatic environment. The organic fish market is one of the fastest-growing sectors in animal meat production sectors. People are prioritizing organic aquaculture products because they believe that these products are safe and healthy for both humans and the environment (Bergleiter, 2008)

Organic feed for aquaculture

In organic aquaculture, feed is offered in such a way that allows natural feeding behavior with the least waste of feed to the environment. The fish production using organic sources of ingredients is challenging. Feed ingredients are produced from organic material or produced as per the standards of organic production regulations that only allow for organic feed production (Isyakaeva et al., 2021). These feed ingredients come from the sustainable use of fisheries and plant-based ingredients originated from organic production. The organic standards promote the use of feed material of animal origin that not suitable for human consumption (Sicuro, 2019). However, the use of a high amount of feed materials from marine sources (fish meal and fish oil) has been a concern both economically and environmentally. Therefore, it is significant in organic aquaculture to develop new locally-produced, cost-effective and eco-friendly ingredients for organic feed production. Generally, all feed ingredients used for organic feed preparation must be traceable to organic standards, except those ingredients or feed materials that do not exist in the organic form on the market but are authorized for use in organic aquaculture (Mente et al., 2011). Genetically modified organisms, growth enhancers such as hormones and their derivatives, synthetic amino acids, and synthetic feed additives use prohibited in organic aquaculture (EU, 2007).

Feed ingredients

Protein source ingredients for organic feed

In organic aquaculture, the protein source material ingredients include organically produced and nature-derived feedstuffs. Fish meal consists of high-quality palatable protein, which is highly digestible, but the use of fish meal and fish oil is contrary to the organic farming principle of sustainability due to overexploitation of wild stock (Prein et al., 2010). Plant-based protein ingredients or by-products obtained by organic production methods are permitted in organic aquaculture. Various oil cakes (soybean meal, cottonseed meal, mustard oil cake, linseed oil cake, sesame oil cake, groundnut oil cake, sunflower oil cake, coconut oil cake, palm oil cake, etc.), pulses (peas, legumes, lentils, etc.), wheat gluten, corn gluten meal, single-cell protein and insect meal can use as protein source ingredients (Adámek et al., 2019). Additionally, a variety

of leaf and seed protein isolate or protein concentrate produced organically using a permitted solvent such as water or alcohol can be incorporated into organic feed as a protein source ingredient. Whereas animal-based protein source ingredients such as feather meal, bone meal, blood meal, etc., produced through chemical treatment using synthetic substances are forbidden to be used in organic feed. However, protein hydrolysates or proteolysates obtained from molluscans or crustaceans by enzyme action are accepted in organic aquaculture norms (EU, 2008).

Most plant-based protein ingredients have unbalanced amino acid profiles, and the addition of synthetic amino acids to organic fish feed is prohibited. Therefore, several protein source ingredients must be incorporated in the feed simultaneously to balance the amino acid profile of the feed. It is possible to formulate organic feed for herbivorous and omnivorous fish species with plant-based ingredients. In contrast, only plant-based protein ingredients may not meet the amino acid requirements of carnivorous species such as trout and salmon, so in their feed inclusion of fish meal and fish oil is necessary to meet specific amino acid and fatty acid requirements (Mente et al., 2011). Therefore, organic aquaculture certification criteria allow the addition of fish meal up to a 10% level in the feed of carnivorous fish such as trout, salmon and shrimp; while the use of fish meal in carp and tilapia feed is strictly prohibited (Lund et al., 2011). The principles of organic aquaculture encourage the development of feed without fish meal to avoid depletion of global fish stocks (EU, 2007).

Energy source ingredients for organic feed

Organically produced plant ingredients with high energy and low fiber (<17%) can be used as energy source ingredients in organic feed. Cereals such as rice, wheat, maize, oats, millet, barley, rye and sorghum are good sources of energy for fish feed. Cereal by-products such as grain, germ, flakes, middling, hulls, brans, etc., that are produced organically and are not directly involved in human consumption can be used to prepare organic feed. Additionally, tubers, roots and their products/by-products (potatoes, sweet potato tubers, potato starch, beet pulp, manioc, etc.) can be supplemented in organic feed as an energy source. These tubers and roots contain a high proportion of starch which acts as a binder in fish feed due to their high gelatinization ability. Leaf meal with low fiber and anti-nutritional factors can also be used in organic fish feed as it is available in high quantity at affordable cost in most of the regions. To meet the lipid requirement of fish, vegetable oil produced by the physical extraction process can be incorporated into organic fish feed (Mente et al., 2019).

Other nutritive feed supplements for organic feed

Vitamins and minerals are micronutrients essential for the proper growth and health of fish. The feed ingredients used in fish feed contain these micronutrients. Nevertheless, the composition of vitamins and minerals of different feed ingredients may vary, so feed mixtures may not always meet the dietary micronutrient requirements of fish. Therefore, additional supplementation of vitamins and minerals in fish feed is necessary to meet micronutrient requirements (NRC, 2011). Vitamins and minerals used in organic feed must be obtained from natural sources because synthetic vitamins and minerals produced through various chemical processes are not permitted to be supplemented in organic feed. Alternatively, fish feed ingredients are incorporated in such proportion that the ingredients themselves meet micronutrient requirements (Nicolae et al., 2018).

Nonnutritive feed supplements for organic feed

A. Pigments

The color of the skin and flesh of the fish is an important factor influencing customer preference and marketing acceptance of the final product. In fish, carotenoids are the primary group of pigments responsible for skin and flesh color and act as antioxidants. In the wild, fish obtain these pigments/carotenoids from natural foods. In contrast to pond culture systems, these pigments (e.g., astaxanthin and canthaxanthin) need to be supplemented in artificial feed because fish cannot synthesize carotenoids de nova, and the availability of natural food is limited in pond culture systems (Breithaupt, 2007). Currently, natural and synthetic pigments are being supplemented in fish feed for pigmentation. The use of synthetic pigments in organic feed is prohibited, so pigments originating from natural sources must be used for pigmentation of fish. Various natural pigmentation feed supplements such as algae, phaffia yeast, krill, shrimp shell, crustaceans and plant-derived products can be used as carotenoid sources in organic feed (Poli et al., 2010; Nicolae et al., 2018).

B. Immunostimulants

Antibiotics and chemicals are used as prophylactic and therapeutic agents in conventional aquaculture practice to treat disease. However, the use of antibiotics and chemicals in feed or water can lead to the development of antibiotic-resistant bacteria and the accumulation of residues in the fish body which ultimately negatively affects the environment and human health, hence use of such kind of substance in organic aquaculture is restricted. Nutrition is closely related to fish health, and many nutrients and natural feed supplement has the disease and stress-relieving properties (Sakai, 1999). Natural substances or products such as herbal extracts, probiotics, prebiotics, organic acids, or salts can be added as alternatives to antibiotics to prevent and treat disease in organic aquaculture (Mehana et al., 2015). Organically produced taurine, lactoferrin and vitamin E can also improve the immunity of fish. The use of probiotics in organic fish and shrimp farming is highly effective as it modifies the gut microbial community and boosts the immune system by controlling disease-causing pathogens (Bergleiter et al., 2009; EU, 2009; Bai and Lee, 2011).

C. Antioxidants

Antioxidants are used in fish feed to delay or inhibit nutrient oxidation. It prevents the degradation of essential nutrients like lipids, vitamins and pigments in aqua-feed and prolongs the storage period. Antioxidants can slow down or prevent cell damage caused by free radicals or unstable molecules in the body. Synthetic antioxidants are widely used in fish feed, but their use in organic aquaculture is not accepted

due to bioaccumulation and consumer health concerns. The European Union is only permitted to use natural antioxidant substances in fish feed for organic farming. There are many natural substances like vitamins, minerals, carotenoids, herbs, spices, plant extracts etc., which have antioxidant properties and are able to neutralize free radicals. Vitamin E (α-tocopherol) and vitamin C (L-ascorbic acid) is well-recognized natural antioxidants that can be supplemented in organic fish feed (Burton and Ingold, 1989). Pigments or carotenoids (such as beta-carotene, astaxanthin, and canthaxanthin) present in various plants or animals have antioxidant potential and can neutralize the harmful effects of oxidation (Breithaupt, 2007). The herb and its by-products contain many bioactive compounds (e.g., phenolic, flavonoids, volatile oils, etc.), which have intense hydrogen donating activity, thus making them highly effective antioxidants and may be used as antioxidants in organic fish feed (Garg et al., 2021).

D. Other non-nutritive feed supplements

Synthetic growth stimulators are not acceptable as an organic feed supplement. Instead of synthetic growth stimulators, naturally produced growth-enhancing substances such as probiotics, prebiotics, organic acidifiers, herbal extracts, etc., can be used in organic aquaculture (Mente et al., 2011). The use of hormones and hormone derivatives for sex manipulation or growth stimulation is against the instructions of organic fish production. The use of synthetic feed attractants and feeding simulators is also prohibited in organic aquaculture. Natural feed attractants such as glutamic acid, betaine, nucleotides, biogenic amines, algal meal are permitted in organic fish farming (Ajiboye et al., 2012). Natural feed preservatives obtained by microorganisms, plants and animals can be used as antimicrobial agents (Gould et al., 2019). Ingredients rich in starch can be used as natural binders in organic fish farming because synthetic ones are unacceptable (Lochmann et al., 2013).

4. Conclusion

Presently people are placing more emphasis on food security, human health and protection of environment which is increasing the demand for organic products. Feeds play an important role for the growth and health of fish in aquaculture practice. The production of organic fish feed is challenging as tracing the feed ingredients and feed additives produced with the following organic standard is no easy task. Only feed ingredients produced by the following organic method are allowed to prepare organic fish feed. The use of animal-based ingredients that negatively affect the environment and biodiversity is against the principle of organic aquaculture. Organic aquaculture standards allow the use of only those feed additives that are derived from natural substances without the application of chemicals.

References

1. Adámek, Z., Mössmer, M. and Hauber, M. 2019. Current principles and issues affecting organic carp (*Cyprinus carpio*) pond farming. *Aquaculture*, 512: 734261.
2. Ahmed, N., Thompson, S. and Turchini, G.M. 2020. Organic aquaculture productivity, environmental sustainability, and food security: insights from organic agriculture. *Food Security*, 45: 1-15.
3. Ajiboye, O.O., Yakubu, A.F. and Adams, T.E. 2012. A perspective on the ingestion and nutritional effects of feed additives in farmed fish species. *World Journal of Fish and Marine Sciences*, 4: 87-101.
4. Bai, S.C.C. and Lee, J.H. 2011. Global Trends of Organic Aquaculture. *Korean Journal of Organic Agriculture*, 19: 43-46.
5. Bergleiter, S. 2008. Organic aquaculture. The World of Organic Agriculture: Statistics and Emerging Trends, pp.83.
6. Bergleiter, S., Berner, N., Censkowsky, U. and Julià-Camprodon, G. 2009. Organic aquaculture 2009. Production and markets. Naturland e. V. & Organic Services GmbH.
7. Breithaupt, D.E. 2007. Modern application of xanthophylls in animal feeding–a review. *Trends in Food Science & Technology*, 18: 501-506.
8. Burton, G.W. and Ingold, K.U. 1989. Vitamin E as an in Vitro and in Vivo Antioxidant a. *Annals of the New York Academy of Sciences*, 570: 7-22.
9. EU, 2007. Council Regulation (EC) No. 834/07 of 28 June 2007 on organic production and labeling of organic products and repealing Regulation (EEC) No. 2092/91. O. J. EU L 189, 23.

More can references can be provide on request.

Made in USA

PRO 5000 WS

BIOLOGICAL WATER/SOIL QUALITY IMPROVEMENT

FOR ENQUIRIES CONTACT
+ 91-8985279999

WORLD CLASS AQUACULTURE PROBIOTIC

BIOFERA™
NATURE + SCIENCE

PRODUCT OF BIOFERA LLC, ATLANTA , USA,

The Plastic Used In Aquaculture

Email: jhamlalj@gmail.com

Jham Lal[1], Tameshwar[2], Shatrupa[3] and Shivbhajan Chandravanshi[1]

[1]College of Fisheries, Lembucherra, Central Agricultural University, Imphal

[2]College of Fisheries, Mangalore, Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar

[3]College of Fisheries, Dholi, Dr. Rajendra Prasad Central Agricultural University, Samastipur

Highlight Points

At present, the use of plastic is increasing day by day. Why plastic is very durable, strong and lasts for a long time. Plastic is used in the aquaculture sector for different purposes. Plastics used as transportation facilities as well as beneficial in another area. Plastics / polythene used in rearing facilitate, poly houses, pipes, water filter, small feeding boat, automated feeder and hand nets

ABSTRACT

The rapid expansion of the application of plastics has been experienced in all walks of life. It has been observed that the use of plastics is directly and positively related to the development of the economy. It has many applications in agriculture so also in fisheries and aquaculture. The traditional system followed "trapping and holding" of fish seeds and raising them to table size, and thus this marked the beginning of aquaculture in India (FAO, 1999).

Introduction

Plastic has found widespread application in aquaculture. Plastics are employed at all stages of aquaculture production, including tanks, nets, feed bags, liners, pipes, polystyrene boxes, product shipping, and chemical storage. Some of the most important uses of plastics in aquaculture are nylon fishnets, plastic pipe-framed and nylon net cages, pen culture in water-locked places, and so on.

Types of plastics used in aquaculture

The most popular plastics used in aquaculture include Low-Density Polyethylene (LDPE), High-Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Polypropylene (PP), Polystyrene (PS), Polyamide (nylon), Polycarbonate (PC), Acrylic (PMMA), Fibre Reinforced Plastics (FRP), and others. In India, the use of plastics in aquaculture and fisheries is quite limited. In general, plastics are used for packaging processed fish, creating crafts and gear, and so on.

Polyhouse ponds

The temperature of the water is critical for fish growth. During the winter in low-temperature zones, metabolic activity is considerably reduced, affecting fish output. Maintaining high water temperatures in ponds for fish culture growth during the winter season. In general, the temperature in polyhouse ponds is kept at a greater level, up to 4 -60 C (Mohapatra et al., 2002).

Plastic liners / Bottom sealing

Plastic liners can be installed over pond bottoms to entirely prevent seepage. Such membranes are long-lasting and can be used for many years. Their biggest downside is the expensive cost. Water leaks into and out of clay ponds. Seepage into ponds can occur when their bottoms are excavated below the water table or when a pond within a series of ponds is drained but surrounding ponds are full of water. Ponds typically face a net loss of water due to seepage, which can be significant if not remedied. Ponds built in sandy locations or on permeable soils are more likely to have high seepage rates. Ponds formed in any type of soil, however, might seep excessively if suitable building practices are not employed.

Fish transportation

When plastic bags are used, oxygen is added to water and fish. Water and fish make up one-quarter of the bag, while oxygen makes up the other three-quarters. A twisted rubber band, string, or other material is used to close the bag after introducing oxygen. When feasible, place the first plastic bag inside a second plastic bag to prevent leakage. The packed double bag of fish is then placed onto a transport vehicle in a box, woven grass bag, or another container for further protection. These containers can transport fish for up to 48 hours without needing to replace the water if properly wrapped and insulated from heat.

Use polythene in ornamental sale

In the ornamental fish trade, polythene is also used for packaging and transportation from one place to another for sale or trade. The collectors accept instructions from the whole sellers, collect ornamental fish from farmers early in the morning, and transport the fish in well-oxygenated polythene bags hung from the motorbike to arrive at the market during early trading hours (Banerjee et al., 2019). Fish can be exported directly to their final destination or

they can be transshipped. Depending on the species, fish are placed in polythene bags with air or oxygen, as well as buffers and/or bacteriostats. Species-to-species variation in packing density is significant (Watson, 2000).

Other Areas of Application

In addition, there are numerous more places where plastics can be used in aquaculture. Among them are, for example (i) Twines, threads, net webbing, monofilament, and other materials for making nets and hapas, among other things, (ii) Pipes and fittings for water supply, aeration, and drainage, (iii) Tubs, buckets, trays, basins, storage tanks, and pools for water holding, (iv) Film for pond lining to prevent seepage, making fish seed transportation bags, and live food culture, (v) FRP raceways and several other applications sometimes go overlooked yet contribute considerably to fisheries and aquaculture. (Mohapatra *et al*., 2011).

Conclusion

There is an emphasis on biodegradable plastics in terms of sustainable development, with the possibility of expanding into bio-plastics. These solutions are currently being investigated around the world. Bio-plastics might be generated from organic waste or seaweed, and these plastics could be created as part of recycling initiatives. This breakthrough allows for the creation of plastics that decompose in a couple of weeks. However, much more research is needed in this subject to better understand the obstacles and viability as a viable option, especially in terms of supporting the necessary scaling up of such manufacturing and evaluating such goods for usage in aquatic environments.

Reference:

Banerjee, S., Mahapatra, B. K. and Mondal, B. (2019). Ornamental fish trading pattern in West Bengal.

Mohapatra, B.C., S.K. Singh, Bikash Sarkar, D. Majhi, C. Moharathi and K.C. Pani, 2002. Common carp, Cyprinus carpio (L.) seed rearing in polyhouse pond environment during low temperature periods. *The Sixth Indian Fisheries Forum*, 17-20 December, 2002, CIFE, Mumbai, India, AQ- 4: 4.

Mohapatra, B .C., Sarkar, B., Barik, N. K. and Jayasankar, P. (2011). Contributions of plastics to aquaculture development. *Central Institute of Freshwater Aquaculture*, 1-12

Watson, I. (2000). The role of the ornamental fish industry in poverty alleviation. *Natural Resources Institute, Kent, UK. The project*, (V0120), 66.

DIETARY NUCLEOTIDES - FUNCTIONAL FEED ADDITIVE IN AQUAFEED

Satheesh M[a], Subashini M[b], Prasanta Jana[a,c], Gour Hari Pailan[a], Parimal Sardar[a], Mritunjoy Paul[a], Akhilesh Kumar Singh[c]

[a]ICAR-Central Institute of Fisheries Education, Mumbai, India

[b]Dr. MGR Fisheries college and Research Institute, Ponneri, TNJFU, Tamil Nadu, India

[c]College of Fisheries Science, Gumla, Birsa Agricultural University, Jharkhand, India

Email: pailangh8@gmail.com

Highlight Points

- Dietary nucleotides are important emerging functional feed additives having major role in all the biological processes in fish and crustaceans.
- Fish soluble, animal meat soluble, bacterial and yeast derivatives are considered as primary sources of dietary nucleotides.
- Fortification with dietary nucleotides in aquafeeds enhances growth, maturation, immunity, stress tolerance and gut health of aquatic animals thus increases the profit of fish farmers in a cost effective manner.

Introduction

Intensification of farming practices not only increase the cost of production but also leads to the disease outbreak due to the deterioration of water quality and increased stress level in culture environment. To control diseases various measures were followed such as vaccination, use of antibiotics, feed based therapeutics etc. Immune suppression, emergence of antibiotic resistance bacterial population generation and food safety issues were the major problems following those control measures. So the researchers are in the place of finding other options or strategies to control diseases without affecting animals, environment and humans. One of the promising alternative strategy in this concern is might be the development of functional feeds for aquaculture.

Functional feeds are having specific type of ingredients in a minimum quantity targeting for specific functions.

Unlike normal feeds, that only focuses on growth but functional feeds focusing on specific functions such as stress mitigation, health management, boost immunity etc. Various functional feed additives are now available in the market (probiotics, immunostimulants, nucleotides, phytogenic compounds). Depending upon the need, suitable feed additives were used to produce functional feed to ameliorate the specific problems found in aqua farms.

Nucleotides

Nucleotides play a major role in almost every biological process such as building blocks of nucleic acids (DNA and RNA),play a central role in cellular metabolism, as energy carriers (i.e. ATP), in cell signalling (i.e. cAMP), serves as components of coenzymes, allosteric effectors and cellular agonists. They are conditionally or semi-essential nutrients for fishes during periods of food deficiency, stress, rapid growth and immunological stress (Li and Gatlin, 2006).

Sources of Nucleotides for aquafeeds

Nucleoproteins are formed by the conjugation of protein with nucleic acid. They serve as a dietary source of nucleotides (Mateo, 2005). Fish soluble, animal protein soluble, fishmeal, legumes (adenine contents particularly high in black-eyed peas), bacteria, Yeast and yeast derivatives are rich in DNA or RNA (Clifford and Story, 1976; Devresse, 2000). Fish meal (FM) and soybean meal contains 75 and 38 ppm total nucleotide, respectively. Soybean meal and corn, oil, oilseeds and muscle protein, which are mainly composed of actin-myosin protein molecules, contain very low levels of nucleotides (Devresse, 2000). Total nucleotide content is higher in protein rich feed ingredients except soybean meal.

Effect on growth performance

Dietary nucleotide supplementation improves the growth performance of younger life stages of different finfishes and crustaceans (Do Huu *et al*., 2012). It has a great role in diet palatability, fish feeding behaviour and biosynthesis of non-essential amino acids (Ringø *et al.,* 2012). Increased growth rate, higher final weight and/or higher body length are found in shrimps (Ancieta-Probstl *et al*., 2005), crayfish (Safari *et al*., 2015) and Artemia (Madalla *et al*., 2013). Dietary nucleotide supplementation in crustacean feed showed better feed conversion rate with improved nutrient utilization and retention (Hertrampf and Mishra, 2006; Andrino *et al*., 2012).

Enhance disease resistance against pathogens

Disease resistance is measured by estimating the survival rate after challenge with certain pathogens. Dietary nucleotide supplementation can enhance resistance of fish against various pathogens including virus, bacteria and parasites, indicating nucleotides can be beneficial for health management in aquaculture (Li and Gatlin, 2006). Enhanced resistance to various pathogenic bacteria has been reported for several fish species including Nile tilapia (Barros *et al.,* 2015), salmonids (Burrells *et al.,* 2001), common carp (Sakai *et al.,* 2001), channel catfish (Welker *et al.,* 2011) and hybrid striped bass. Enhanced protection and survival of juvenile shrimp against white spot syndrome virus (WSSV) infection was found in nucleotide fed shrimps (Andrino *et al.,* 2012).

Enhancing the feed intake

Inosine monophosphate (IMP), adenosine diphosphate (ADP), guanine monophosphate (GMP), and uradine monophosphate (UMP) were reported to be effective feed attractants in carnivorous fish. Nucleotides also synergistically interact with amino acids. Effectiveness of nucleotide is species specific. UMP is effective in eels whereas ATP is effective in lobsters. Feeding stimulatory property of nucleotides increases feed intake and digestion leads to reduce the feed wastage and nitrogen discharge in water thus maintains a favourable culture environment for the animal.

Improves gut health condition

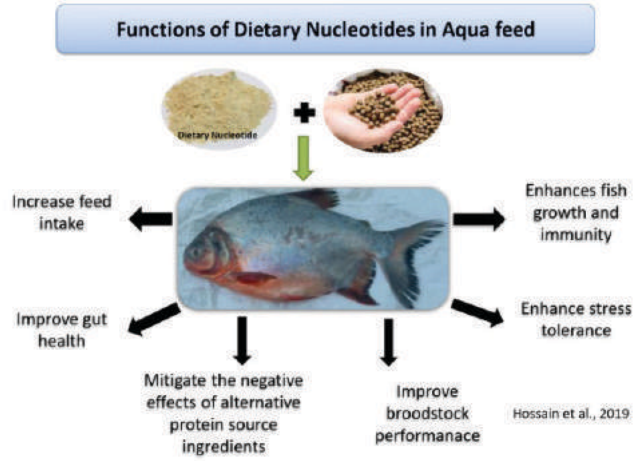
Dietary nucleotide improves gastrointestinal (GI) health of fish and shrimp through positively influencing on the physiological, morphological and microbiological status of GI tract. Supplementation of nucleotides increases intestinal fold height, microvillus and enterocyte height and also increase the growth and maturation of gastrointestinal tract. In shrimps dietary nucleotide enhance the gut intestinal structure and integrity via stimulating the intestinal growth and maturation (Do Huu, 2016) and increase in the total gut mucosal surface (Burrells *et al*., 2001) which has the positive effects on more efficient nutrient digestion and absorption. Positive effects on enzyme secretion and growth of beneficial microflora in GI tract also been reported. Increased gastric pepsin activity, intestinal trypsin and lipase activities were found in rainbow trout fed diets supplemented with nucleotide but did not influence the amylase enzyme activity (Hunt *et al.,* 2014). Intestinal microbiota of fish plays a key role in improving GI tract physiology and function and also stimulates the host immune response (Rawls *et al.,* 2006).

Enhancement of broodstock quality

Oogenesis is a process of intensive cell division with high nucleic acid formation concomitant with high requirement for nucleotides. Therefore, supplementation of broodstock diets with nucleotides was found to be beneficial in terms of improving reproductive performance. Offspring from nucleotide fed brood fish had a significantly better developed gut and first feeding success. Arshadi *et al.* (2018) reported that dietary nucleotides exhibited a positive effect on reproductive performance in shrimp (increased absolute fecundity, egg diameter, hepatopancreatic index, reduced latency period, improved fatty acid profile of ovaries, haemocyte counts as well as hemato-biochemical indices). Therefore, dietary nucleotide supplementation can promote health status and reproductive success in shrimp broodstock.

Immunomodulatory effects of dietary nucleotides

Nucleotides increases first line defence mechanism to fight against external pathogens. Up regulation of immune related gene increases innate and adaptive immunity and thus enhanced disease resistance capabilities in fish. The



modulatory effects of dietary nucleotides on lymphocyte maturation, activation and proliferation, macrophage phagocytosis, immunoglobulin responses, gut microbiota as well as genetic expression of certain cytokines have been reported in fish. Crustaceans lack an adaptive immune system and they entirely depend on non-specific immune system. Supplementation of nucleotides in shrimp diet increased the survival rate and immunity through increment in haemocyte count against bacterial (Biswas *et al*., 2012; Guo *et al*., 2016) and viral infections (Andrino *et al*., 2012) and environmental stressors like abrupt salinity change (Hertrampf, 2003).

Antistress effects of dietary nucleotides

Dietary supplementation of nucleotides serves as an antistress agent by lowering the level of stress biomarkers such as glucose and cortisol and oxidative stress enzymes such as superoxide dismutase and catalase and increased osmoregulatory capacity in fish and crustaceans (Tahmasebi-Kohyani *et al.,* 2012). Therefore, nucleotides can be used as a stress mitigating nutraceutical in aquafeed.

Utilization of alternative proteins in aquafeeds

Alternative protein sources having some negative effects on growth and health status of fishes. Dietary supplementation of nucleotides ameliorates the negative effects of alternative proteins inclusion levels and increases the nutrient utilizing capability. This leads to the production of cost effective functional feed. Supplementation of nucleotides in alternate protein based fish feeds can alter the intestinal structure, increases stress tolerance and modulate innate and adaptive immune responses in fish.

Concerns while using nucleotides in aquafeeds

Impairment of liver, intestinal disorder and immune depression in animals were reported when diet is deficient in nucleotides. On the other hand excessive concentration of dietary nucleotides reported to be toxic and reduces the growth performance and nutrient utilization by the crustaceans. However, nucleotide requirement is higher at early stages of prawn (Huu *et al.,* 2012). Efficacy of dietary nucleotides varies with the cultured species with different feeding behaviour such as carnivore, herbivore and omnivore. Carnivorous fishes showed positive results with dietary nucleotide supplementation while omnivorous or herbivorous fishes showed only marginal effects (Welker *et al.,* 2011). This variation occurs due to the differences in the nucleotide synthesis and physio-metabolic regulation of various fish species.

Conclusion and future perspectives

Cost of functional feed is mainly depends on the cost of functional feed additives. Depending on the source, production technology and purity of dietary nucleotide cost will vary (Hossain *et al.,* 2016). Now researchers focusing on dietary nucleotide production from different sources such as yeast, bacterial sources, fish meal, soybean meal and from other alternative feed ingredients in a cost effective manner. Dosage of the dietary nucleotide will vary from species to species. Functional feed additives and their derivatives were showed positive effects on the health status of fish. Most importantly the leaching property of functional feed additives and cost of the functional additive were the two major constraints and it is needed to be evaluated.

References

Ancieta-Probstl, D. K., Smullen, R. P., & Barnes, A. C. (2005). Enhancing growth performance of shrimp with nucleotide-supplemented diets. *Aquaculture Asia Pacific*, *1*, 26-28.

Andrino, K. G. S., Serrano Jr, A. E., & CorreJr, V. L. (2012). Effects of dietary nucleotides on the immune response and growth of juvenile Pacific white shrimp *Litopenaeus vannamei* (Boone, 1931). *Asian Fisheries Science*, *25*, 180-192.

Arshadi, A., Yavari, V., Oujifard, A., Mousavi, S. M., Gisbert, E., & Mozanzadeh, M. T. (2018). Dietary nucleotide mixture effects on reproductive and performance, ovary fatty acid profile and biochemical parameters of female Pacific shrimp *Litopenaeus vannamei. Aquaculture Nutrition*, *24*(1), 515-523. https://doi.org/10.1111/anu.12584

Barros, M. M., Guimarães, I. G., Pezzato, L. E., de Oliveira Orsi, R., Fernandes Junior, A. C., Teixeira, C. P., ... & Padovani, C. R. (2015). The effects of dietary nucleotide mixture on growth performance, haematological and immunological parameters of Nile tilapia. *Aquaculture Research*, *46*(4), 987-993. https://doi.org/10.1111/are.12229

Biswas, G., Korenaga, H., Nagamine, R., Kono, T., Shimokawa, H., Itami, T., & Sakai, M. (2012). Immune stimulant effects of a nucleotide-rich baker's yeast extract in the kuruma shrimp, *Marsupenaeus japonicus. Aquaculture*, *366*, 40-45. https://doi.org/10.1016/j.aquaculture.2012.09.001

Burrells, C., Williams, P. D., & Forno, P. F. (2001). Dietary nucleotides: a novel supplement in fish feeds: 1. Effects on resistance to disease in salmonids. *Aquaculture*, *199*(1-2), 159-169. https://doi.org/10.1016/S0044-8486(01)00577-4

Burrells, C., Williams, P. D., Southgate, P. J., & Wadsworth, S. L. (2001). Dietary nucleotides: a novel supplement in fish feeds: 2. Effects on vaccination, salt water transfer, growth rates and physiology of Atlantic salmon (*Salmosalar L.*). *Aquaculture*, *199*(1-2), 171-184. https://doi.org/10.1016/S0044-8486(01)00576-2

More can references can be provide on request.

Postal Regn. No. HD/1068/2021-2023
Published on 7 April 2022