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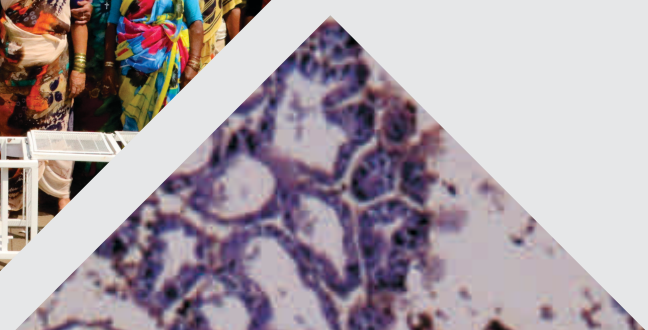
CIFE Technologies & Innovative Products for Fish Farmers and Entrepreneurs



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PREFACE

We are delighted to present this booklet showcasing "CIFE Technologies & Innovative Products for Fish Farmers and Entrepreneurs," a compilation of advancements developed by ICAR – CIFE, Mumbai. Previously, the institute released booklets and leaflets featuring available technologies, warmly received by farmers and entrepreneurs. It brings us joy to see some of these technologies from the prior publications successfully commercialized.

This updated edition of our booklet features the latest advancements in aquaculture, breeding, feed technology, health management, genetics, and processing developed by CIFE. Our aim is to make these technologies readily accessible to a broad audience, including fish farmers, entrepreneurs, and developmental agencies. Each technology is accompanied by a brief description, information on its applicability, and its economic viability.

Our primary objective in publishing this booklet is to facilitate the transfer of technology from the laboratory to practical application in the field or industry. It's a recognized challenge that many technologies developed by research institutes fail to reach their intended users. We sincerely hope that this booklet will empower end-users to adopt these valuable innovations.

I would like to extend my commendation to all the researchers involved in the development of these technologies, as well as express my appreciation to Dr. S.P. Shukla, Officer-in-charge of ITMU, and his team for their outstanding efforts in compiling this technology profile.

Dr. Ravishankar C. N.
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ICAR-CIFE MUMBAI
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I. PRODUCTION RELATED TECHNOLOGIES IN INLAND SALINE AREAS

Technology No. 1

CULTURE OF PACIFIC WHITE SHRIMP, *Litopenaeus vannamei* IN INLAND SALINE WATER

Inventors: Dr. A.K. Reddy, Dr. V. Harikrishna, Dr. P.S. Ananthan and Dr. W.S. Lakra

Division: Aquaculture

Technical details:

- Shrimp culture is traditionally practiced in coastal areas across India. It can also be done in some inland areas where ground saline water (IGSW) is available BUT ONLY with appropriate technology developed by ICAR-CIFE.
- 40% (2.2 million ha) of the salt-affected soils in India that lie in Haryana, Punjab, U.P., Delhi and Rajasthan have become less productive or increasingly unfit for crop cultivation.
- Since the IGSW different from natural seawater with regard to potassium, calcium and magnesium, it is very important to manipulate the ionic compositions to bring them within the optimum range.
- ICAR-CIFE has innovated and perfected a cost-effective solution to alter / amend the IGSW to make shrimp culture feasible and viable in inland saline ecosystem.
- The technology was demonstrated successfully in CIFE's Rohtak farm during 2012-13 and in farmers field during 2013-14.

5. Geographical area of use: Inland areas affected with saline soil

(ICAR-CIFE Rohtak centre is located in Lahli Village, Rohtak, Haryana. The centre is located about 15 km from Rohtak city on Rohtak – Bhiwani road)

6. Approximate Number of users: > 450 Farmers

7. Impact, if any:

- ICAR-CIFE's technology adoption and spread has kept doubling every year during the last 5 years across Haryana, Punjab, Rajasthan and Delhi.
- In 2019, about 450+ farmers have adopted the technology in about 1000 acres with production estimated to be nearly 2000 tons.

Salient features of the technology

- Shrimp farming in inland states of Haryana and Punjab is already a success story with the technology being hailed and appreciated by farmers, Fisheries Departments and Chief Ministers as well as institutions such as NABARD.
- The *cumulative revenue generated from the technology during the last 5 years of technology spread (2013-2018) is estimated to be nearly 600 crores which would only increase multiple fold in the coming years*. It far outweighs the investments in R&D / technology development.
- Apart from generating avenues of direct employment, technology has also led to generation of indirect employment through development of supporting industries like icing, transportation, netting, feed and chemical marketing. It is estimated that each acre of *shrimp farming generates about gainful employment for 4 people directly and 2 people indirectly* which is a great boon, given the otherwise unproductive lands that supports no employment as of now. It is expected that in future the technology will have a huge impact in the development of rural economy and livelihood generation (through support industry namely icing, transportation, netting, production and marketing of shrimp feed and chemicals).

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Technology No. 2

TIGER SHRIMP FARMING IN SALINE AFFECTED AREAS

Inventors: Dr. A.K. Reddy and Mr. Chandra Prakash

Division: Aquaculture

Technical details:

Tiger shrimp (*Penaeus monodon*) grows in sea/brackish water is considered as the best marine shrimp in terms of growth, meat quality and market demand globally. Tiger shrimp farming is limited to coastal states in India as its culture is practiced only in brackish water. CIFE however has demonstrated that this shrimp can be commercially farmed in inland saline lands using underlying saline water. This has opened new avenues for utilization of waste saline lands and ground saline water for a profitable venture.

Description of technology:

Tiger shrimp do not survive in inland saline water due to difference in the chemistry with that of seawater. The cause of mortality was assessed through bioassay trials and it was found that poor concentration of potassium in saline water is mainly responsible for mortality. Based on indoor experiments, field trials were carried out at high saline Baniyani Farm (Rohtak Centre, CIFE) during 2008 in two non-drainable ponds of size 0.25 ha, each lined with polyethene sheets to prevent seepage and placed with 0.30 m thick layer of soil. These ponds were fed ground saline water from a bore well of salinity 12 ppt. The level of potassium was enhanced in saline water by adding muriate of potash (fertilizer grade) around 50 percent equivalents to coastal seawater. The methods of husbandry remained the same as that of coastal farms. A production 1680 kg/ha in 110 days at a stocking density of 10 PLs/ m^2 could be obtained. During 2012, grow-out trials of tiger shrimp were carried out in low saline (2-4 ppt) area of Lahli Farm (Rohtak Centre, CIFE) at a stocking density of 10 PLs/ m^2 and achieved a production of 2.2 ton/ ha in 150 days.

Technology benefits:

Interception of ground saline water and utilization in aquaculture ponds will lower down the ground table and help in soil improvement and reduction in secondary salinization. Since inland saline water is drawn from deep bore wells, it is pathogen free and bio-secure. Like agriculture, a crop of tiger shrimp is of 4-months duration and hence farmers may harness returns in a short time and can take two crops in a year during 8-months warmer climate (March- November).

Target geographical area:

The technology is highly suitable for the farmers of north-western India whose lands have become saline and where agriculture productivity is poor or zero.

Financial aspects:

1.	Capital cost	: Rs. 8,00,000
2.	Fixed cost	
	Instalment of loan	: Rs. 1,14,280
	Interest of capital	: Rs. 96,000
	Sub-total	: Rs. 2,10,280
3.	Variable cost	
	Seed (2 lakh numbers per two crops)	: Rs. 90,000
	Feed (2 crops)	: Rs. 2,79,939
	Other miscellaneous	: Rs. 2,00,000
	Sub-total	: Rs. 5,69,939
4.	Gross income (Sale of 4 tones/ 2 crops)	: Rs. 12,00,000
5.	Total (2+3)	: Rs. 7,80,216
6.	Net income (4-5)	: Rs. 4,19,784

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Technology No. 3

A METHOD FOR RECLAMATION OF SALT EFFECTED SUGARCANE FIELDS THROUGH SUB-SURFACE DRAINAGE SYSTEM AND AQUACULTURE

Inventors: Dr. A.K. Reddy, Dr. W.S. Lakra and Mr. Chandrakant M.H.

Division: Aquaculture

Technical details:

The technology relates to the development of a sub-surface drainage (SSD) system connected to an aquaculture pond, wherein the sub-surface drain water enhances the natural productivity of fish. Further, to install a sub-surface drainage system it is necessary for the soil to be permeable along with the gravity or availability of any artificial system. Implementation of innovative integrated technology for reclamation of salt-affect sugarcane fields through aquaculture and sub-surface drainage system will enhance the sugarcane production from the existing average production of 15 tonnes to 50 tonnes per 0.4 ha. The soils get its original status and help to achieve sustainable production of sugarcane which improves socio-economic condition of farmers and avoid migration of farmers.

Salient features of the technology:

- This technology overcomes the hurdle of high cost and also the wastage of land.
- In the instant system, the salts are leached at a faster rate (it requires less than one year to leach out excess salts from soil), into the aquaculture pond which is close to the system and is an integral part within the experimental field.
- Water collected in the pond is utilized for culture of fish which provides substantial additional income to the farmers.
- It also enhances the growth of vegetation and improves the soil environment.

Transferred to Maharashtra, Pune, Satara, Sangli and Kolhapur through training and installed sub surface drainage system through pilot scale project (NAIP)

	
Before SSD	Improved sugarcane crop after SSD
	
Fish tank	Fish harvest

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(Package of practices, novel feeds, machinery and genetic management)

Technology No. 4

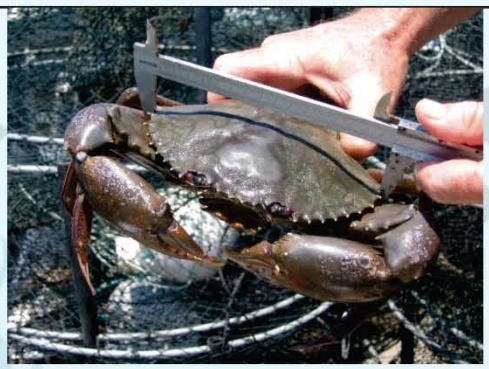
MUD CRAB FATTENING

Inventors: Dr. G. Venugopal, Dr. S.S.H. Razni, Dr. A. Muralidhar

Division: Aquaculture

Technical details

Owing to domestic as well as export demand, the crab culture has gained momentum. CIFE, Mumbai has initiated as package of practices for crab culture and fattening using two major varieties of crabs, *Scylla serrata* and *Scylla tranquabarica* with variable stocking densities.



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Technology No. 5

ORGANIC AQUACULTURE THROUGH BIOFERTILIZER

Inventors: P. K. Pandey, C. S. Purushothaman, A. Vennila

Division: Aquatic Environment and Health Management Division

Technical details:

Nitrogen and phosphorus play a very important role in primary production. These nutrients are provided in aquaculture system from external sources in the form of organic manures and inorganic fertilizers. Certain organisms are capable of fixing atmospheric nitrogen and are capable of producing enzyme phosphatase. Large scale culture of nitrogen-fixing bacteria *Azetobacter chroococcum* and phosphatase-producing, *Bacillus* species are carried out separately. After achieving the density of 10^9 c.f.u./ml, broth culture of these bacteria are inoculated in sterilized and moist charcoal at room temperature to get 10^6-10^9 c.f.u./g of charcoal. Its shelf life is three months. It can be applied at the interval of 15 days in freshwater carp culture ponds.

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Technology No. 6

GIANT FRESHWATER PRAWN SEED PRODUCTION USING ARTIFICIAL SEA WATER

Inventors: Dr. A.K. Reddy & Dr. Chandra Prakash

Division: Aquaculture

Technical details:

Giant freshwater prawn, *Macrobrachium rosenbergii* has vast potential resources for its culture in both maritime as well as inland states including North Eastern States. Desired quantity of quality seeds at desired time is one of the major constraints for expansion of prawn farming particularly in the inland states. Giant freshwater prawn needs 12 ppt saline water to complete its life cycle. The requirement of saline water hampers the establishment of giant prawn hatcheries in the inland states. Keeping in view of this the CIFE, Mumbai has developed a technology for establishment of hatcheries in the inland states by using artificial sea water.

Description of technology:

In order to meet the requirement of saline water for completion of life cycle of giant fresh water prawn, a chemical formula was prepared with six major, six minor and six trace salts to prepare artificial sea water. Since most of the minerals and trace salts are available in natural fresh water, a simple formula with seven major salts is prepared. Initially laboratory grade chemicals were used for preparation of artificial sea water. Keeping in view of the economic feasibility of the technology, commercial grade salts are in use for the preparation of artificial saline water of 12 ppt. In order to prepare artificial sea water desired quantity of filtered fresh water is filled in a thoroughly cleaned tank. Size of the tank and volume of water depends on the production capacity of hatchery. After filling water, desired quantity of various salts to be calculated, weighed and kept ready. The salts should be mixed one after other with thorough aeration and to be kept for two- three days with aeration. Then water is filtered and used for the operation of giant fresh water prawn hatchery. The hatchery operation is same as followed in the natural sea water hatchery. The hatchery can be operated by following either flow through or recirculatory systems. In flow through system, in order to use water economically the siphoned water is collected in a separate tank for treatment and reused in the hatchery operation. Supernatant water from used water tank is pumped into a separate tank provided with biological filter attached to recirculatory system for a period of one week. This helps in removal of ammonia and nitrite from the used water. This water can be used in regular hatchery operation. If water quality is maintained properly, the same water can be used for a period of three year or even more with salinity adjustment by adding fresh water, if necessary.

Commercialized to Department of Fisheries, Assam

Technology benefits:

The establishment of prawn hatcheries in the inland states will help in production of quality seed locally and enhance the productivity which in turn improves the socio-economic status of farmers and entrepreneurs. Various government and semi-government organizations, corporate sector, NGOs, entrepreneurs and farmers can get benefit out of this technology.

Commercialization status:

The technology was developed and demonstrated on experimental scale in the states of Maharashtra, Madhya Pradesh, Uttar Pradesh, Assam, Karnataka, Orissa, Kerela, Andhra Pradesh and West Bengal. Giant freshwater prawn hatcheries using artificial sea water have been established in the states of Tripura, Chattishgarh, Madhya Pradesh, Nagaland and Manipur. MoU has been signed between Department of fisheries, Government of Assam and this institute for establishment of three prawn hatcheries in Assam. One hatchery has been established in Guwahatti and the other two hatcheries are under construction at Silchar and Dubri. Another proposal is also in progress for establishment of a giant freshwater prawn hatchery in Bihar and Uttar Pradesh.

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Technology No. 7

CATFISH HATCHERY AND REARING OF SEED UNDER THREE TIER SYSTEM

Inventors: Dr. C. S. Chaturvedi, Dr. W. S. Lakra, Dr. Arpita Sharma and Dr. Asha Landge

Division: Aquaculture

Technical details:

Catfish seed production is essential for species diversification in freshwater aquaculture. Catfish seed is collected naturally from paddy field or swampy areas. However, there is a big gap between supply and demand. During transportation of seed, high rate of mortality occurs due to fluctuation in water parameters like temperature, pH, dissolved Oxygen etc. CIFE has developed a new model catfish hatchery comprises of three tier rearing system.

Salient feature:

- Mature catfishes released into cemented/ fiberglass breeding circular tank for mating to obtained eggs. Under optimum environmental conditions fertilized eggs hatch within 26-28 hours.
- Hatchlings then transfer to the rearing system which comprises of three tier system
- From hatchery unit hatchlings transfer to the first-tier system, where hatchlings took 4-7 days to reach early fry.
- Followed by transferring early fry to second tier system, where early fry reach post fry stage in 7-12 days.
- Then post fry fish transferred to the third-tier system where post fry grows to fingerling stage within 16 – 23 days. Fingerlings can be reared in this system for 30 days.

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Technology No. 8

CONTROLLED BREEDING AND SEED PRODUCTION OF PENGBA, *Osteobrama belangeri* – AN ENDANGERED FISH

Inventors: Dr. A.K. Reddy & Dr. W.S. Lakra

Division: Aquaculture

Technical details:

Pengba, *Osteobrama belangeri* is a native fish of Myanmar and migrated to Manipur, India from River Chinwin of Burma to River Manipur. This fish remained in the river systems of Manipur and Loktak Lake and became an esteemed fish of Manipur. Pengba is 'State Fish' of Manipur and is not available in any other North Eastern States. The fish fetches very high price, ranging from Rs. 300-400/kg. It is placed under endangered category. It is herbivorous and can be utilized for control of aquatic weeds. To establish the culture of this species, desired quantity of seed is essential. The CIFE has been developed the breeding and seed rearing technologies on semi-commercial scale.

Description of Technology:

A few numbers of pengba fry were brought by CIFE from Manipur during 2006. The fry were grown to fingerling stage and portions were supplied to CIFE centre, Powarkheda and CIFE centre, Kakinada during 2007. The fingerlings were grown to adult stage. The breeding technique is similar to that of carps. The matured Pengba were successfully bred by using 'Ovatide' and 'Ovaprim' spawning agents. The females and males were simultaneously injected at the rate of 0.30 -0.40 ml and 0.20-0.30 ml per kg body weight of fish respectively. A total of more than 10 lakh spawn were produced at CIFE, Mumbai; CIFE, Kakinada Centre and CIFE, Pawarkheda Centre. Out of this, more than 4,00,000 fry and 50,000 fingerlings were supplied to the farmers of Andhra Pradesh for grow out trials. Some of the stock is maintaining at CIFE, Mumbai and its Regional Centers for undertaking breeding and seed production programmes regularly.

Technology Benefits:

As pengba, *O. belangeri* was placed under endangered category, the technology of breeding and, rearing fry and fingerlings will be helpful in conservation of natural resources and provides desired quantity of quality seed to the farmers and helps in getting better income to the growers due to its high value.

Technology is Transfer to Andhra Pradesh Fisheries Department

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Technology No. 9

RAISING OF FISH SEED IN CAGES

Inventors: Dr. M.P. Singh Kohli, Dr. Kiran Dube & Dr. A.K. Reddy

Division: Aquaculture

Technical details:

Average fish production from the Indian reservoirs is about 15 kg/ha. If a proper stocking is taken up in open water bodies, this production can easily increase up to 100 kg/ha. For optimum fish production from reservoirs, lakes, ponds, bheels etc, it is necessary to stock them with healthy fingerlings of above 100 mm size. Thus, cage culture offers in situ rearing of fry to fingerling before releasing them into the reservoirs and becomes the best option available for enhancement of fish production from large water bodies.

Description of technology:

Webbing of the cages is made of HDPE (high density polyethylene). Mesh size of 6 to 8 mm and cage size of 3m×3m×3m are ideal for large and deeper open water bodies. The frame of the cage can be constructed from bamboo, teak or Sal wood (preferably water resistant and light wood). Nut, bolts or other fasteners used to construct the cage should be of rust-resistant material. The frame should be wide enough (1.5 to 2.0 ft) to support the cages and provide a working platform on the cages. This framework is also provided with HDPE barrels functioning as floats. Net cages are allowed at 1.0 meter above the water level and fixed with ropes to four corners of the poles. Each cage is also covered from the top by using the same material. Bottom periphery of the cage is provided with sinkers so as to keep them stretched. Corners of each cage unit are provided with anchors to keep the cage infrastructure stationery at a definite location in the water body. Stocking of fish is done with fry of length, 35 mm at a stocking density of 50-200 fry/m^3. 60 days of raising period is adequate for raising carp fingerlings in cages. It is advised to clean the webbing at weekly interval by brushing. Biofouling organisms such as algae, sponges and debris, if allowed, will obstruct the water exchange in the cages. Feeding of fish in cages is necessary for higher yield especially if productivity of the reservoir is poor. Formulated feed (rice bran 10%, GOC 40%, maize 7%, soybean 20%, Acetes 20%, vitamin mix 2%, mineral mix 1%) should be given to the fish (carps) at 3-5% of body weight, at least twice a day. At the end of 60 days, 100 to 120 mm sized fingerlings can be harvested. Three or four persons can manage to harvest one fish cage by lifting the net using four corner ropes attached up to the bottom of each cage. All fishes can be pushed at one corner of the cage to scoop out the confined fish at one end of the net and place them in buckets.

Technology benefits:

The production of fingerlings through cage aquaculture will improve country`s production in two ways

(I) by regularly stocking open water bodies like lakes and reservoirs with desired varieties of fingerlings and thereby improving fish catch from these water bodies

(ii) by culture of fish in ponds

Fish farmers, fishers, cooperative societies, community depending on the reservoir fishery or other open water bodies will be benefited through generation of income and livelihood by application of this technology.

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Technology No. 10

NON-INBRED SEED PRODUCTION OF CARP

Division: Aquaculture

Technical details:

The technique is employed to produce non inbred seed of carps by crossing genetic lines/ parents from unrelated ancestry with superior records. Progeny thus produced is suitable to be developed as future brood stock for further propagation. Suitable breeding plans are also suggested to exploit the genetic potential.

Description of technology:

The parent stocks are maintained at a central breeding farm. Fry and fingerlings of the carps (rohu) are provided to the government / private hatchery owners who further produce the seed propagation. The fingerlings are tagged so that their growth can be monitored. Based on the identification of the individuals, breeding plan is given for further reproduction. The record of the progeny and the farmers to whom these are provided are maintained. Growth of the stock is monitored and productivity can be evidenced by comparing with other stock. Along with this, the hatchery managers are advised on how to raise the brood stock and develop the seed. Tagging, recording the performance of progeny and replacement of the brood stock is streamlined for further research on brood stock development and management for quality seed production.

Technology benefits:

Hatchery manager will be in a position to maintain the stock of high quality. Fry and fingerlings will not exhibit inbreeding depression with respect to major economic traits. In turn, the farmers get the advantage of the technique.

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Technology No. 11

BREEDING TECHNOLOGY FOR LOACH (*Lepidocephalichthys berdmorei*)

Inventors: Dr. Sukham Munilkumar; Dr. Makamguang Kamei; Dr. Ch. Basudha Devi; Dr. Subrata Dasgupta; Dr. Paramita Banerjee Sawant; Mr. W. Romen Mangang

Division: Aquaculture Division

Technical details:

The technology is related to captive maturation and breeding of a loach, *Lepidocephalichthys berdmorei* (Blyth, 1860). The fish is of immense economic and cultural importance in south Asian countries like Myanmar, India and Bangladesh. It is traded as ornamental fish valued at around 0.3 USD per fish and these are sold in local market as food fish for ₹.1200/kg in northeast Indian states. The technology involves the captive maturation of the fish in specially designed tank for water filtration and recirculation under controlled photo-period, fed with specially formulated semi moist diet. The larval rearing consists of a feeding regime with micro algae and zooplankton which are cultured separately.

Application:

To produce fry of *Lepidocephalichthys berdmorei* as ornamental fish

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Technology No. 12

CIFE FLOC-BOOSTER

Inventors: Dr. Babitha Rani A. M. and Ms. Sushree Sangeeta Dey

Division: Aquaculture

Technical details:

Biofloc technology (BFT) is a zero-water exchange sustainable technology for high density aquaculture system. However, it has limitation of requirement of long start-up time. Thus, a novel biofloc media was developed with an intent to accelerate biofloc development within a reduced span of time. It is a ready-to-use novel biofloc media for the aquaculture farmers using BFT. It is composed of soil for nucleation site, ammonium sulfate as nitrogen source, Jaggery as carbon:nitrogen manipulator, chitosan as bioflocculating agent, cationic starch as bioflocculating catalyst, vitamin-mineral mixture and yeast as fermenting agent. When this novel media is used for inoculum in a tropical freshwater aquaculture tank, it develops biofloc instantly within 3-5 days. It reduces the starter time, which was a key drawback of biofloc technology. It improves the nutritional quality of biofloc, which forms in-situ food for the culture species. It enhances the growth, survival, and immunity of fish at higher stocking density. Considering all these salient features, it is named as "CIFE FLOC-BOOSTER".

Salient Features

- Accelerate floc development instantly within 3-5 days.
- Ameliorates water quality expeditiously.
- Improves nutritional quality of biofloc.
- Enhance the growth and immunity of fish.
- No sludge removal is required upto 75 days.

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Technology No. 13

CIFE-ECO HATCHERY

Inventors: Dr. A. K. Verma and Dr. V. K. Tiwari

Division: Aquaculture

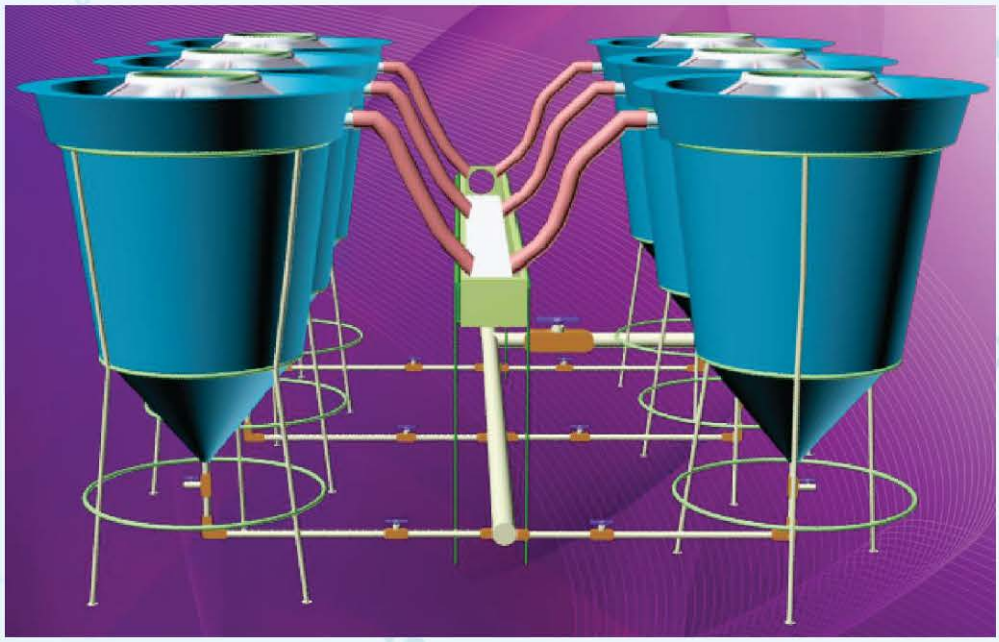
Technical details:

The need for development of hatcheries was emphasized so as to achieve maximum production of fish seed from the huge quantities of eggs produced by the hypophysation technique. The present prevalent practice for incubation and hatching of carp eggs is to use the circular hatchery but due to horizontal flow of water in the hatchery, sometimes, eggs do not get separated resulting into low survival rates of spawns. A hatchery unit was developed which includes 6 FRP Jars that have conical shape are connected by inlet and outlet pipes with control valves. Water enters the jars from the bottom and comes out through an outlet provided at the top maintaining vertical flow of water in the jar, which bobs up the eggs continuously to avoid settlement of eggs at the bottom; and finally leads to hatching of eggs. In order to prevent the escaping of eggs and hatchlings/ spawn from the jar, dispose off the dissolved waste and free flow of water, MS flat framed cone shaped skeleton fitted with fine cloth mesh (40 micron) fits in the groove on the inner wall of the jar at a depth of 44 cm from the top of the Jar.

Salient features of the technology

1. Low cost of establishment
2. Maintenance free long life due to FRP material
3. Low water requirement compared to circular concrete hatchery
4. Less man power requirement and negligible recurring expenditure
5. Ease in operation due to simple technology
6. Low mortality rate of hatchings at all stages of larval life of eggs, better water quality parameters, and control unforeseen hazards
7. Low water pollution and better aeration due to running water
8. Performance of hatchery is least affected due to Sun and rain as the hatchery unit is established under roof
9. Ease in establishment due to its portability (as FRP jars are light weighted) and also ease in handling and harvesting of spawn
10. The larvae will be collected automatically into the spawnery by gravity.
11. More than 90% hatching success and survival of spawn

Cost/ Benefit ratio: 2 – 2.5



Commercialized to TEEWAVE Pvt. Ltd Andhra Pradesh

Patent No. IN369476 Granted on 17th June 2021

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Technology No. 14

DESIGN OF DOUBLE COMPARTMENT DEVICE FOR MICRO AND MACRO PLASTIC ENTRAPMENT IN FLOWING WATER

Inventors: Mr. Manickavasagam, S.; Dr. Satya Prakash Shukla; Dr. Kundan Kumar; Dr. Saurav Kumar; Dr. G.R. Bhuvanesvari

Division: Aquatic Environment and Health Management Division

Technical Details

The debris and plastic collection device consist of two chambers made of laminated aluminium. Each chamber is fitted with a movable flap of bakelite at the proximal end and a double layer collection pouch of nylon net at the distal end. The bakelite flap moved inward during the flow of water in the chamber however, a reverse movement is checked by fixing a stopper on the lower arm of the frame. This facilitated the opening of chamber during a unidirectional flow of water during high and low tide conditions. The collection pouch had chambers made of two layers of nylon mesh of 5mm and 0.5 mm, respectively. The inner chamber (5mm pore size) collected the debris and plastic of 5mm and above however, the outer chamber collected the plastic and debris of 0.5mm or less. The collection pouches are attached to main frame of the chamber and can be removed after they are filled with the debris and plastics. The aluminium device has a mouth opening (260cm×65cm) fitted with two flaps of size (125 X60 cm) to prevent the escape of plastic debris during reverse flow of water. These flaps act like a door during water ingress into the unit. The thickness of bakelite flap is 3mm thickness for smooth movement during tides. The sides of the bakelite flaps are covered with aluminium layer.

Cost-Benefit Ratio: Cost of the device can vary from 15,000/- to 3,00,000/- depending upon the size of entrapment compartment of the device.

Objective of the product / technology:

- To develop device for the removal of plastic (micro, macro and mega) flowing in the sea water.

Application:

Microplastics were identified on the size basis (less than 5mm). Mega and macroplastics were quantified on weight basis. The plastic material was separated from debris manually, washed with clean water (to remove adhered particles) and sun dried for evaporation of water. The dried plastics were weighed for quantification. The entrapped debris containing plastics was collected from the pouches attached to both the compartments of the unit.

Microplastic, macro- and megaplastic collected in the lower compartment of the device during post-high tide duration . The upper compartment shows the plastic and floating debris collected during high tide

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Technology No. 15

ELECTRICAL DEVICE WITH CHARGED COLUMN FOR DE-CONTAMINATION OF WATER

Inventors: Dr. S.P. Shukla; Dr. Sanath Kumar; Dr. Vidya Shree Bharati; Dr. Kundan Kumar; Dr. Saurav Kumar; Dr. Nalini Poojary

Division: Aquatic Environment and Health Management Division

Technical details:

The filtration unit designed for the treatment of low-quality water by removal of contaminants from water is based on an electrically charged column matrix with physically entrapped adsorbents with specific type of algal compounds to enhance their adsortion capacity is developed by CIFE. The column matrix consists of 4 layers of a porous non-toxic, non-biodegradable, non-corrosive material. A gradient of electric fields is generated in the matrix by placing the positive and negative terminals of a DC supply at the opposite ends of the column.

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Technology No. 16

ELECTRO-REMOVAL TECHNOLOGY USING A COLUMN BED FILTRATION DEVICE FOR FLUORIDE REMOVAL FROM GROUND WATER

Inventors: Dr. S.P. Shukla; Mr. Milind Girkar; Dr. V.S. Bharti, Dr. Kundan Kumar; Dr. Saurav Kumar

Division: Aquatic Environment and Health Management

Technical details:

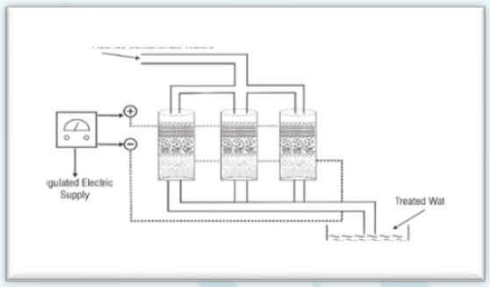
Fluoride pollution is caused by many industries, including those producing glass, ceramics, semiconductors, electroplate coal-fired power plants, beryllium extraction factories, brick and ironworks, and aluminium smelters. Fluoride concentrations in these enterprises' effluents were higher than those found naturally, which range from ten to thousands of mg/L. At least 20-25 countries worldwide have an endemic problem with fluoride contamination of groundwater.

The technology is related a process of physical entrapment of the adsorbents with high affinity for binding with fluoride. The adsorbents are entrapped in a porous matrix and immobilized on the walls of the pores of the matrix using a hydrophobic compound as an immobilizing agent. Successive layers of adsorbent coated matrix and pre-treated biochar were packed in three vertical columns with a common inlet and outlet. The fluoride removal rate was further enhanced by adding two electrodes at the top and bottom layer of the column bed. The ground water contaminated with fluoride is passed at a particular flow-rate through the column. The field trials of the developed technology in four villages of Maharashtra are completed. The developed filtration system removed 50-86 % fluoride from groundwater in the trails conducted in eight villages of Latur, Nanded and Yavatmal Districts. This is first technology where enhanced fluoride removal can be achieved through an electrically charged column filtration system.

Saving of water, labour, time and energy: Higher water efficiency than traditional water filtration system; Comparative less labour intensive and time consuming; lower energy consumption

Application:

- No similar product or design is available in market for fluoride removal from the water.
- The unique feature of the technology is its column bed configuration. The use of chemically modified biochar from agro-waste is a novel approach to reduce the cost.
- The pellet-based column bed is not used so far for fluoride removal from ground water
- The column filtration system is suitable for fluoride removal from ground water
- The units can be up-scaled to desired capacity by expanding column bed.



Prototypes of electrically charged column bed with capacity 1200-6000 L per hour

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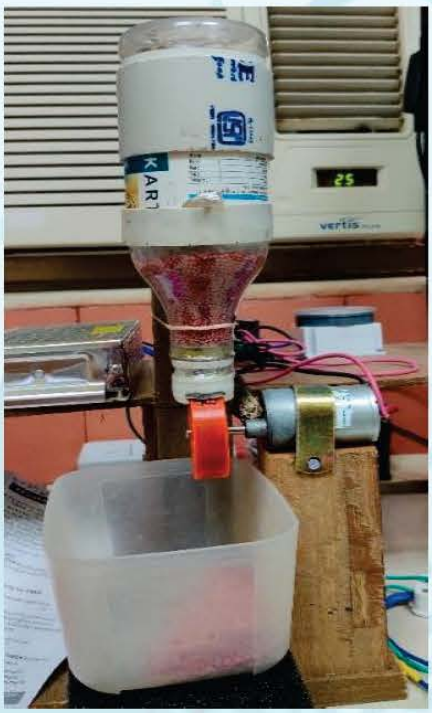
Technology No. 17

PROTOTYPE AUTOMATIC FEEDER FOR AQUACULTURE

Inventors: Dr. A.K. Verma, Dr. B. B. Nayak, Dr. Chandrakant, M.H.

Division: Aquaculture

Technical details



The timer based automatic fish feeder is designed to supply food to fish / aquatic animals at appropriate time (or at regular intervals of time) in preferred quantity so as to avoid wastage of food and minimize the production of unwanted toxic pollutants like ammonia in any given aquatic system including aquaria. The automatic fish feeder is a device made up of PVC or FRP bottle / container mounted on a support structure with its mouth put upside down as shown in the figure. The container is designed to hold the pre-decided quantity of fish-feed.

Salient features of the technology

- It dispenses exact amount of feed at exact time at a designated location it is fixed
- Quantity and time specific adjustments are possible. However, prototype is designed for 2 to 10 g feed per day.
- Multiple time dispensation, causes the maintenance of feed integrity in water and may improve consumption
- Due to exactness of feed, the wastage of feed is minimized while water quality increases

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Technology No. 18

TIMER-BASED POWER OPERATED PROTOTYPE WATER FILTRATION SYSTEM FOR AQUACULTURE

Inventors: Dr. A.K. Verma, Dr. Chandrakant, M.H., Dr. B. B. Nayak

Division: Aquaculture

Technical details:

Aquaculture industry is progressing quickly over the past few decades. This rapid growth has resulted in competition for natural resources i.e. land and water. Apart from strong annual growth, the culture of fish over the past few decades has also been strongly intensified. This intensification has significant drawbacks such as an increased environmental impact due to larger amount of waste discharged in the form of effluent. Aquaculture, like other animal- production sector generates biological wastes but unlike other sectors, the aquatic animals cannot separate their living space from their area of excretion. This causes deterioration in water quality due to ammonical excretion inside the aquaculture production system leading to poor growth and an increase in the incidences of diseases. Management of the waste generated from aquaculture is quite difficult and costly as the waste disintegrated becomes diluted in the culture water. Treatment of wastewater demands large investment and sophisticated equipment. Feed is the main source of waste and is also responsible for most of the environmental impact of aquaculture, and water quality is a critical factor when culturing any aquatic organism. Optimal 2 water quality varies by species and must be monitored to ensure growth and survival. The quality of water in aquaculture production systems can significantly affect the organism's health and the costs associated. Therefore, removal of particles from water flow is important in aquaculture. Suspended solids, dissolved solids, and organic matter are removed from water by filtration of water through suitable media.

Salient features of the technology:

- Keep system clean
- Helps to improve water quality
- Which help to keep fishes healthy

Prototype of filter in Aquarium

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Technology No. 19

FLOATING CARP HATCHERY FOR RESERVOIRS

Inventors: Dr. A.K. Verma & Dr. Chandrakant, M.H.

Division: Aquaculture

Technical details:

For enhancing fish production in reservoirs, it is imperative that the reservoirs are to be stocked with quality seed. Fingerlings of carp produced in land-based hatcheries at distant places experience stress during transportation from hatchery to reservoir. Further, the change in type and quality of water may reduce the survival rate of fingerlings when transported from hatcheries and stocked in reservoirs. Hence, it is a novel idea to design a floating hatchery unit. This technology involves breeding, spawning, production of seed, and rearing of spawn to fingerling in reservoir itself.

Salient features of the technology:

- Provide healthy, stress free, disease free and continuous seed supply
- Relatively low cost
- No transportation stresses

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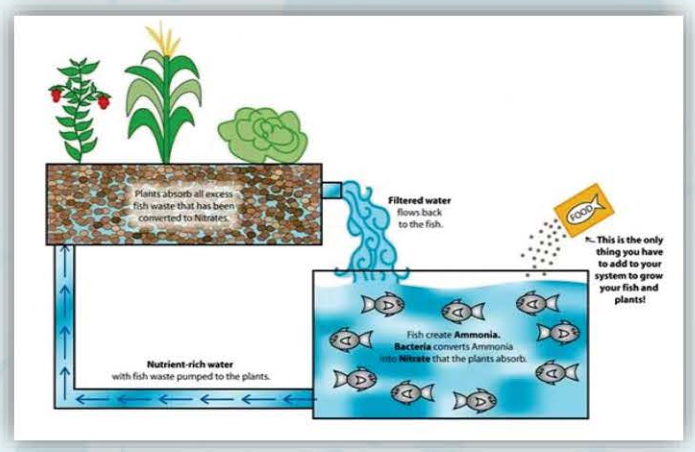
Technology No. 20

PRODUCTION OF FISH AND PLANT AQUAPONICS MODEL

Inventors: Dr. A.K. Verma & Dr. Chandrakant, M.H.

Division: Aquaculture

Technical details:



The model of recirculating type integrated fish-plant production system essentially consists of fish tank, filter, and hydroponics unit. A concrete or FRP tank of capacity 5000 l is used for culture of Pangasius. The tank is provided with an inlet and outlet for water management. Hydroponics unit consists of a trough with rows of models (nutrient film technique) for keeping plants saplings. A submersible pumping unit is installed in a filter unit which receives aquaculture waste water from the fish tank. The fish are cultured following standard protocol. Unfinished feed and animal excreta are mainly responsible for generation of aquaculture waste in the form of dissolved and suspended solids. The waste water fish culture tank is lead to primary filtration unit which contains a submerged pumping unit, which in-turn supplies the waste water to hydroponic unit. When water passes through hydroponics unit, nutrients present in aquaculture waste are absorbed and filtered water returns to fish tank under gravity. About 2 to 5% freshwater (or new water) is added/ top up to compensate water losses due to evapotranspiration in the system.

Salient features of the technology:

- Reduces chemical fertilizers use for Aquaponics
- Reduce water disposal for aquaculture operation
- Controlled environmental agricultural benefits: year-round and local organic food production

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Technology No. 21

POWER OPERATED SOLID WASTE REMOVAL DEVICE FROM AQUARIA

Inventors: Dr. A.K. Verma, Dr. Chandrakant, M.H., Dr. B. B. Nayak, and Dr. K.K. Krishnani

Division: Aquaculture

Technical details

1. Problem Description:

Removal of solid waste and contaminants from aquarium is very essential to maintain the good ecosystem and quality of water. Excess food which leads to formation of waste, fecal matter, and other metabolic waste are big concerns and are the main sources of toxic ammonia production and bad smell can be eliminated from the aquarium by a filtration process. This is ess ential to maintain a healthy aquarium. Overfeeding leaves uneaten food that nourishes the ammonia, nitrites and nitrates which can kill the fish; and it means more fish waste. As the fish excrete, the aquarium's filter should remove most waste, but some uneaten food and solid biological waste may still make it to the tank bottom where it will remain causing havoc with the elevated nitrite and ammonia levels. For these problems, a cleaning tool that siphons the waste while cleaning the substrate during water changes is useful. If a very effective filter is used, partial water changes are necessary only two or three times a year. In general, solid removals which are deposited at the bottom of the aquarium are done either by exchange water or removing solids by syphoning method.

Therefore, to minimize the use of water, there is a need to develop a Power Operated Solid-Waste Removal Device by which solid waste can be removed at faster rate and in an easy manner so that huge water can be saved and quality of water can be maintained in the aquarium for improving the health and growth of the fish.

Sediment's removal equipment consists of a perforated suction pipe, submersible pump, and a container to collect the waste. The submersible pump is mounted with submersible pump on a PVC pipe

as shown in the figure. The suction arrangement consists of a rectangular shaped frame work of PVC pipes with one of its sides having perforations to suck the sediments of unfinished feed and fecal matter from the bottom of the aquarium. Plastic tubes are inserted in the perforations for convenience in sucking the sediments. The suction pipe is attached to the inlet of the submersible pump. A plastic container is attached to the outlet pipe of the submersible pump to collect the sediments lifted by the suction pipe. An electric cable supplies the electricity to the submersible pump. The submersible pump along with the suction arrangement is mounted to a handle bar made up of PVC pipe upon which the power supply switch is fitted for smooth operation of the equipment.

When electricity is supplied, the suction pipe sucks the sediments of waste and unfinished feed, fecal matter, and other foreign particles through the plastic tubes and thus the waste solids are removed from the bottom of the aquarium or any tank having culture species. The waste solids are collected in a detachable plastic container attached to the outlet of the submersible pump. The device can be moved in any direction with the help of the handle bar to remove the waste particles deposited on the bottom of the aquarium or fish tank.

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Technology No. 22

SENSOR BASED AUTOMATIC AERATION SYSTEM FOR AQUACULTURE

Inventors: Dr. A.K. Verma, Dr. Chandrakant, M.H., Dr. B. B. Nayak, and Dr. K.K. Krishnani

Division: Aquaculture

Technical details

1. Problem Description

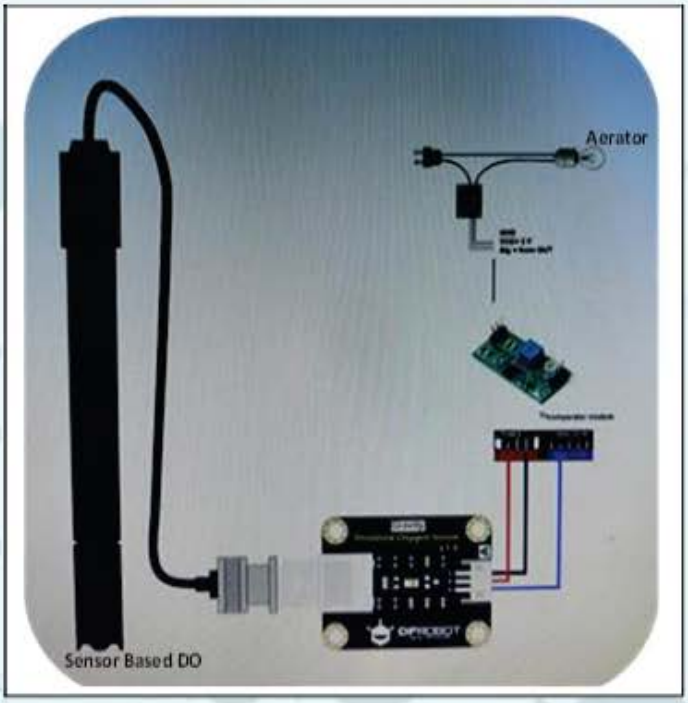
The aquaculture being the fastest growing food production system, a shift from extensive to intensive farming practices is imperative to address the challenges of rising population, food demand, and declining land resources. The intensive aquaculture system with high stocking, feeding, etc. faces several problems like dissolved oxygen deficiency, increased carbon dioxide level, production of ammonia-nitrogen, nitrate-nitrogen, organic pollution, etc. However, the major threat in intensive aquaculture systems is the oxygen depletion in water, a limiting factor in the intensive aquaculture systems. Maintenance of optimum level of dissolved oxygen (DO) is the most essential requisite for proper fish growth, food conversion ratio, and feeding efficiency. Aerators provide a prompt solution for oxygen deficiency and water quality management in aquaculture system. The aerators are mechanical devices used to enhance dissolved oxygen (DO) concentration in water either by direct injection of air/oxygen or by bringing water in intimate contact with air for the purpose of diffusion of atmospheric oxygen into the water. The use of aerator ensures better survival, higher production, and disease-free environment by removing the system's toxic components.

Though the use of aerators is prevalent in aquaculture, the cost entailed in operation is often excluded. The aerator cost is the third recurring largest cost in an intensive aquaculture system after seed and feed cost accounting for about 15% of the total production cost. Hence, to maximize the profit from culture operation, selection of suitable aerator, the time period of operation, etc. are very important.

Presently, in most of the intensive aquaculture systems, aqua-culturists normally run the aerators round the clock without looking at dissolved oxygen (DO) levels in water. It is imperative that aerators should be run only when DO levels in culture water falls below the required level. This proposes the need for proper dissolved oxygen (DO) management and related cost in aquaculture. A sensor-based aeration system with control capabilities and remote alarm continuously monitors the system's DO requirement and thereby providing aeration as per requirement of culture water. This helps in reducing the production cost and thereby maximizes the profit. These aerators are equipped with automatic sensors that detect the fall in DO level below the optimum level (i.e. <5 ppm) and initiate action. The

automatic monitoring and control in sensor-based aerator system are significant in minimizing energy cost and maximizing the yield and profit ensuring better system management.

2. Solution Description: Please explain (in simple terms) how this innovation addresses or solves the problem.



Sensor-based automatic aeration system consists of dissolved oxygen sensing probe, sensor, control unit, power supply unit, and an aerator. The DO probe is immersed in culture media of aquaculture system like pond, tank etc. The probe produces accurate DO readings even with organic buildup on the sensor. The controller has a built-in data logger that collects measurements at user selectable intervals (1 to 30 minutes).

The probe plug into controlling unit which continuously reads the DO values. In turn, the controlling unit sends signal to signal receiving unit as shown in the figure. The signals receiving unit is connected to power supply unit that supplies power to aerator so that the aerator starts functioning.

When DO reading falls below the optimum value (say 5 mg/L), the control unit senses the oxygen depletion and sends signal to signal-receiving unit which in turn enables power supply unit to supply power to the aerator. Upon receiving the power supply, the aerator starts supplying oxygen into water. When dissolved oxygen level rises above the optimum value, the controlling unit senses the same and sends signals so that aerator stops functioning.

Thus, the aeration system functions automatically in accordance with fluctuations (above or below the optimum value) in dissolved oxygen concentration in the culture media of the aquaculture system.

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Technology No. 23

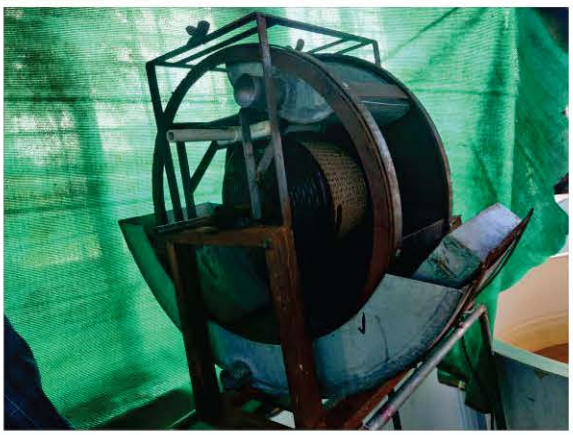
MECHANICAL-CUM-BIOLOGICAL DRUM FILTER

Inventors: Dr. A. K. Verma, Dr. Chandrakant, M.H., Dr. B. B. Nayak, Dr. Ashutosh D. Deo

Division: Aquaculture

Technical details:

All contaminants in waste-water except dissolved gases contribute to solids load. Solids may consist of both organic and inorganic constituents. Solids removal is important in recirculating aquaculture systems because they can physically block pipes, pumps, and filtration equipment. Further, removal of solids is also essential to maintain good ecosystem and quality of water. Excess food which leads to formation of waste, fecal matter, and other metabolic wastes are big concerns and are the main sources of toxic ammonia production and bad smell which can be eliminated by filtration process. Overfeeding leads to generation of ammonia and nitrite, which can kill the fish. Uneaten feed and animal excreta get deposited on tank bottom causing havoc with elevated nitrite and ammonia levels. Therefore, it is essential to remove solids from the aquacultural waste.



Therefore, to maximize water efficiency and water productivity, it is essential to remove the solids. Drum filter in association bio filter media inside the drum helps in removing solids as well as ammonia and nitrite.

An Indigenous rotating drum filter is designed to remove solid waste and nitrogenous compounds from the waste water. It consists of a mild steel drum having an outer diameter of 0.60 m and fitted in a metal casing of width 0.25 m. The mesh/ screen is fitted on the outer surface of the drum. A spray bar provided with high-pressure jets is fitted on the top of the drum. The drum is connected to a AC motor provided with a stepped gear motor to rotate the drum at 2-5 RPM. When electricity is supplied, the drum rotates slowly as the waste water enters the drum from one side. The solid particles present in the waste water remain

inside the drum adhering to the filter/ screen. Due to continuous deposition of solids inside the drum, filtration efficiency reduces and water level in drum increases.

The drum is designed in such a way that when the water level inside the drum increases beyond a certain level, the water jets fitted on the top of the drum spray the water with enormous pressure. The high-pressure jets hit the drum surface so that the solid particles adhered to the filter get detached and collected in a separate tray kept below the spray bar inside the drum. The solids thus detached from the filter are taken out from the drum to a sludge collection tank. There is a basket fitted with biofilter media inside the drum. Biofilter media contain nitrifier colonies. When water comes in contact with biofilter media, the ammonia gets reduced to the least toxic form of nitrogen i.e. nitrate. Thus, this Indigenous drum filter functions as both mechanical filter and biofilter. The capacity of this indigenous filter can be made as per the desired capacity.

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Technology No. 24

PROTEIN CONCENTRATOR

Inventors: Dr. N.P. Sahu and Shamna N

Division: Fish nutrition, Biochemistry and Physiology Division

Technical details:

Aqua feed industry is facing competition with other food/feed industry for protein rich ingredients like soybean meal, fishmeal etc. This stimulates the cost of production of aquafeed and it became a necessity to find out an alternate low-cost ingredient which can replace the conventional ingredients.

The by-products of oil industries come out as seed cakes/seed meals which are rich in protein. Jatropha seed cake contains 23 % protein, rubber seed contains 21-25% crude protein are few examples.

Salient Features

Jatropha seed cake, rubber seed are used for this purpose. The presence of anti-nutritional factors is an obstruction for its use in feed. In order to remove these constraints, a protein concentrate from Jatropha seed cake (78-80% protein; 93% digestibility), jatropha protein isolate (87.5%) and an isolate from rubber seed meal (90 .8 %) is prepared.

The equipment designed can utilize the agriculture waste as its raw material and extract the protein from it.

The equipment work under the principle of isoelectric precipitation and is a user friendly one.

Benefit

The dried product come out of the equipment can be utilized as a raw material for aquafeed preparation

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Technology No. 25

INTERNET OF THINGS (IOT) PROTOTYPE FOR BIOFLOC FISH CULTURE

Inventors: Kiranmayi D and Dr. Arpita Sharma

Division: Fisheries Economics, Extension & Statistics Division

Technical details:

In a world dominated by digital technology, the Internet of Things (IoT) plays a prominent role in our lives. The IoT has made the world more efficient, convenient, and enjoyable, with the dramatic surge of internet connected devices transforming daily interactions between individuals, households and businesses. The IoT is about connecting everyday things embedded with electronics, software and sensors to the internet enabling them to collect and exchange data. Internet of Things applications are available in every industry for Smart homes, Wearables, Connected Cars, Industrial Internet, Smart Cities, Agriculture, Smart Retail, Smart grids, Healthcare, Poultry and Farming. Precision agriculture is now gaining lot of importance and smart agriculture is being given focus by our government.

Biofloc Fish Culture

- Biofloc Technology is an environment friendly aquaculture technique and is considered as new "blue revolution" since nutrients can be continuously recycled and reused in the culture medium, benefited by the minimum or zero-water exchange.
- Biofloc is the suspended growth in ponds/tanks which is the aggregates of living and dead particulate organic matter, phytoplankton, bacteria and grazers of the bacteria.

Need of IoT technology for biofloc fish culture

- The success of biofloc culture depends on the water quality.
- Temperature, dissolved oxygen (DO), pH, salinity, total dissolved solids, total suspended solids, alkalinity, are some of the parameters that should be continuously monitored in this technology.
- The constant monitoring of different factors and maintaining them at proper levels using manual methods is very difficult and at most of the times observation errors may cost the system very badly.

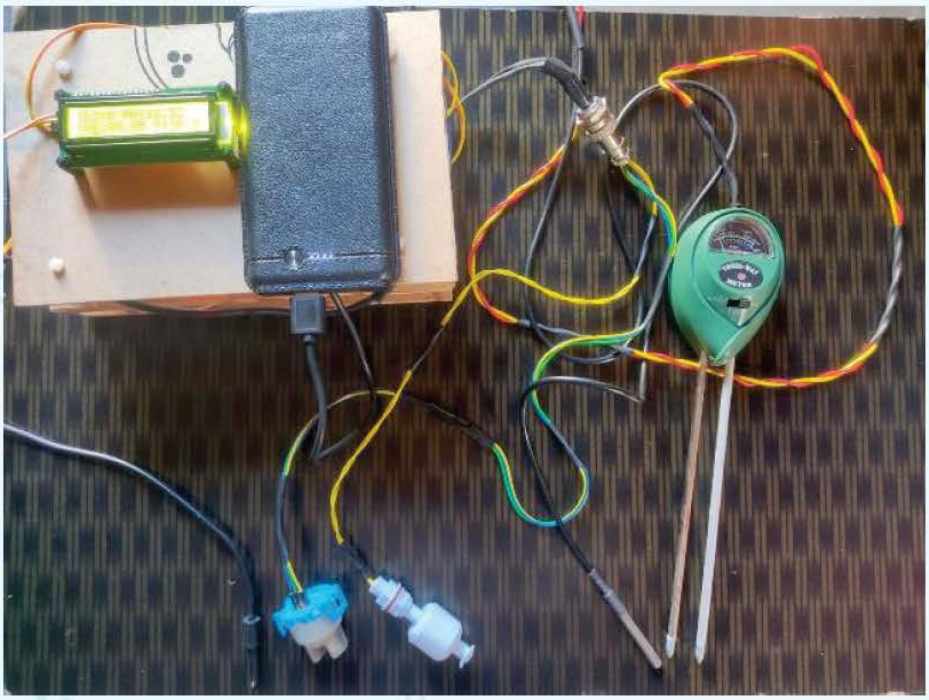

Fig 1: IoT prototype for Biofloc Fish Culture

Potential buyers: Fish Farmers, Biofloc fish famers, RAS farmers, Researchers, Fisheries students and others

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Technology No. 26

SOLAR POWERED COOL BOX

Inventors: Dr. Sanath Kumar H and Dr. Binaya Bhusan Nayak

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

The solar fish cooler can hold 50 kg of fish. Powered by two solar panels, the system has a battery to store power. The cooler can achieve a temperature of -20°C. However, fish intended to be sold in retail market can be stored at 0 to 5°C, which will lower the consumption of power and prolong the storage period. Solar-powered cooler is expected to reduce the dependency on ice, prolong the shelf life and ensure the quality and hygiene of fresh fish sold in the retail markets.

Salient features of the technology

Useful for retail fish vendors who do not access to or cannot afford ice. Solar panels make use of free solar energy to generate electricity and this electricity is used to run a conventional cooler.

Director & Vice-Chancellor Dr. Gopal Krishna (third from left) and Head of the Division Dr. B. B. Nayak (third from right) with other faculty.

Impact, if adopted?: The solar cooler can preserve fish for longer and thus reduce the spoilage of fish. It will also reduce the dependency on ice. Fish can keep longer and the better-quality fish will fetch better price.

Social impact: Useful to retail fish vendors/fisherwomen and help them store their fish hygienically. The increased shelf life of fish will reduce the loss due to spoilage and improve the economic returns.

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Technology No. 27

FISH DRYING RACK

Inventors: Dr. B. B. Nayak, Mrs. Ajita Ghag and Dr. Arpita Sharma

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

The invention relates to a portable, foldable, fish drying rack having extendable panels laterally extending on opposite sides of the central panel of the rack for hygienic drying of fish. It provides a fish drying rack having tenfold expandable area, which can be employed for drying fish by spread drying as well as hanging. Yet another object of the invention is to provide a portable fish drying for small scale drying as well as for drying during the monsoon period when sunshine intervals are short. In accordance with the preferred embodiment, the 'CIFE fish drying rack' is constructed using Burma Teak Wood (BTC) wood, and has a total length of 15'6" and a height of 3'1".

Fish drying rack demonstration in Arnala, Virar

Granted Patent No.: IN326749 on 4th December, 2019

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Technology No. 28

ERGONOMICALLY DESIGNED TRANSPORTABLE FISH ANAESTHETIC DEVICE FOR HILSA (*Tenualosa ilisha*)

Inventors: Dr. Subrata Dasgupta; Dr. Gayatri Tripathi, Dr. Gouranga Biswas, Dr. Mujahid Khan Pathan, Dr. Srikanta Samanta; Dr. Subhendu Adhikari; Dr. Debasis De; Dr. Puja Singh; Mr Dinesh Gumta

Division:

- ICAR-Central Institute of Fisheries Education, Kolkata Centre
- ICAR-Central Institute of Inland Fisheries Research Institute, Barrackore, KRC,
- ICAR-Central Institute of Brackishwater Aquaculture, Kakdwip, WB RRC,
- ICAR-Central Institute of Freshwater Aquaculture, Rahara

Technical details:

Hilsa is very susceptible to handling and operational stresses. A suitable device for the optimum delivery of anaesthetic drugs can reduce such stresses. An ergonomic fish anaesthetic device (FAD) has been designed and fabricated using low-cost materials. The device can deliver the optimum amount of anaesthetic solution with an optimum flow over the gills through the buccal cavity of the hilsa. It consists of a plastic tray equipped with an adjustable V-shaped foam cell, a rectangular crate for holding cylindrical reservoir tanks for storing and mixing anaesthetic solution (AS) employing an aerator, one submersible pump delivers AS over the gill surface through a delivery tube fitted with T-shaped short piece into the buccal cavity of fish and another pump sprinkles AS over the body surface. A spillway plugged with biofilter is placed through the plastic tray drains the used AS into the cylindrical reservoir for recirculation. The submersible pumps are operated through a power bank. An inlet controller regulates the flow rate of AS. The aerator is equipped with an air inlet pipe and air stone. The reservoir tank has a drainage system with a regulator or cock. A separate tank with a constant aeration is necessary for reviving fish after surgery for non-invasive investigation.

Application:

- To develop an ergonomic automated anaesthetic device to assure the optimum flow of anaesthetic solution necessary for obtaining various stages of anaesthesia
- To determine the scope of using FAD in remote field locations and on-boat.

Operation of FAD in achieving surgical anesthesia in hilsa caught from river by gillnet

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Technology No. 29

RAS INTEGRATED PORTABLE LIVE-WORM REARING SYSTEM

Inventors: Dr. Upasana Sahoo; Dr. Babitha Rani A.M, Dr. Shamna N & Ms. Tejaswini

Division: Aquaculture Division

Technical details:

Use of tubifex as an aquafeed for finfish larvae and ornamental fishes are an age-old practice and it even supports in brood-stock development of certain fish species. Because of its high caloric value, it is considered as an essential feed item in intensive freshwater fish culture units. The colony of tubifex appear in red colour as it contains hemoglobin. It can survive in hypoxic condition by exploiting all the available oxygen through waving the hemoglobin rich tail end and can also exchange oxygen and carbon dioxide through the skin. Constant movement of the worm favours the acceptability of it by the visually feeding larvae. Moreover, the nutritional composition, especially the high crude protein, amino acid contents and presence of carotenoids make tubifex a highly demanding live feed for fish. In the wild, they mostly inhabit the drainges and the derelict water bodies having very high organic load. The chances of contamination with pathogenic strains of bacteria. In addition, the wild collection of the species on a regular basis is a difficult task and the presence of pathogens will lead to disease in fish. Moreover, seasonal variation can cause non-availability and variation in nutritional composition of the species. By constructing a portable prototype of tubifex hatchery, the farmer/entrepreneur can produce pathogen (mainly virus) free and nutritionally balanced worms. We have designed a worm rearing model as a vertical flowthrough system integrated with recirculation facility to minimize the water usage and to maintain the continuous water Is flow to support the good growth of the worms. The standardised media used in the system is a combination of organic soil/vermicompost, ground nut oil cake, and vegetable waste in a specific ratio. The unit is composed of multiple culture trays arranged one above the other in a suitable rack, connected with pipeline to make a closed circuit of water from the water storage tank.

Application:

To produce live worm in a healthy environment for feeding larvae and brooders

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Technology No. 30

RAPID, NON-LETHAL AND NON-INVASIVE METHOD OF DETERMINING SEX AND MATURITY IN HILSA (*Tenualosa ilisha*) USING ULTRASOUND IMAGING

Inventors: Dr. Subrata Dasgupta; Dr. Gouranga Biswas; Dr. Gayatri Tripathi; Dr. Mujahid Khan Pathan; Dr. Srikanta Samanta; Dr. Debasis De; Dr. Subhendu Adhikari, Dr. Paroma Mitra; Mr. Tanmoy Jana

Division: Aquaculture Division

Technical details:

An ultrasound imaging method has been developed for reproductive application in fish particularly for hilsa (*Tenualosa ilisha*). Initially, suitability of portable ultrasound machine was evaluated for abdominal imaging in small and medium sized fish. Thereafter, the operational parameters of portable ultrasound machine was standardised for gonad imaging of live Cyprinus carpio brooders collected from local markets. The sex and gonad morphometrics were determined in hilsa through an ultrasound machine operated with the variable operational parameters suited for hilsa of different sizes and maturity. The sole use of ultrasonography (USG) identified the sex, followed by dissection and gross visual examination of gonads. The gonad volume was estimated with the mean cross-sectional gonad area calculated from ultrasound images. The gonado-somatic index (GSI) was calculated from ultrasonographic gonad volume and compared with the GSI calculated from live hilsa. The stages of the ovary and testes were confirmed by routine histology. The estimated ultrasonic - GSI values and maturity stages have been compared following Roy et al., (2021).

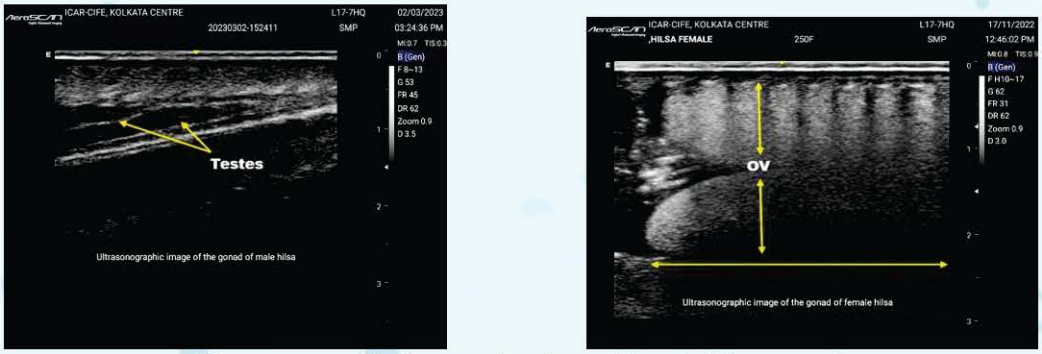
The existing techniques for assessing sex and maturity involve gonad biopsy, dissection of gonad for morphometrics, histology and gene expression studies, which require a sacrifice of the precious stock of fish. Endoscopy and blood sample analysis are less invasive but might be risky and stress-generating.

Applications:

- USG presents a novel tool for assessing annual gonad status and for determining sex and alteration of sex in the case of hermaphrodite species.
- The USG method enhances animal welfare by reducing handling stress and potential lethality or mortality.

Objective:

- To develop rapid non-lethal and non-invasive methods of determining sex and maturity in fish, particularly with monomorphism or temporary dimorphism, and
- To determine the scope of using USG methodology in remote field locations.



Ultrasonographic image of male and female hilsa gonads

Scanning of hilsa juveniles reared in pond at KRC, ICAR-CIBA at Kakdwip (A) and at Kolaghat farm of ICAR-CIFRI, Barrackpore (B).

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Technology No. 31

CIFE *Gro:* A HERBAL CONGLOMERATE TO PROMOTE GROWTH, MITIGATE STRESS AND ENHANCE IMMUNITY IN FISH

Inventors: Dilip Kumar Chowdhury; Dr. Narottam Prasad Sahu; Dr. Parimal Sardar; Dr. Ashutosh D. Deo; Dr. Megha Kadam Bedekar; Dr. Gopal Krishna

Division: Fish Nutrition, Biochemistry & Physiology Division

Technical details

1. Problem Description

Intensive aquaculture is always associated with stress of fish followed by decreased immunity and outbreak of diseases leading to reduced production. Feed is the most critical factor, which needs to be considered for sustainable intensive aquaculture. Increased use of plant-based feed with unconventional feed ingredients aggravates the situation due to imbalance of essential amino acids along with presence of anti-nutritional factors. Use of antibiotics and other chemicals as a growth promoter, antioxidant, immunostimulant and antimicrobial agents in intensified aquaculture system is discouraged due to the development of drug-resistant pathogenic bacteria and residual effect of chemicals that lead to human health hazards. Therefore, use of eco-friendly and quality feed with supplementation of feed additives like growth promoters, antioxidants, immuno-stimulants can only sustain the intensified aquaculture

2. Solution Description: Please explain (in simple terms) how this innovation addresses or solves the problem

A comparative study using ten herbal meal was conducted and turmeric, ginger and garlic meals were found to have better effect on digestive, metabolic, antioxidant enzymes activities and innate immunity in *Labeo rohita*. Turmeric, ginger and garlic meal in different combination were evaluated for their synergistic effect and found that 1% inclusion of turmeric, garlic and garlic mixture at specific ratio was found to be effective in enhancing growth (15-20%), gene expression, nutrient digestibility, digestive, metabolic & antioxidant enzymes activities, immunity and disease resistance against *Aeromonas hydrophila*. Similar trend was also found for farmed tilapia (*Oreochromis nilotica*).

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Technology No. 32

LEAF MEAL AS A REPLACER OF DORB IN CARP FEED

Inventors: Dr. Ashutosh D. Deo, Dr. Md. Aklakur and Dr. N. P. Sahu

Division: Fish Nutrition Biochemistry and Physiology Division

Technical details:

The intensification of aquaculture invariably requires rapid growth and development in aquafeed production. As a practice, major feed ingredients used by Indian farmers for carp production include de-oiled rice bran (DORB), groundnut or mustered oil cakes, etc. depending on the availability and price. De-oil rice bran is the by-product of the rice milling factory, which contains 14-17% crude protein. The utilization of bran has been increased manifold, which resulted in increased price (Rs.14-19/kg) in the market. Furthermore, increasing fish production to match the requirement of ever-increasing human population requires an additional amount of DORB, which will be insufficient in future considering the current production scenario. An alternative non-conventional ingredient that can replace DORB is leafmeal, which is the most unexplored resources, less expensive and readily available.

Salient Feature:

- The leaves which are having higher protein content (20-28% CP) are used for the preparation of leafmeal. These include sweet potato, Subabul, Sesbania, Mung, green pea, soybean leaves etc.
- The digestibility and nutrient content of the leafmeal are enhanced by solid-state fermentation (SSF). For sweet potato leafmeal SSF is carried out with fungus, Chaetomium globosum for 120hrs. Other microbes like Saccharomyces cerevisiae (commonly known as baker's yeast), and Lactobacillus subtilis can also be used depending on the type of leaf.
- For SSF of leafmeal, a mixer cum fermenter was fabricated, which can effectively process 20kg of leafmeal at one time.
- The fermented leafmeal are used to prepare carp feed with enhanced nutrients content and replace DORB completely without compromising the growth and health of fish.
- Carp feed prepared with leafmeal by replacing DORB are comparatively cheaper.

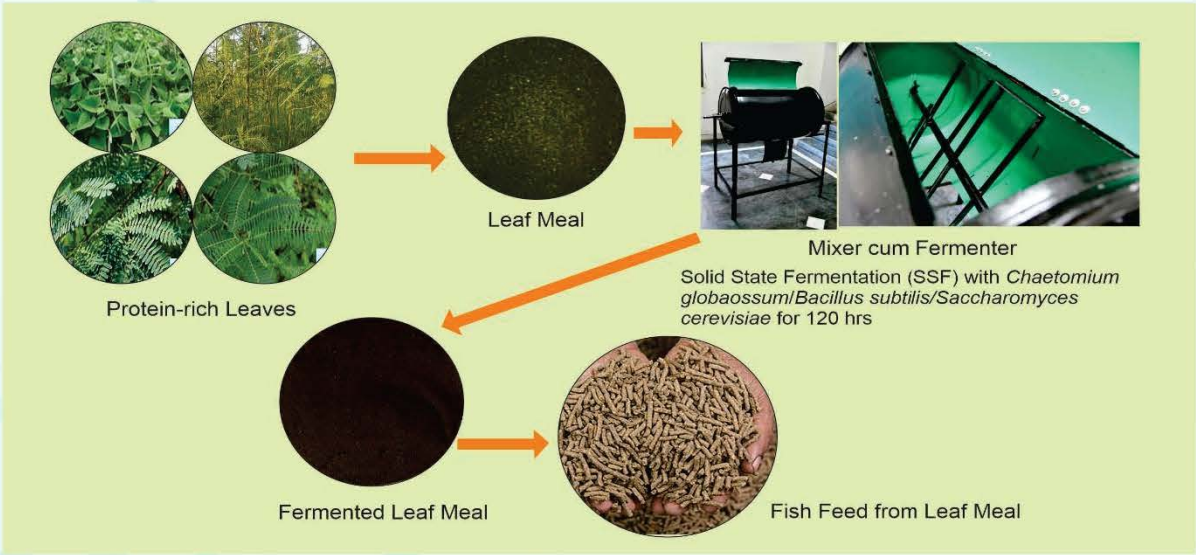
Cost benefit ratio:

As there is no direct cost involved in leaf meal preparation, but labour cost involved by the farmer is the recurring expenditure beside the Fermenter cum Mixer, which can be fabricated locally with very minimum cost. This needs to be popularised without much cost involvement.

Precautions:

- The processed leaf meal should be stored in cool and dry places.

Microbes should be handled with care.



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Technology No. 33

BIO-TRANSFORMATION OF COMPOSITE WASTE INTO FISH FEED

Inventors: Subal Kumar Ghosh, Amjad Khansaheb Balange, Martin Xavier, Sanath Kumar H, Binaya Bhusan Nayak

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

The amount of fish waste produced globally has risen significantly along with the growth in fish production. According to research, finfish and shellfish make up 50–60% of the waste generated throughout different phases of fishing activities such as harvesting, transportation, marketing, processing, and packaging. The vast majority of fish waste generated has no immediate use and as a result, creates significant economic and environmental problems.

Similar way, one of the most crucial elements of the agro-industrial waste system is the processing of vegetable waste, which is produced every day during post-harvest handling. Cauliflower and cabbage leaves, which are routinely thrown away, are common vegetables with high waste indices. These leaves technically serve as a source of antioxidant and antibacterial supplies for the animal feed industry. Vegetable waste and by-products, which are abundant in dietary fibre, carbohydrates, crude protein, and energy, are either discarded for site filling or allowed to decompose naturally due to the lack of a comprehensive usage and management strategy.

The routine processing and marketing of vegetables (such as cauliflower and cabbage) and fish produces a large amount of waste. Vegetable waste is high in carbohydrates (C), while fish waste is a rich source of nitrogen (N). By combining these two waste mixtures, the carbon/nitrogen ratio will be improved, enabling bacteria to break down more quickly. It produces composite bio-fermented silage, which could be used in the aquaculture and fish feed industries as a source of high-quality protein and carbohydrates.

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Technology No. 34

PRODUCTION OF KETO CAROTENOID (ASTAXANTHIN) FROM RAW FAUNAL BIO-WASTE FOR IMPROVED COLOUR, GROWTH AND GONADAL MATURATION IN ORNAMENTAL AND FOOD FISH

Inventors: Dr. Paramita Banerjee Sawant; Mr. Ramjanul Haque; Dr. Martin Xavier K.A.; Dr. Parimal Sardar; Dr. Tincy Verghese; Dr K.K. Krishnani.

Division: Aquaculture Division

Technical details:

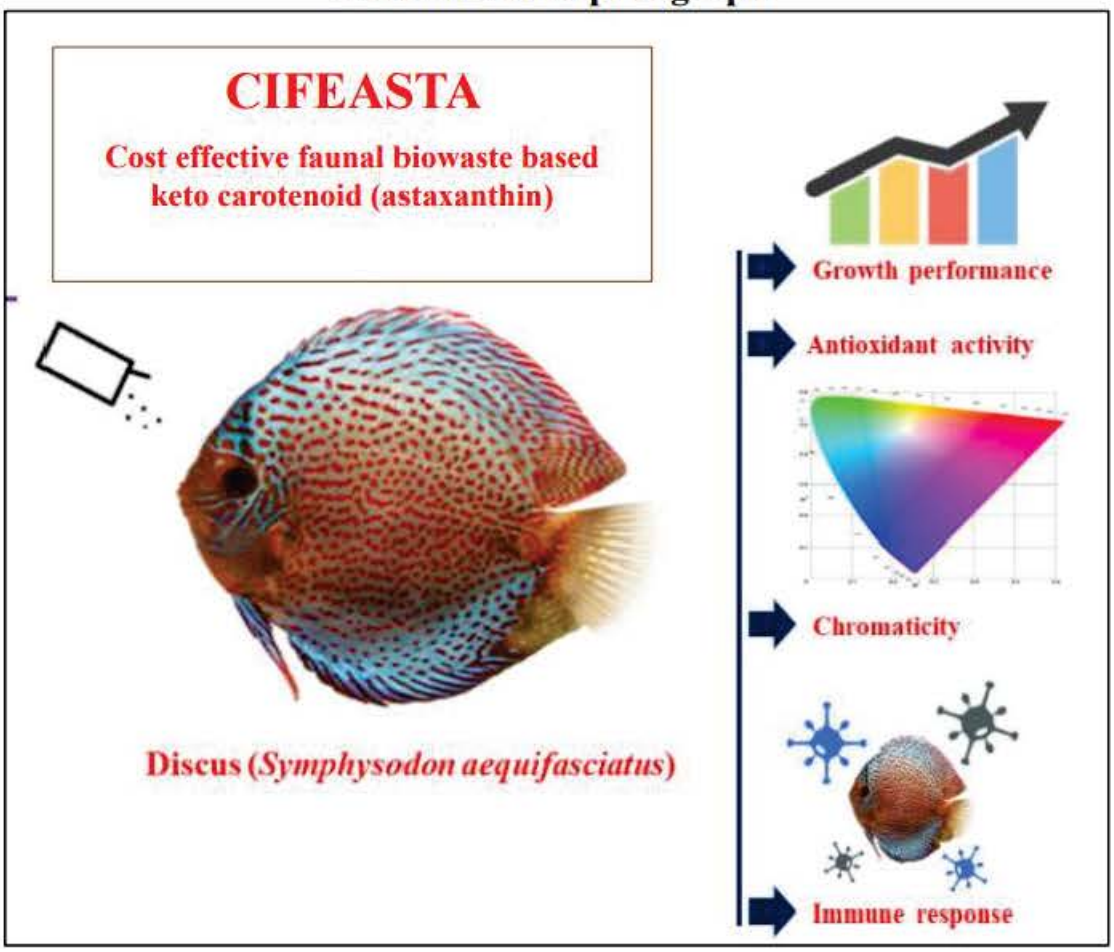
Feed accounts for 60% of the cost in aquaculture production systems. Most commercially formulated fish feeds are costly wherein, the ingredient cost and cost of additives are dominant. So, a situation where cost of ingredient can be minimized along with added benefit of growth promotion and maturity induction, will be beneficial for fish feed manufacturers. Moreover, synthetic additives are commonly used in fish feed by dominant manufacturers, which, even though potent, are also high in cost. In this regard, it was of interest to us to embark upon the

quest for feed additives which are not only from natural sources but also low in cost due to its origin especially from raw faunal (crustacean) bio-waste. Most crustaceans are valuable components of the seafood industry and command good price in the export market. However, approximately 40% of the crustacean body are edible and the remaining 60 % (exoskeleton) accounts for the post processing faunal bio-waste, which are either discarded or dumped, creating environmental pollution. Among such waste, shrimp waste (calcareous exoskeleton) is predominant owing to shrimp being the dominant exportable item and its fishery being a targeted fishery in the Indian coastline. With the above requirement in mind, the present innovative technology attempted the use of raw faunal (crustacean) bio-waste for production of low cost natural astaxanthin (feed additive) which can be judiciously utilized as feed additive in fish feed. Since crustacean processing waste is among the largest industrial wastes to be dumped into the oceans globally, this potential use of discards from processing industries may be ideal in not only reducing feed preparation and ingredient cost in aquafeed and other animal feed industry, but also for utilizing bio-waste to create bio-wealth, thus justifying the Wealth from waste approach towards sustainability. This will be socioeconomically beneficial for fishermen communities and for fish farmers equally, wherein, fishermen can earn profit by selling faunal bio-waste and fish farmers/startups/business houses can reduce feed manufacturing cost by purchasing and utilizing cheap faunal bio-waste raw material for preparing potent nutrient enriched feed, thus justifying the Make in India and Atmanirbhar Bharat concepts of the Govt. of India.

Application:

- Superior antioxidant properties boosting physio metabolic responses and innate immunity,
- Skin colour enhancing properties
- Nutrient utilization properties
- Digestive and metabolic enzyme activities
- Maturation inducing properties (enhanced reproductive steroid levels, gametogenesis and oocyte maturation) specifically tested in a high value ornamental fish discus (*Symphysodon aequifasciatus*).

Schematic Info-pictograph



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Technology No. 35

CIFEVRUDDHI: A NON-ENZYMATIC NUTRACEUTICAL CONGLOMERATE TO PROMOTE GROWTH, MITIGATE STRESS AND ENHANCE COMPENSATORY GROWTH IN FISH

Inventors: Dr. Shamna N; Dr. Narottam Prasad Sahu & Dr. Parimal Sardar

Division: Fish Nutrition, Biochemistry and Physiology Division

Technical details:

The present invention relates to the development of a vitamin-mineral based nutritional composition which enhances the compensatory growth performance of carp fingerlings. The formulation does not contain any water-soluble vitamins. 0.1-0.5 % of this non-enzymatic conglomerate enhance the weight gain %, specific growth rate, protein efficiency ratio and reduce abiotic and biotic stresses in stunted carps during the compensatory growth phase. Dietary intervention by providing additional non-enzymatic free radical scavengers has potential application in stimulation of the entire antioxidant defence system of the fish through alleviation of multiple stresses / oxidative stress effects. This has an edge to conventional farming practices by enhancing the weight gain in stunted carps during the compensatory phase. The field validation showed that the formula can enhance the growth and immunity of both stunted and normal reared carps.

Application:

- To reduce stress in stunted fingerlings
- To enhance growth and immunity in carp during compensatory phase

Uniqueness of the technology in comparison to the existing one.

- The product is a nutraceutical conglomerate
- The product can enhance growth and immunity in normal and stunted fish
- The product is non-enzymatic and non- antibiotic in nature
- The product can coat in any commercial feed/ mix in any feed formula

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Technology No. 36

FEED SUPPLEMENT FOR BROODSTOCK DEVELOPMENT OF *Clarias magur*

Inventors: Dr. Elzein Mohamad Hamza Fahal; Dr. Neelam Saharan; Dr. T.I. Chanu Dr. Md. Aklakur Dr. Babitha Rani

Division: Aquaculture Division

Technical details:

The product supplement is to enhancing captive maturation and breeding performance of Magur fish captive condition. Magur exhibit some form of reproductive dysfunction. In females, there is often failure to undergo final oocyte maturation, ovulation and spawning; while in males milt production reduced and require sacrifices of male for breeding. These dysfunctions are due to the fact that fish in captivity do not experience the conditions of the spawning grounds, and as a result there is a failure of the pituitary to release the maturational gonadotropin, luteinizing hormone LH. Vitellogenesis appears to progress normally in the above-mentioned fish, but at the onset of the spawning season the post-vitellogenic oocytes fail to undergo FOM and ovulation, and become atretic. The product provides early maturation and enhance the reproductive performance in both male and female. The supplement is prepared from locally available plant. The product has to be supplement for three months prior to monsoon.

Objective of the product / technology:

To produce good quality Brooders of Catfish *Clarias magur*

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Technology No.37

READY- TO-EAT FISH SANDWICH PASTE IN RETORT POUCHES

Inventors: Dr. S. Basu & Dr. B.B. Nayak

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

A novel technology was developed at CIFE, Mumbai to produce ready-to-eat fish sandwich paste in retortable pouches by utilizing low-cost fish and fish oil rich in omega-3 fatty acids. Heat process schedule was standardized to get an acceptable quality and the nutritive value of sandwich spread was enhanced by incorporating fish oil which was evident from increased levels of EPA and DHA as determined by GC-MS. The storage characteristics were studied and found that the product showed no significant changes during 12 months of storage period. Under optimum process conditions, fish oil incorporated sandwich paste made from low-cost fish mince did not show any oxidative rancidity. Improved stability, spread ability and texture of the product were obtained. The sandwich paste in retortable pouches could be stored at ambient conditions for 12 months.

Market potential:

Market for processed foods has been growing at a greater rate due to change in lifestyle and food habits of people. It has been changing from whole, frozen foods through ready to cook products to finally ready to eat products. The demand for ready to eat fish products is increasing both in domestic and international market because of health benefits associated with fish and fishery products.

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Technology No. 38

FISH MUNCH

Inventors: Dr. S. Basu, Dr. G. Venkateshwarlu, Dr. B.B. Nayak, Avinash Sabale & B.T. Phande

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Fish munch is an extruded fish product. Usually, starch is used for extrusion because of their temperature tolerance and behaviour at high temperature. Addition of protein adversely affects the crunchiness of the product and usually not added beyond 5%. CIFE has the unique technique of blending up to 25% fish protein (a level that is equal to the protein content in fish) in to extruded product. A temperature-controlled twin screw extruder is used for unique blend of starches and protein from different sources. The extrusion parameters (feeding rate, moisture, barrel temperature, die diameter, screw speed) have been optimized using surface-response technique for maximum expansion.

Salient features of the technology

- Nutritionally more complete than other products in the market because of high protein
- Low-cost fish can be utilised for this purpose to make the product cheaper and better use of the otherwise commercially important fish
- Products can be packed under nitrogen for prolonged shelf life which does not require refrigeration.
- No synthetic preservatives are added and excellent acceptance in sensory evaluation.

Financial aspects:

- Total investment: 40 lakhs
- Production capacity: 800kg/ day
- Production cost: Rs. 180/kg

Technology is commercialized to Vijaya Infra Project (Pvt.) Ltd.,15/A, Kaysons Building, Station Road, Vikhroli West, Mumbai

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Technology No. 39

FISH PANEER

Inventors: Mr. K. B. Joshi and Dr. G. Venkateshwarlu

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

This study was taken up with the object to process, modify and develop surimi into a form which would overcome these hindrances and suit the preference of Indian consumers. A particular combination of brine concentration, time and temperature reduced the sweetness and improved both textural and sensory characteristics of the surimi prepared in cube forms. Further, treatment with weak organic acid or weak alkali showed improved results with more desirable qualities. The resulted surimi cubes had appearance, texture and sensory properties comparable to that of milk paneer and it was rated high score in sensory evaluation both prior and post cooking. The resulted cubes were then named Fish Paneer

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Technology No. 40

SALT FERMENTED INDIAN MACKEREL

Inventors: Dr. B. B. Nayak, Mrs. L. Manjusha, Anita Ghag, Dr. K. Kamala, Dr. Sushri Ratnamanjiri Senapati, Negasi Tsighe, Devanand Uchoi

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

The Indian mackerels were fermented using a combination of dry salting and wet salting in microaerophilic condition. Representative bacterial isolates from each stage of fortnightly samplings were picked up identified, verified for their salt tolerance and fermentation potential. The fermentation potential was mainly studied from their capabilities to show lipolytic and proteolytic activities. Out of the eighty representative isolates, one major bacterial player and three minor players were identified. A set of six vats, two each were used for fermentation of mackerel without any enrichment, with the consortium of all the selected isolates, and with only the major player. The biochemical, microbial and sensory analyses were done at fortnightly interval. The formation of characteristics flavour, colour and texture were considered as end point. The single species inoculated vats matured in 75 days, the consortia inoculated vat matured in 105 days while the control vats matured after 120 days.

Salient features of the technology

- Supply of Bacterial isolates with biotechnological potential to augment fermentation process.
- The importance of fermented foods is increasing as health food due to presence of probiotic microorganism and bioactive peptides.
- Indian mackerel is the only species has been suitable so far for salt fermentation as like salt fermented Lona ilish.
- CIFE Laboratory made salt fermented Indian mackerel has been evaluated from experts of fermented fish producers and wholesalers from Tripura state and received good feedback in terms of quality of the product.
- Excellent acceptance in sensory evaluation
- Prolong shelf life and does not require refrigeration
- No preservative added

Fig. 1 Indian mackerel (*Rastrelliger kanagurta*)

Fig 2. Containers used for fermentation of Indian mackerel

Fig 3. Fresh mackerel cut in diagonally sticks same as lona ilish

Fig 4. Fermented Mackerel on 75thday (incubate with 90LHM1)

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Technology No. 41

PANGASIUS MINCE EMULSION SAUSAGES

Inventors: Dr. A.K. Balange, Dr. B. B. Nayak, Dr. M. Xavier, Mr. B. T. Phande, Ms. S. Shitole

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details

In seafood processing, several methods are available for value addition of fish but surimi technology has been accepted as one of the most successful techniques for low-cost fish utilization. Surimi is a stabilized myofibrillar protein, obtained from mechanically deboned fish flesh, is washed, mixed with cryoprotectants and stored frozen and used as a raw material in order to obtain a great variety of products (Gonzalez et al. 2008). At present chicken sausages available in the market which shows there will be good market available for fish sausages. In comparison with chicken sausages, prepared fish sausages found more likeness. Seafood products are highly perishable products and their deterioration is mainly from the biological reactions such as oxidation of lipids, protein degradation or decomposition mediated by endogenous or microbial enzymes. These activities lead to a short shelf-life of products. To alleviate the spoilage caused by microorganisms, frozen storage has been used widely. Besides that, spices shows benefit in seafood industry because of their phenolics content. Phenolic compounds have been used as the natural antimicrobial and antioxidant property in foods. Also, phenolic compounds are used as protein cross linker at optimum concentration (Prigent et al., 2003; Balange and Benjakul, 2009; Shitole et al., 2014). Use of spices improves the taste and make sausages more acceptable. Sausages can be stored for six months duration at -180 C storage.

Salient features of the technology

- Product is based on novel technique of fish sausages preparation with spices and fish mince
- A unique technique of retorting used for sausages preparation
- Excellent acceptance in sensory evaluation
- No preservative added
- Stored at -18˚C for up to six months.

- Before consumption thaw the sausages at room temperature for 15-20 minutes, then immerse in boiling water (100˚C) for 5 minutes and then open the pouch and serve or after thawing, take out the sausages from pouch and shallow fry and serve
- Fried sausages become more acceptable due to their soft texture and desirable flavour
- Complete source of fish protein

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Technology No. 42

LAMINATED BOMBAY DUCK

Inventors: Dr. B.B. Nayak, Dr. Amjad Balange, Ajita Ghag, Madona Thachil, Radhika Keluskar

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Bombay duck, *Harpodon nehereus* is one of the most important commercial species landed along Maharashtra coastline. Bombay duck comprises around 3.88 % share in total marine landings during 2016 in India (Annual report CMFRI, 2017). The Northwest coast of India particularly between the Alibag, Maharashtra and Porbander in Gujarat, a distance of 500 km (Fernandez and Devaranjan, 1996) is the region of major landings of Bombay duck. It is also taken in appreciable quantities on Andhra- Orissa coast and from the estuaries of Bengal. In India most of the Bombay duck processed by traditional method of drying on bamboo scaffolding and it is sold out in dry form majorly than freshly caught. Bombay duck is unique marine species has moisture around 90 % and flesh quality also differs from other species. Laminated Bombay duck is improvised product of traditional dried Bombay duck. Laminated Bombay duck has good consumer feedback and can be used as base product for making Bombay duck chips.

Salient features of the technology

- Bombay duck availability at west coast is huge during season, from August to October
- Product is based on novel technique of drying method
- A unique technique of coating with starch adds appreciable textural enhancement
- Excellent acceptance in sensory evaluation
- Prolong shelf life and does not require refrigeration
- No preservative added
- Product meets consumers requirement due to its unique dried form
- The product can also be deep fried in oil & consumed
- Fried salted Bombay duck chips become more acceptable due to its crispy
- texture and desirable flavor
- Complete source of fish protein

	
Arranged for drying	Laminated Bombay duck

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Technology No. 43

PRAWN PICKLE

Inventors: Dr. B.B. Nayak, Dr. A.K. Balange, Dr. M.K. Chouksey, Mr. Avinash Sable, Mr. Bhanudas Phande, Miss. Snehal Shitole, Miss. Pranita Chande

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Value can be added to fish and fishery products according to the requirements of consumer and market need. There is great demand for fish and shellfish-based products in ready to eat —convenience form. A number of such diverse products have already invaded the western markets. One factor responsible for such a situation is more and more women getting educated and taking up employment. In India, a substantial quantity of this group locally known as 'Jawala' or 'Kolim' is landed along the north-west coast in the states of Gujarat and Maharashtra. At present acetes is very cheap and is consumed mostly in fresh and dried form in internal markets. Developed acetes chatney is crispy and spicy chatney from dry acetes. This is one of the convenience products suits the taste of consumer. Chutneys are mainly originated in India and the name comes from the word "Chatni", meaning a strong, sweet relish and spicy. It is often said that the traditional Indian meal is incomplete without chutney. There is no need of costly equipment's for the chatney preparation so the cost is also low. Acetes chatney can be stored at room temperature for 3 months.

Prepared product is based on traditional technique of chatney preparation. This method is comparatively simple, without use of huge equipment's. Prepared products have excellent acceptance in sensory evaluation. Developed product become more acceptable due to its texture, desirable flavour and taste. Acetes chatney is one of the value-added product from dry acetes and has great potential for income generation.

Salient Features:

- Acetes chatney can be prepared from dried acetes
- Product is based on unique technique of chatney preparation with dry acetes
- Excellent acceptance in sensory evaluation
- Ready to eat product
- Product meets consumers requirement due to its unique flavor
- Source of nutritious food can get better market

Commercialized to Mrs. Rekha Phande (ABI Incubatee and proprietor at M/S Ekvira Seafoods, Juhu, Mumbai)

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Technology No. 44

Acetes chatney (Jawala Chatney)

Inventors: Dr. Amjad Khansaheb Balange, Dr. Binaya Bhushan Nayak, Mr. Avinash Sable, Mr. Bhanudas Phande, Mrs. Snehal Parab

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Value can be added to fish and fishery products according to the requirements of consumer and market need. There is great demand for fish and shellfish-based products in ready to eat —convenience form. A number of such diverse products have already invaded the western markets. One factor responsible for such a situation is more and more women getting educated and taking up employment. In India, a substantial quantity of this group locally known as 'Jawala' or 'Kolim' is landed along the north-west coast in the states of Gujarat and Maharashtra. At present acetes is very cheap and is consumed mostly in fresh and dried form in internal markets. Developed acetes chatney is crispy and spicy chatney from dry acetes. This is one of the convenience products suits the taste of consumer. Chutneys are mainly originated in India and the name comes from the word "Chatni", meaning a strong, sweet relish and spicy. It is often said that the traditional Indian meal is incomplete without chutney. There is no need of costly equipment's for the chatney preparation so the cost is also low. Acetes chatney can be stored at room temperature for 3 months.

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Salient Features

- Acetes chatney can be prepared from dried acetes
- Product is based on unique technique of chatney preparation with dry acetes
- Excellent acceptance in sensory evaluation
- Ready to eat product
- Product meets consumers requirement due to its unique flavor
- Source of nutritious food can get better market

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Technology No. 45

Acetes papad

Inventors: Dr. Binaya Bhushan Nayak, Dr. Amjad Khansaheb Balange, Mr. Avinash Sable, Mr. Bhanudas Phande, Mrs. Snehal Parab

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Value can be added to fish and fishery products according to the requirements of markets. There is great demand for fish and shellfish-based products in ready to eat —convenience form. A number of such diverse products have already invaded the western markets. One factor responsible for such a situation is more and more women getting educated and taking up employment. Acetes papad is used as snacks as crispy garnish. This is one of the convenience products that is rich in nutritive value and suits the taste of consumer. Papad can be prepared from different ingredients and methods. The most popular recipe uses black gram flour mixed with black pepper, salt, and a small amount of vegetable oil and a food-grade alkali, and the mixture is kneaded. Well-kneaded dough is then flattened into very thin rounds and then dried and stored for later preparation and consumption. It is a deep-fried or roasted before serve. There is no need of costly equipment's for the papad preparation so the cost is also low. Acetes papad can be stored at room temperature for 3 months.

Prepared product is based on traditional technique of papad preparation. This method is comparatively simple, without use of huge equipment's. Prepared products has excellent acceptance in sensory evaluation. Developed product become more acceptable due to its texture, desirable flavour and taste. Acetes papad is one of the value-added product from fish and has great potential for income generation.

Salient Features

- Acetes papad can be prepared from dried acetes
- Product is based on unique technique of papad preparation with acetes incorporation
- Excellent acceptance in sensory evaluation
- Ready to fry or eat product
- Product meets consumers requirement due to its unique flavor
- Source of nutritious food can replace regular papad from market

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Technology No. 46

FISH CHAKALI AND SHEV

Inventors: Dr. Amjad Khansaheb Balange, Dr. Binaya Bhushan Nayak, Mr. Avinash Sable, Mr. Bhanudas Phande, Mrs. Snehal Parab

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Value addition is an expanding sector in the food processing industry, especially in export markets. Fish value added products has assumed greater importance nowadays because of the societal change that have led to the development of outdoor catering, food services, convenient fish products in a ready-to-eat or ready-to-serve form. Chakley and shev is used as snacks as a main ingredient or mostly as a crispy garnish. Fish chakley and sev is one of the convenience snack products that is rich in nutritive value and suits the taste of consumer. The fish chakley and shev is prepared with fish mince, gram floor and other spices. It is a deep-fried product in ready to eat form. There is no need of costly equipment's for the fish chakley and shev preparation so the cost is also low. Fish chakley and shev as nutritional food is a better alternative for regular shev and chakley with gram floor and spices which is available in market.

Prepared product is based on traditional technique of chakley and shev formation. Method for fish chakley and shev preparation is comparatively simple, without use of huge equipment's. Prepared products has excellent acceptance in sensory evaluation. Developed fish product become more acceptable due to its texture, desirable flavour and taste. Fish chakli and shev is one of the value-added product from fish and has great potential for income generation.

Salient Features

- Fish chakley and shev can be prepared from marine water fishes (Tuna, Mackerel, Crocker, Pink perch) and from fresh water fish (Rohu, catla)
- Product is based on unique technique of fish chakley and shev preparation
- Excellent acceptance in sensory evaluation
- Ready to eat product
- Product meets consumers requirement due to its unique flavor
- Source of nutritious food can replace regular chakley and shev from market

Fish shev and chakali

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Technology No. 47

FISH CUTLET

Inventors: Dr. Binaya Bhushan Nayak, Dr. Amjad Khansaheb Balange, Mr. Avinash Sable, Mr. Bhanudas Phande, Mrs. Snehal Parab

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Value addition is an expanding sector in the food processing industry, especially in export markets. Fish value added products has assumed greater importance nowadays because of the societal change that have led to the development of outdoor catering, food services, convenient fish products in a ready-to-eat or ready-to-serve form. Fish cutlet is one of the convenience food products that is rich in nutritive value and suits the taste of consumer. It is prepared from cooked fish mince. This fish mince mixed with cooked potato, fried onion, spices and other optional ingredients. Cutlets were prepared into the desired shape, battered, breaded and fried. Raw cutlets can be stored in deep freezer and can be fried in oil and served hot. There is no need of costly equipment's for the fish cutlet preparation so the cost is also low. This low-cost fish cutlet technology is a solution for fishermen's when there is a bulk availability of fish and fishermen's got very low price for the same.

Prepared product is based on technique of cutlet formation. Method for fish cutlet preparation is comparatively simple, without use of huge equipment's. Prepared product has excellent acceptance in sensory evaluation. Product in ready to fry condition, have to store at -180C for six months. Developed fish cutlet become more acceptable due to its texture, desirable flavour and taste. Fish cutlet is one of the value-added products from fish and has great potential for income generation.

Salient Features

- Fish cutlets can be prepared from marine water fishes (Tuna, Mackerel) and from fresh water fish (Rohu)
- Product is based on unique technique of fish cutlet preparation
- Excellent acceptance in sensory evaluation
- Six-month shelf life at -180C
- Product meets consumers requirement due to its unique flavor
- Source of nutritious food

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Technology No. 48

FISH SAMOSA

Inventors: Dr. Binaya Bhushan Nayak, Dr. Amjad Khansaheb Balange, Mr. Avinash Sable, Mr. Bhanudas Phande, Mrs. Snehal Parab

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Value addition is an expanding sector in the food processing industry, especially in export markets. Fish value added products has assumed greater importance nowadays because of the societal change that have led to the development of outdoor catering, food services, convenient fish products in a ready-to-eat or ready-to-serve form. Fish samosa is one of the convenience food products that is rich in nutritive value and suits the taste of consumer. The samosa is prepared with all-purpose flour (locally known as maida) and stuffed with a filling of fish mince and other vegetables with spices. The entire stuffing is deep-fried in vegetable oil to a golden brown. Raw samosa can be stored in deep freezer and can be fried in oil and served hot. There is no need of costly equipment's for the fish samosa preparation so the cost is also low. This low-cost fish samosa technology is a one of the solutions from fish value addition for fishermen's when there is a bulk availability of fish and fishermen got very low price for the same.

Prepared product is based on technique of samosa formation. Method for fish samosa preparation is comparatively simple, without use of huge equipment's. Prepared product has excellent acceptance in sensory evaluation. Product in ready to fry condition, have to store at -180C for two months. Developed fish samosa become more acceptable due to its texture, desirable flavour and taste. Fish samosa is one of the value-added products from fish and has great potential for income generation.

Salient Features

- Fish samosa can be prepared from marine water fishes (Tuna, Mackerel) and from fresh water fish (Rohu)
- Product is based on unique technique of fish samosa preparation

- Excellent acceptance in sensory evaluation
- Two months shelf life at -18°C
- Product meets consumers requirement due to its unique flavour
- Source of nutritious food

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Technology No. 49

FISH VADA

Inventors: Dr. A.K. Balange, Dr. B.B. Nayak, Mr. Avinash Sable, Mr. Bhanudas Phande, Mrs. Snehal Parab

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Value addition is an expanding sector in the food processing industry, especially in export markets. Fish value added products has assumed greater importance nowadays because of the societal change that have led to the development of outdoor catering, food services, convenient fish products in a ready-to-eat or ready-to-serve form. Fish vada is one of the convenience food products that is rich in nutritive value and suits the taste of consumer. The vada is prepared with gram floor coating and stuffed with a filling of cooked or mashed boiled potato, fish mince and other vegetables. The entire stuffing is deep-fried in vegetable oil to a golden brown. Raw vada can be prepared and fried in oil before serve. There is no need of costly equipment's for the fish vada preparation so the cost is also low. This low-cost fish vada technology is a one of the solutions among fish value added product for fishermen's when there is a bulk availability of fish. Fish vada is a better alternative for potato vada available in market as healthy food source. Prepared product is based on technique of vada formation. Method for fish vada preparation is comparatively simple, without use of huge equipment's. Prepared product has excellent acceptance in sensory evaluation. Developed fish vada become more acceptable due to its texture, desirable flavour and taste. Fish vada is one of the value-added product from fish and has great potential for income generation.

Salient Features

- Fish vada can be prepared from marine water fishes (Tuna, Mackerel) and from fresh water fish (Rohu, catla)
- Product is based on unique technique of fish vada preparation
- Product meets consumers requirement due to its unique flavor

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Technology No. 50

BIOACTIVE PEPTONE FROM JAWALA (*ACETES SPP.*)

Inventors: Dr. Martin Xavier K. A., Dr. Vignaesh D, Dr. Amjad K. Balange and Dr. B. B. Nayak

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Acetes spp. is an unexploited tiny shrimp landed as bycatch along the Maharashtra and Gujarat coast comprises 13% protein. Jawala prawn (Acetes spp.) is mainly used as fish meal for the feed industry. Although several reports shown bioactive and functional properties of protein hydrolysates from various fish and shellfish species, the influence of extent of hydrolysis and hydrolytic mechanism of action on bioactivity is not studied extensively. The commercial protein hydrolysate powder obtained from fish and shellfish species are also not abundant.

Salient Features:

- Conversion of this effective and cheap source of raw material into protein hydrolysate generates better utility to the product.
- This enables the circular economic approach of utilizing an under-utilized raw material in to valuable product.
- On the other hand, comprehension of the hydrolysis mechanism via varying DH will produce hydrolysate with varied properties.
- Commercialization of protein hydrolysate from *Acetes spp.* is also important to gain marketable status of the product.

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Technology No. 51

APPLICATION OF CHITOSAN GEL FOR ENHANCING THE QUALITY AND STORAGE LIFE OF EMULSION SAUSAGE

Inventors: Dr. Martin Xavier, Dr. Kasturi Chattopadhyay, Dr. Amjad K. Balange, Dr. Layana P,

Dr. Binaya Bhusan Nayak

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Emulsion sausages prepared from fish mince is usually very soft and requires incorporation of additives like starch. Conventional sausages from fish mince (particularly fatty fishes) have a shelf life of less than 30 days under refrigerated conditions (3-4 degree Celsius) which reduces the sausage product viability from fish mince. During the refrigerated/ frozen storage starch added to the sausage undergoes retrogradation and lead to hard texture to the product along with high purge loss and low water holding capacity.

Salient Features:

Chitosan hydrogel inclusion in varying concentration (0.15-0.3%) can truly benefit the quality of low cost fish mince sausage and has helped in developing a superior, functional and healthy ready-to-eat fish-based product with best functional and physiochemical attributes that can fulfill consumer's desirability as well as improve its shelf life.

Shelf life can be successfully extended to more than 60 days under refrigerated conditions.

This can pave the way for utilizing chitosan which is a valuable byproduct of shell wastes in developing functional fish products by quality enhancements and shelf-life extension.

Results of the work done can be commercialized and can help in creating good market for value addition of low-cost fatty fishes.

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Technology No. 52

PREPARATION OF NANOCHITIN FROM SHRIMP SHELL WASTE

Inventors: Dr. Martin Xavier, Mr. Soibam Ngasotter, Dr. A. K. Balange, Dr. Layana P, Dr. Binaya Bhusan Nayak

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Chitin is an abundantly available polysaccharide and is the primary structural component of shrimp shells. Every year, shrimp-processing sector generates a large amount of shell waste, which is largely discarded, posing major environmental risks. This shrimp shell waste can be utilized to produce valuable products such as chitin which has enormous applications in food, medicine, and other industrial fields due to its environmentally friendly attributes, including biocompatibility, biodegradability, sustainability, and renewability. Chitin however has limited application due to its poor soluble nature in various solvents. This limitation can be removed by downsizing chitin to nanochitin using various methods including acid hydrolysis using strong acids which possess environmental hazards and with lower yield. In this context, we have developed a method to prepare nanochitin that uses takes lesser time with higher yield using steam explosion method with minimal concentration of acid.

Salient Features:

- capable of producing nanochitin from shrimp shell waste with an average diameter of 55.70 ± 13.12 nm.
- The yield of nanochitin production with the technology is high, approximately 78% as compared to the usual 20-30%.
- As compared to existing technology is fast and takes approximately 24 min instead of the usual 3 h.
- Uses less concentration of HCl (2.63 N) as compared to other methods.
- Uses less chitin to acid ratio of 1:22 as compared to the usual 1:30.

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Technology No. 53

NOVEL AND EXOTIC LEATHER FABRIC FROM FISH SKIN

Inventors: Mr. Shubham Soni, Dr. Arpita Sharma and Dr. Martin Xavier

Division: Fisheries Economics, Extension & Statistics Division

Technical details:

This invention is about the development of 'Novel and Exotic Leather Fabric from Fish Skin'. Fishes are mostly filleted, and after filleting, the fish's head, skin, fins, bones, and viscera are discarded and thrown away as waste. This fish's skin has a larger surface area, is thick enough for leather fabric development, and the raw material is available at zero cost at present.

The advantages of this invention are:

1. The fish skin used in the present invention are the waste fish skins that would otherwise be thrown away in the garbage, so waste is utilized.
2. The process can be used to develop leather from any other fish species also.
3. The 'Novel and Exotic Leather Fabric from Fish Skin' so developed can be used to produce various leather articles and designer works etc.

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Technology No. 54

TECHNOLOGY AND PROCESS FOR COLORANT GRADE PHYCOCYANIN EXTRACTION AND PURIFICATION FROM SPIRULINA

Inventors: Dr. S.P. Shukla; Dr. G. Rathi Bhuvaneswari; Mr. Sachin Belsare

Division: Aquatic Environment and Health Management

Technical details:

Two types of photobioreactors were designed.

1. Tubular (Semi-indoor) photobioreactor with an integrated harvesting module and LED panels
2. An outdoor raceway with a horizontal mixer in place of a paddle wheel as used in traditional raceways.

The culture is circulated in transparent polypropylene tubes encircled on an outdoor panel and connected to main indoor culture tank. The biomass is harvested through outlets that pour the culture on the trays mounted with nylon cloth (20 micron). The trays are fitted in the groves of harvesting module and the filtrate accumulated in the tank of harvesting module is channelized back to main culture tank through a submersible (60W) pump. The developed technology is superior from traditional open raceways as it allows the farmers to produce biomass in rainy seasons also. The technology and process developed for biomass production in the photobioreactors and extraction of colorant grade Phycocyanin are cost-effective due to lesser inputs for biomass production and phycocyanin extraction and purification.

Objective of the product / technology:

- To develop new designs of photobioreactors for microalgae biomass production
- To develop a low-cost process for phycocyanin extraction and purification

Application:

Phycocyanin has antioxidant, pain-relief, anti-inflammatory, and brain-protective properties. Many antioxidants in spirulina have anti-inflammatory effects in the human body.

Commercialized to: Phoenix Agrotech LLP, Mumbai and consultancy for the same technology.

Spirulina Culture

Extraction Process

Final product in powder form

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Technology No. 55

NOVEL TECHNIQUE DEVELOPED FOR EXTRACTION OF COLLAGEN PEPTIDE FROM FISH WASTE

Inventors: Sahana M D, A.K. Balange, Dr. Layana P., Dr. Elavarasan Krishnamoorthy

Division: Fisheries Resources, Harvest and Post-Harvest Technology Division

Technical details:

Collagen peptides offer several advantages over natural collagen, including higher therapeutic loading, cost-effectiveness, and a simpler extraction process. Collagen peptides can improve bone health by increasing bone mineral density and reducing inflammation in osteoarthritis. Since fish industry scales account for a significant portion of fish collagenous waste, it is important to find ways to eliminate this waste in compliance with stricter pollution control regulations. This study aimed to produce collagen peptides with osteoporosis and bone mineralization effects from fish scale waste. The collagens were hydrolysed using the enzyme papain, resulting in collagen peptides with a molecular weight of less than 3kDa. These peptides exhibited antioxidant properties when tested alongside BHT and BHA as controls. The UV absorption spectra indicated the presence of aromatic residues such as phenylalanine, tyrosine, and tryptophan. The fish scale-derived collagen peptides were found to contain a high proportion of protein with lower levels of fat and ash. This low-cost technology holds potential for commercial use and offers functional and physical properties comparable to commercially available bovine and chicken collagen peptides.

Application:

Firstly, it utilizes a low amount of chemicals, reducing environmental impact and potential health hazards associated with their use. Furthermore, it is highly efficient in terms of time and labor, streamlining the production process and optimizing productivity. The technology also focuses on the efficient utilization of fish waste, offering a solution that can be applied to a broad spectrum of fish waste materials. While there are existing products in the market, they are primarily industrial and expensive, limiting accessibility for everyday buyers. In contrast, our technology stands out as it not only provides cost-effective solutions but also aligns with the current trends of sustainable development goals (SDGs). By prioritizing affordability and sustainability, our product caters to a wider audience and contributes to the global efforts of achieving SDGs.

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Technology No. 56

CIFE – FLAVAC VACCINE

Inventors: Dr. Megha Kadam Bedekar, Dr. Kundan Kumar, Dr. Saurav Kumar, Dr. Gaurav Rathore, Mrs Pooja Vinde, Dr. Rajendran KV, Dr. Gopal Krishna

Division: Aquatic Environment and Health Management

Technical details:

Flavobacterium columnare inactivated vaccine is a formalin inactivated vaccine for protecting fresh water fish against *F. columnare* infection mainly affects gill and external surface of fresh water fish. Laboratory and field trials of developed inactivated vaccine of *F. columanare* in *Labeo rohita* have been successfully tested. The efficacy and performance of vaccine is estimated in terms of relative percent survival along with antibody titer and some vital cellular immune responses. In this process, a new pathogenic strain of *F. columnare* was isolated from *L. rohita*, and characterized by biochemical and molecular techniques.

Technology of vaccine preparation primarily depend on selection and preparation of immunogenic antigen and for this isolation of extracellular protein, whole cell protein, outer membrane protein and inactivated whole cell were tested for different properties. Further, based on positive agglutination test the whole cell was selected for vaccine preparation.

Application: Vaccine would be suitable for field application on farms/hatcheries/brooders

Benefits and Utility:

- Alternative to antibiotics for controlling columnaris, a bacterial disease of fresh water fishes.
- Vaccine would be suitable for preventing columnaris disease in fish under different aquaculture system like farms and hatcheries.
- Effective and environmental friendly approach for controlling columnaris disease.
- Inactivated vaccine has benefit of safety aspects of host and practitioners
- This vaccine can be used for both fingerlings and adult stage of fish.

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Technology No. 57

INACTIVATED VACCINE CIFE-AEROMONAS-V-VAC FOR USE IN FISH

Inventors: Dr. Megha Kadam Bedekar; Sanjay Rathore; Dr. H J Solanki; Dr. Gayatri Tripathi; Dr. K.V. Rajendran

Division: Aquatic Environment and Health Management

Technical details:

Aeromonas veronii, is a Gram-negative, rod-shaped bacterium that can cause outbreaks of severe infectious diseases in cultured fishes around the globe and is one of the main causes of economic loss in aquaculture. It is commonly isolated from environmental, clinical, and food samples (Ghenghesh et al., 2008). This is a common pathogen in of freshwater goldfish (*Carassius auratus*), Nile tilapia (*Oreochromis niloticus*,), Chinese Longsnout catfish (*Leiocassis longirostris günther*) and catfish (*Ictalurus punctatus*). The clinical symptoms of infected fish commonly comprised ulcer, fin rot/tail rot, abdominal distention, exophthalmia and hemorrhage. This is a primary pathogen of fish which effects not only to fish but also causes clinical complications in human (Janda and Abbott, 1998). Multidrug resistance genes, such as NDM1, have been identified in this group of bacteria which is of serious health concern. Recently *Aeromonas veronii* infection has been repeatedly reported from tilapia farms and hatcheries near Mumbai (2019-22). One of the field isolate of *Aeromonas veronii* MN603659 (CIFE isolate) which caused severe mortality in fish farms was used to prepare inactivated vaccine for prevention of *Aeromonas veronii* infection. Vaccine trial was done in farmed tilapia fingerlings. The result observed in this experiment indicated that the vaccination with inactivated *A. veronii* in tilapia with booster immunization through the immersion route elicits immune response and protection against *A. veronii* infection in tilapia. The vaccine provided 64% protection in tilapia fingerlings. The vaccine can be used in ornamental fish and cat fish. The technology is a package of Aeromonas strain (*Aeromonas veronii* MN603659), method of inactivation, dose and mode of vaccine delivery.

Application: First vaccine against *Aeromonas veronii* for tilapia cage usage, bacterial isolate, dosing and mode of delivery of vaccine are the package of vaccine.

Commercialization: Vaccine is already commercialized on non-exclusive basis to Indian Immunologicals Private LTD, Hyderabad.

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Technology No. 58

INACTIVATED VACCINE AGAINST EDWARDSIELLA TARDA IN FISH CIFE-ED-VAC

Inventors: Dr. Megha Kadam Bedekar; Dr. Kundan Kumar; Dr. Saurav Kumar; Dr. Gaurav Rathore; Mrs Pooja Vinde; Dr. Rajendran K.V.

Division: Aquatic Environment and Health Management

Technical details:

The developed, chemically inactivated adjuvant free, vaccine against *E. tarda* infection, with a standardized dose @ 107 cfu/ml for *E. tarda* of primary and booster vaccination after 21 days, through 1 h immersion mode, would provide 43% of relative protection to *L. rohita* when challenged with live pathogenic *E. tarda*, at optimum condition of fish rearing. This is the first package of technology for vaccination of Indian major carp which is ready for release and demonstration to field. In the present study, complete sterility of *E. tarda* bacteria are achieved by chemical inactivation for developing vaccine. ICAR-CIFE has developed a vaccination protocol using inactivated pathogen administered through immersion method which facilitates vaccine absorption from all mucosal surfaces. The method has advantages over feed-based as well as parenteral vaccination, and the method is less stressful.

Application: Vaccine would provide around 43% of relative protection to fish when challenged with live pathogenic *E. tarda*, at optimum condition of fish rearing.

Bacterial isolate, dose and mode of delivery of vaccine are the package of vaccine

Particular	1st day 7/1/19 (Primary vaccination)	21st day 31/1/19 Booster	35th day 15/2/19 Challenge
killed *E. tarda*	for 1 hr by immersion	2 hr by immersion	*E. tarda* injection method
Control	-	-	*E. tarda* injection method

Commercialization: Vaccine is already commercialized on non-exclusive basis to Indian Immunologicals Private LTD, Hyderabad.

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Technology No. 59

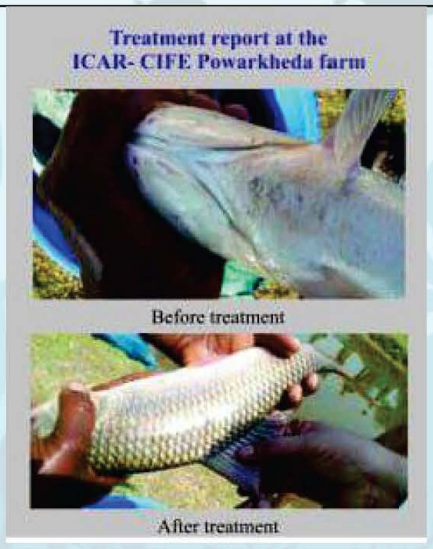
CIFE-ARGUNIL

Inventors: Dr. Md. Aklakur, Dr. A. K. Pal, Dr. N. P. Sahu

Division: Fish Nutrition, Biochemistry and Physiology Division

Technical details:

The argulus infestation in fish ponds is very rampant across the country. Due to the parasitic diseases fish culture faces the biggest problem for its sustainability and the commercial expansion. The Argulosis disease causes almost 25% loss to farmers in the form diseases associated mortalities and reduce growth rate. The only immediate remedy is used by the farmers is the unregulated dumping of the insecticide and different drugs/ chemical in the culture water which may give temporary solution from the problem. On the other hand this leads to a series of other problems such as accumulation of environmental hazards, impact on other organisms, reduction of growth rate in fish and higher upgraded residue in fish tissue with potential health hazards to human. ICAR-CIFE, have a tested the feed mix with the pharmaceutical and higher upgraded residue in fish tissue with potential health hazards to human. ICAR-CIFE, have a tested the feed mix with the pharmaceutical and nutraceutical component which include the regulated and monitored dose of the pharmaceutics for growth restoration and better productive performance.



Patent No. IN330484 Granted on 28th Jan 2020

Advantages: the product practice the treatment of Argulus infection and make the fish harvest superior in term of absence of lesion on the body, healing of the lesions (Argulus spot) and secondary infections, good colour and appearance, better overall health and condition factor of fish.

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