



Fish waste from fish market

ENHANCING AQUACULTURE PRODUCTION USING RECYCLED FISH WASTE

Novel ICAR - CIBA technology
(ICAR-CIBA Plankton ^{Plus}) scores in farm trials

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Introduction

Globally, fish waste represents 25 - 50% of the total fisheries production and it is estimated that a waste of >40 million tonnes has been generated in 2018 from the total fisheries production of 170.9 million

tonnes. The wastes generated through processing of fish, crab and shrimp amount to 30 - 60%, 75 - 85% and 40 - 80% respectively, in processing units and fish markets. Due to lack of adequate disposition, the waste generated from the fish market and industry creates sanitary and environmental problems.

A way of minimizing the environmental problems generated by the high amount of fish waste is its transformation into products, through recycling, that can be used as an ingredient in animal/fish/shrimp rations; as fertilizers for boosting plankton production in aquaculture ponds or as nutrient-rich manure for agriculture/horticulture. The fish waste or trimmings accumulated in fish landing centres and fish markets in India are not properly disposed or utilized, and the poor disposal results in polluting the air and water, in its course of deterioration. Therefore, a technology that recycles fish waste into such value-added products would be the solution, where objectives of waste management and its effective utilisation can be met.

Utilization of fish waste in fish farm for increasing the pond productivity through production of plankton could improve pond environment as well as increase the production of fish, contributing to the nutritional security of our ever-increasing population by providing quality protein at lower costs. The novel technology of recycling fish waste and fish trimmings from the

processing units developed by ICAR-CIBA is having the potential to clean fish markets, landing centres and fish processing centres of the country and can also provide livelihood security to the people/fishers/farmers involved in this.

Conversion of fish waste into value-added products

A unique technology has been developed by ICAR-CIBA, by which fish waste is converted to two value-added cost effective and indigenous eco-friendly quality products (Fig 1) branded as CIBA-Plankton^{Plus} and CIBA-HortiPlus (*Patent application Number 201941009741 dated March 13, 2019*). These products have been developed under the concept "waste to wealth" in Swachh Bharat initiatives of Govt. of India. CIBA-Plankton^{Plus}, is unique liquid product developed by CIBA from marine fish trimmings/waste, through the extensive research in utilization of fish waste.

Nutritional composition of

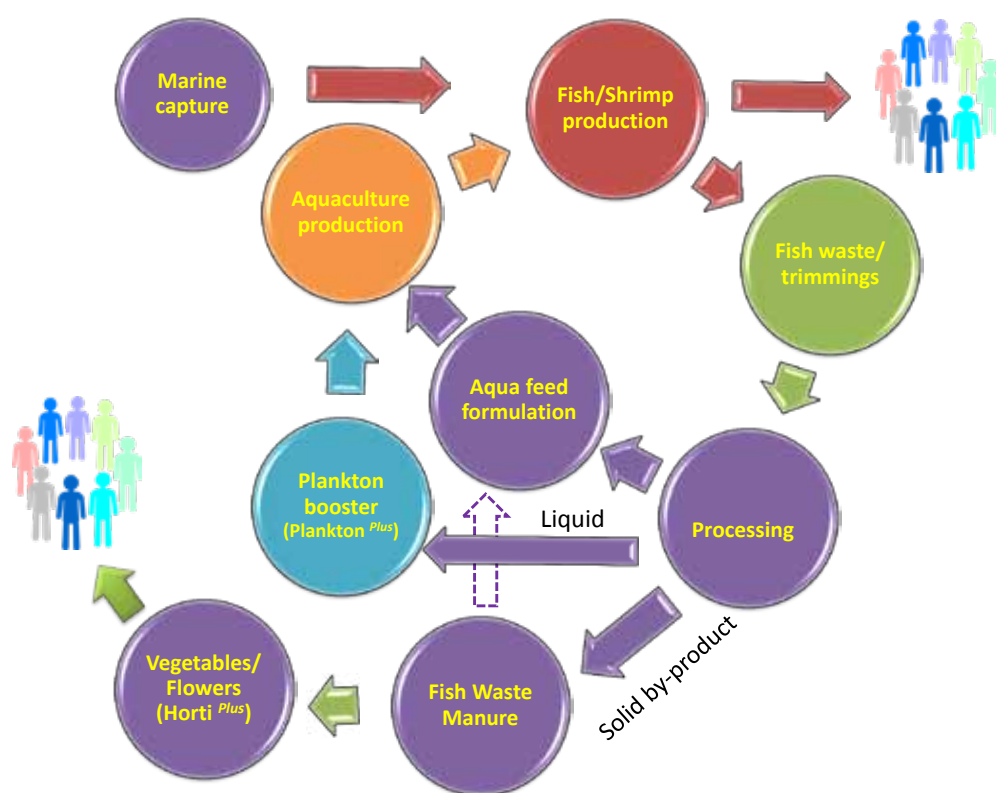


Fig: 1. Recycling of fish waste

Plankton^{Plus}

CIBA-Plankton^{Plus} is a liquid product having a protein content of 45 - 55% and lipid of 15 - 22% (Fig 2). It is rich in histidine (4.92 ± 0.04 %), Glutamic acid (4.58 ± 0.10 %), Cysteine (4.40 ± 0.08 %) and Lysine (4.12 ± 0.07 %). It also contains 9.13 % Docosa Hexaenoic Acid (DHA), 3.65 % Eicosa Pentaenoic Acid (EPA) and 3.58 % Arachidonic Acid, apart from being a high source of calcium (Ca-4.03%), phosphorous (P-1.43%) and iron (Fe-3.54 %).

Salient features of CIBA-Plankton^{Plus}

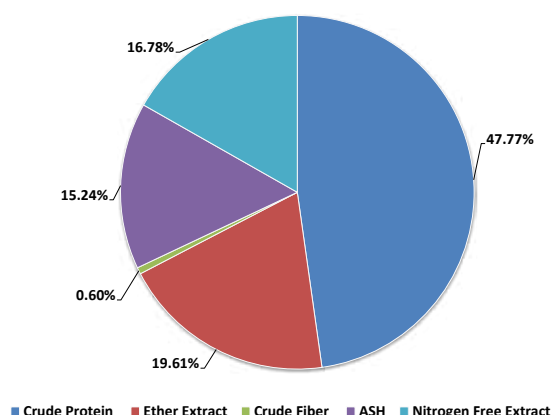


Fig 2. Proximate composition of Plankton^{plus} (De et al., 2020)

Efficiency of Plankton^{Plus} for boosting phytoplankton and zooplankton and thereby enhancing the aquaculture production has been tested through various experiments and farm level culture trials. Since Plankton Plus is rich in nutrients like protein, lipid, essential fatty acids, amino acids and minerals, it can be used to enrich the zooplankton like rotifers, artemia and copepods in order to boost their nutritional quality. Unlike inorganic fertilizers, Plankton^{Plus} when used in aquaculture ponds, does not have any adverse impact on water quality or on the bottom soil of the pond. Results of the experiments unravelled that Plankton^{Plus} supplementation improved the growth and survival of *Penaeus vannamei*, *Penaeus indicus*, *Chanos chanos*, *Penaeus monodon*, *Etroplus suratensis* etc. The experiments were conducted in outdoor tanks, replicated in farms of Kakdwip Research Centre and Navsari Gujarat Research Centre and further demonstrated in farmer's ponds in Kerala, Gujarat,



Fig 3: Fish waste hydrolysate as Plankton^{plus}

Andhra Pradesh and West Bengal. The supplementation of the product enhanced the abundance and diversity of phytoplankton and zooplankton. Supplementation of PlanktonPlus significantly increased growth and survival of *P. vannamei* compared to control, even at 30% less feed in tank system.

Farm trials using Plankton^{Plus}

Pond trial of *P. vannamei* with Plankton^{Plus} @ 10 ppm supplementation at Bapatla, Andhra Pradesh, India showed higher growth and survival which might be due to higher abundance and diversity of phytoplankton and zooplankton. The survival rate was significantly higher (12.31%), with an enhancement yield to the tune of 1.71 t/ha in pond supplemented with Plankton^{Plus} when compared to control. Plankton^{Plus} supplemented ponds were dominated by beneficial microalgae (Bacillariophyceae, Prasinophyceae and Dinophyceae etc.) and zooplankton. Enhanced growth



Fig 4: Application of Plankton^{Plus} in shrimp ponds of Navsari, Gujarat

performance of *Penaeus vannamei* might be due to the augmented density and diversity of phytoplankton and zooplankton in the Plankton^{Plus} supplemented ponds. Plankton^{Plus} demonstration was also conducted in a farmer's ponds at Namkhana in West Bengal. A higher production of 7.24 t/ha was achieved when Plankton^{Plus} was supplemented @ 30 ppm along with commercial

feed, against 6.04 t/ha registered in the control pond in *P. vannamei*. The pond culture demonstration of shrimp (*Penaeus monodon*) with Plankton^{Plus} was conducted at Payyannur, Kerala. Plankton^{Plus} supplementation @ 30ppm showed significant increase in growth compared to control. There was a significant increase in total number of phytoplankton (*Nitzschia*, *Chlorella* etc) and zooplankton (copepod and rotifer) in Plankton^{Plus} supplemented pond compared to the control pond.

Plankton^{Plus} helps to enhance the production to the tune of 1.2 to 1.7 t/ha of shrimp and thereby helps to enhance the farmers' income by Rs 3.60 lakh to Rs.5.1 lakhs per ha. The input costs incurred for fertilizers and chemicals used for primary production in aquaculture ponds can be saved by using Plankton^{Plus}. Additionally, this product is also having a cost advantage over similar products for boosting the plankton in aquaculture ponds.

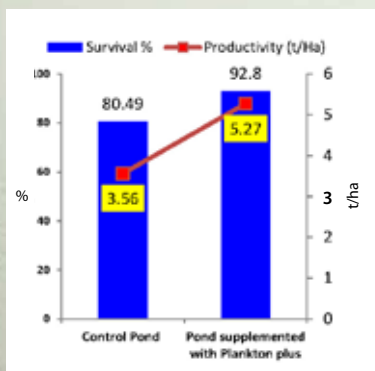


Fig 5: Growth of *P vannamei* supplemented with Plankton Plus at Bapatla, AP



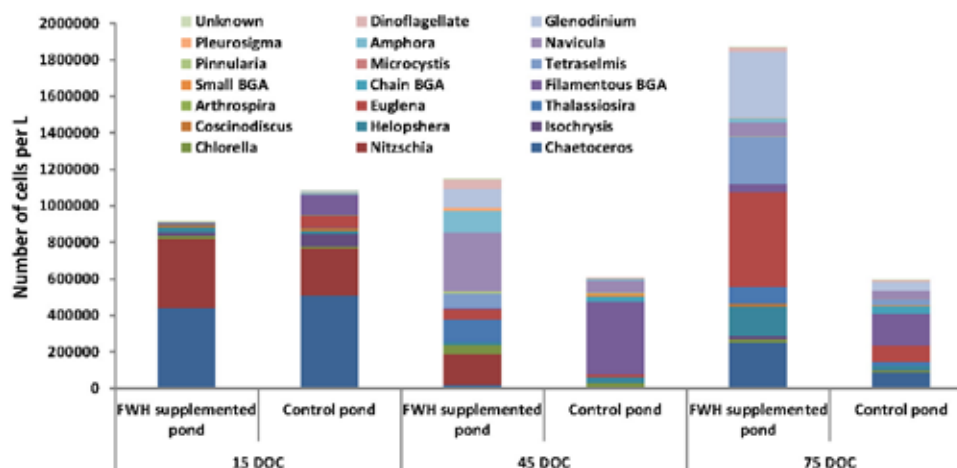


Fig 6: Abundance of phytoplankton in Plankton^{Plus} (Fish Waste Hydrolysate/FWH) supplemented pond

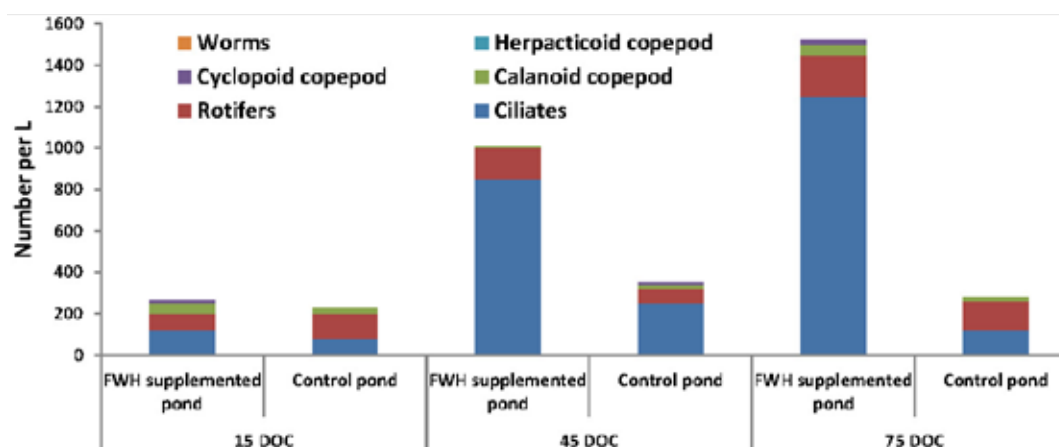


Fig 7: Abundance of zooplankton in Plankton^{Plus} (FWH) supplemented pond

NFDB Award to Nambikkai Fish Farmers group

CIBA has established a 'Fish waste Processing unit' on 18th February 2019 for recycling of fish waste into high value-added products; Plankton^{Plus} and Horti^{Plus}, at Nambikkai Nagar, Pattinapakkam, Chennai, Tamil Nadu (Fig. 9), to promote and showcase the technology. The unit is being operated by Nambikkai Fish Farmers Group, Chennai. Shrimp/fish farmers of Kerala, Tamil Nadu, Andhra Pradesh, Gujarat and West Bengal have commenced the usage of Plankton^{Plus}, being commercially produced by the Nambikkai Fish Farmers Group. CIBA is assisting the group, both in the production as well as marketing of Plankton^{Plus} and Horti^{Plus}. The group has produced 16.345 tonnes of Plankton^{Plus} and 0.82 tonnes Horti^{Plus} and generated a

revenue of Rs. 13.07 lakhs, during a period from May 2019 to July 2020.

The unique technology developed by CIBA enabled the Chennai based fish farmers group to bag this year's National Award, the "Best Fisheries Self Help Group 2020 award" from National Fisheries Development Board (NFDB), Ministry of Fisheries, Animal Husbandry and Dairying, Government of India. Shri. Pratap Chandra Sarangi, Hon'ble Minister of State for Fisheries, Animal Husbandry and Dairying, presented the award to Shri. T. Kennit Raj, leader of Nambikkai Fish Farmers Group, in the presence of Dr. Rajeev Ranjan, IAS, Secretary (Fisheries), Ministry of Fisheries, Animal Husbandry and Dairying, Government of India and Dr. Suvarna C., Chief Executive, NFDB on the eve of World Fisheries Day on 21st November 2020.



Fig 8: Fish Waste Processing unit at Nambikkai Nagar, Pattinapakkam, Tamil Nadu



Fig 9: NFDB Award to best SHG, Nambikkai Fish Farmers Group



Conclusion

Propagation of this CIBA technology has the potential to keep the fish markets across the country clean and helps to provide a hygienic environment. The 'wealth from waste' concept of the circular economy also provides ample livelihood opportunities to the needy. In an aquaculture system, this technology offers a solution to the unstable plankton blooms and frequent plankton crashes but the biggest advantage of this novel technology is the enhancement of productivity in aquaculture systems.