CHAPTER 4

Agricultural and Animal Farm Inputs from Fishery Waste

Zynudheen A. A.* and Binsi P. K.
ICAR-Central Institute of Fisheries Technology, Cochin-29
*E-mail ID: zynucift@gmail.com

Fish processing industry generates huge quantities of waste in the form of head, skin, viscera, scales and other entrails which comes around 50% of the raw material. Even though the waste contains good protein, it is simply being discarded unscientifically causing serious environmental threats and polluting land and water. At the same time, severe resource scarcity is faced today by the animal feed industry. Conversion of these discarded resource into feed for poultry, fish and other animals can enhance the productivity of the fishery sector to a great extend. Training programme on animal feed preparation will help in creating awareness and in developing skilled manpower. Fish processing sector generate two types of waste i.e. solid waste and liquid waste. The solid wastes can be as high as 50–80% of the original raw material which includes dark meat, head, fins, scale, skins, frames, visceral mass, gills etc. Crab shell, shrimp head/shells, cuttle fish skin and bone are generated from shellfish processing as waste. And Liquid waste is mainly contributed by effluents consist of blood, slime, mucus, wash off and surimi wash water**.**The biochemical composition of waste from fin fishes is equally good as edible portion. Dark meat is as

good as edible portion. Head waste contains proteins, lipids and mineral rich bone matrix. Skin contains collagen, minerals and to a lesser extent fat. Frame waste consists of bones and meat tissues. Hence fish wastes are obviously good source of protein, lipids and minerals. Discarding these waste will lead to loss of huge amount of nutrients and environmental pollution. Such waste can provide high-protein feed ingredients and palatability-enhancing agents for animal feed processing industries.

The waste is generated in pre processing centres, fish processing and exporting factories, fish markets and other handling premises. Total utilization of fishery waste by converting it into useful products by appropriate technologies is essential for the improvement of revenue of the fishers as well as for a cleaner environment. The existing technologies are to be refined to and novel technologies are to be developed to achieve this objective. A number of products of pharmaceutical, industrial and agricultural application can be attempted from fishery waste which needs to be segregated and properly preserved before converting it into useful products. India still remains as a supplier of raw waste at a meager rate to developed countries who in turn convert it into high value end products of different applications.

Converting the fish waste into fishmeal is a viable option for stabilizing the otherwise highly perishable waste. The processing making fish meal from waste is almost same as that of making fish meal from whole fish, except modulating the time and

temperature of operation and pressing. India is ranked 8th in the world in fish meal production with a quantity of about 1.03 lakh tonnes production during the year 2015 (IFFO, 2016). In the past five years, it has been observed that the international fish meal prices varied from Rs. 80 to Rs. 120 per kg. In India prices varied from Rs. 25 for traditionally produced fish meal to Rs.65 for fish meal produced by modern fish meal plants. Fish meal is considered as an ideal ingredient in animal nutrition and is a highly concentrated nutritious feed supplement consisting of high quality protein, minerals, vitamins of B group and other vitamins and other unknown growth factors. But the quality of meal from waste is inferior in quality with high content of ash. Fish meal is stable during room temperature storage and used as the protein content while compounding feed.

Another option of fish meal utilization is fish silage. Fish silage can be defined as a product made from whole fish or parts of the fish to which no other material has been added other than an acid and in which liquefaction of the fish is brought about by enzymes already present in the fish. The product is a stable liquid with a malty odour which has very good storage characteristics and contains all the water present in the original material. It is a simple process and it requires little capital equipment particularly if non-oily fish are used. The use of oily fish usually requires oil separation. This involves expensive equipment and is suited to a fairly large-scale operation. Foliar spray which contains soluble

protein and other micro and macro nutrients is another option for fish waste utilization. In fact it is an ancillary activity of collecting the upper clear portion of fish and packing. This is diluted many folds before direct application on the foliage, which will give quick results by enhanced productivity in plant. Besides it acts as booster for the plant and also as a pest repellant. ICAR-CIFT has been giving training on production of fish silage and foliar spray from different types of aquatic wastes including cephalopod waste. The incubatees of CIFT are successfully marketing their products and it is a profitable venture.

Preparation of feed for aquaculture and poultry is another important option for utilization of general, unsorted waste from industry as well as fish markets. There is a growing demand for pellet feeds, due to the increase in aquaculture activity. A significant portion of costs in the sector is for feed. The cost of feed production can be cut down by utilizing the waste generated from nearby fish markets. Apart from this, trash and juvenile fish from the landing centers can also be used as raw materials for pellet feed production. As mentioned earlier fish meal made from waste can be used for feed preparation. The quality of fish meal is determined by content of its crude protein. Internationally marketed fish meal has a crude protein content of 65% and it varies from 57 to 77%, based on the raw material used for fish meal production.

Pellet fish feed production based on fish waste:

The technology of feed processing has undergone substantial improvement in recent years from simple hand mixing to the nutritionally balanced pellet feeds available in the market today. This requires a considerable amount of specialized equipment and technical expertise. ICAR-CIFT has been working on technologies for production of low-cost alternatives to commercial feeds using locally available ingredients. The feed ingredients used are rice bran powder, soya powder, wheat powder, corn flour along with fish waste producing low cost fish pellet feeds using small indigenous machinery like grinding/pasting machine, ingredient mixing machine, cooking device and pelletizer etc. The feed developed is comparable to commercial feeds in terms of its quality. This model can be easily setup at the fish farm site itself and based on the fish age and species cultured, the ingredient mixture composition and pellet feed size can be changed considerably reducing the wastage.

The fish pellet feed production process starting from receiving the raw material to finished products is illustrated in Figure.1. Fish waste is fed into a magnetic drum which removes the iron and metal pieces from the fish waste. The raw material is then ground into a slurry paste form.

Fig 1: Flow chart of fish pellet feed production of ICAR-CIFT

An improved method in feed production from fish waste has been worked out by ICAR- CIFT. Fish waste is crushed and pasted and calculated quantity of other ingredients are added and mixed properly. This is extruded out after sufficient cooking and the pellets are dried. The process simplifies pelleted feed production by cutting down some steps and amalgamating some important steps. This in turn will reduce the cost of production, handling time and manpower requirement, when compared to

conventional process. Based on the experience of preparing fish waste based a training programme was organized for dissemination of the technology. Three days practical training was given to a group of fish farmers and poultry farmers and all the participants were satisfied with the programme. Many farmers have taken up the technology and producing their own feed as per CIFT guidance

Economic analysis of the production of Fish feed pellets from the fish waste:

The annual investment is around ₹ 1.65 lakhs. Out of the total investment, machinery items such as grinder and pelletiser cost up to 42% of the total investment. The annual operating cost was around 8.7 lakhs and the main components of the operating expenditure were the raw material cost, which includes fish waste as well as the ingredients constituting 70% of the cost. The annual fixed cost was ₹ 0.33 lakhs.100 Kg fish contains roughly 80% moisture and 20% dry matter. 20Kg of this dry matter is mixed with 80kg ingredient to produce 100Kg pellet feed per day. A break up of ingredient costs excluding fish cost is around ₹4.75 Lakhs, out of which the cost of rice bran was 34%, remaining soya powder 25% and corn flour 17%.

The investment made is found profitable and the option for the fish farmer to start a unit locally is feasible and this technology will act as a way to mitigate the rising cost of commercial feed.

Even though the ingredient cost itself was about 54% of operating cost, this can be reduced by using locally available raw materials such as agricultural byproducts. Species specific feeds with improved nutritional profile can also be thought of catering to the needs of the growing aquaculture industry. The technology will enable the development of rural enterprises to producing affordable fish feed and also generate local employment and economic participation of rural entrepreneurs including women. The technology will improve and fish waste management and address fish waste pollution related issues.

ICAR-CIFT has also developed technologies for the extraction purification and characterization of high end products from fishery discards. To name a few, chitin & chitosan, various derivatives from chitin, squalene, hydroxyl apatite, fish calcium, fish protein hydrolysate, PUFA etc, which has various industrial and pharma and nutraceutical applications. The conversion of waste material with its consequent reutilization can bring economical advantages for the industry, besides solving a great problem with the discharge of the waste into the environment.