AN ATTEMPT TO UTILIZE FISH WASTE AND TRASH FISH IN SRI LANKA

by

T.S.S. Peiris
Research Division, Ministry of Fisheries
Colombo, Sri Lanka

Abstract

Although the amount of fish waste and waste fish available in Sri Lanka is not large, its conversion into useful products is important. Fish meal is produced by the public and private sectors; a portion of the country's requirement is met by imports. Some waste fish which is not utilized could be used for fish silage production in Sri Lanka. Before installing a new fishmeal plant the possible advantages of making fish silage should be investigated. Experimental trials and investigations are needed to assess the best possible means to utilize all fish and fish waste.

INTRODUCTION

Technological research in Sri Lanka began in 1953 with the analysis of the flesh, skin, head, bones, viscera and liver for moisture, ash, fat and protein on several varieties of popular fish (Lantz and Gunesekera, 1957; Peiris and Grero, 1972, 1973). Such analyses form the basis for the optimum utilization of fish in any development programme.

Total fish production in Sri Lanka for the year 1976 was 133 731 tonnes. Since the present production does not meet the demands of the population of 13.7 million, there is a need to use as much of the fish as possible for human consumption. Although the quantity of waste material available is not very high, its conversion into useful products is important.

At present, fish waste and trash fish are not fully utilized although some is converted into fish meal. A fish silage industry has not been established. A portion of discarded fish livers is used for the extraction of liver oil. Skin, heads, liver, bones, fins and skeletal parts offer a further source of material for research and investigation.

FISH MEAL

Fish meal may be defined as the solid product made by removal of most of the water and some or all of the oil from fish or fish waste. It is too valuable to be used as a fertilizer.

The Ceylon Fisheries Corporation is a state-owned organization with two small-scale fishmeal plants; one is situated in Mutwal, Colombo and the other at Pesalai, Mannar. Another small, privately owned plant is also situated at Pesalai, Mannar. At certain fish landing centres waste fish is dried and ground to obtain a product similar to fish meal. A portion of the demand for fish meal is met by imports.

Plants

State-owned plant at Mutwal, Colombo

Operational efficiency of this plant has been impaired by age and it is not running at maximum capacity due to a lack of raw material. Other activities of the Ceylon Fisheries Corporation Complex at Mutwal, include catching, handling, processing and marketing of fish. Thus a major proportion of the raw material for fishmeal production is easily collected within the organization.

Fish waste from the Corporation's marketing is also collected. The process involves cooking, pressing, drying and grinding; there is no recovery of press liquor. Table 1 shows the production data for the plant from 1973 to 1977.

Processing of crude fish meals

At certain fish landing centres in the country, crude fish meals are prepared. One example is the fish landing centre at Kandakkuliya, Kalpitiya where fish offal and inferior varieties of fish are collected, sun-dried and ground to a suitable particle size. This product finds a ready market. Certain poultry food manufacturers also collect waste material at fish curing yards, dry fish store houses, wholesale and retail outlets and grind it to obtain a similar product.

Fish meal and similar products: improvement and development

Occasional checks are made on the quality of the fish meal produced by the state-owned plants. Testing is performed at the Research Division of the Ministry of Fisheries, where samples are analysed for moisture, fat, protein, ash, acid insoluble ash, sulphides and salt. Test results are conveyed to the authorities for necessary action. The quality of the fish meal is satisfactory and its use as an animal feed can be recommended. Few tests are carried out on fish meal produced by the private sector on the crude fish meals.

Investigations on the acceptability and safety of these products are required. These should be oriented toward an improvement in quality. Installation of new fishmeal plants should be considered only after a careful survey has been made. Special attention should be paid to a regular supply, and adequate amounts of raw material for economical running of the process. The private sector plant at Pesalai would provide an ideal model for such a study. It is not advisable at present to install larger plants in any part of the country.

FISH SILAGE

Animal protein can be digested under acidic conditions to produce a stable, liquid product called silage. Fish waste and slaughterhouse waste can be converted into a useful product by this process. Fish silage should be prepared only from fish or fish waste. The product is sometimes known as liquid fish meal.

There are several methods of making fish silage; microbiological fermentation and acid digestion are the most common methods. Enzymes responsible for liquefaction are active at tropical environmental temperatures. The product, like any other liquid, can be transported in bulk in suitable containers. In order to promote easier and cheaper handling, attempts have been made by several workers to produce a dried product from silage. Methods of preparation and potential hazards are discussed by Lantz and Gunesekera (1955) and Disney *et al.* (1977). Investigations into the preparation of fish silage and its subsequent conversion into a dried product are being conducted at the Institute of Fish Technology, Sri Lanka. Disney *et al.* (1977) have reviewed recent developments in fish silage including an account of the work carried out at the Tropical Products Institute, London, to develop a dried silage product for use in the tropics.

Some fish waste (offal) and inferior varieties of fish are discarded at fish landing centres in Sri Lanka. Fish waste is also produced from fish markets and retail outlets, certain types of fishing, for example prawn trawling operations, beach seining operations, etc., and fish processing and curing activities, e.g., processing prawns for preparation of dried and smoked fish, etc. It is impracticable to produce fish meal from this waste but a possible solution is to convert it into fish silage at selected locations. The operation is simple and economical; no sophisticated equipment is required. Flour mill sweepings from the State flour milling corporation could provide a suitable carbohydrate filler for the preparation of a dried product; other fillers could be tried. Fish silage, whether in liquid or dried form, would be a new product in Sri Lanka and great care would be needed in its introduction. Technical and economic feasibility of the operation must also be tested.

FISH LIVER OIL

Fish liver is a source of medicinal oil containing Vitamins A and D. The size of liver, its oil and vitamin content are the important factors for economical extraction of oil from fish livers.

Production

Oil can be removed easily from fish livers by a steam rendering process. Whole livers are cleaned, cut into small pieces and collected in a vat into which steam is passed. After standing, an oil layer is formed at the top. The crude oil is taken off and any free acid present is neutralized by using an alkali (e.g. dilute sodium carbonate solution). The neutralized oil is washed to remove any excess alkali and the resultant oil is treated with a dehydrating agent (e.g., anhydrous sodium sulphate) to remove suspended water. The purified, water-free oil is then stored in the dark until used. For medicinal use this oil should be standardized with respect to its vitamin content; this is done by blending it with a suitable refined edible oil which has a very low acid value (e.g., soy bean oil or ground-nut oil).

Table 1

Fishmeal production: Mutwal Plant

Year	Raw material converted (tonnes)	Fish meal produced (tonnes)
1973	268.86	98.27
1974	373.37	131.84
1975	203.72	72.87
1976	263.05	121.09
1977	116.52	46.56

State owned plant at Pesalai, Mannar

The Ceylon Fisheries Corporation has a small fish canning factory and a fishmeal plant at Pesalai. The purpose of this plant is to convert fish offal, from the canning operation, into fish meal. At present the canning factory is not functioning at full capacity, mainly due to a lack of fish; the fishmeal plant uses waste fish from the prawn catching operations. The raw material is converted into fish meal by a procedure similar to that used in the Mutwal plant. Table 2 shows the production data for the plant from 1973 to 1977.

Table 2

Fishmeal production: Pesalai Plant

Year	Raw material converted (tonnes)	Fish meal produced (tonnes)
1973	120.04	29.07
1974	206.72	48.48
1975	391.49	93.43
1976	325.29	78.76
1977	555.17	121.80

Private-sector plant at Pesalai, Mannar

This plant is smaller than the state-owned one at Pesalai and it also converts a portion of the waste fish from the prawn fishery into fish meal. During glut periods the plant receives too much raw material and at other times it is idle.

The plant is constructed from locally manufactured machinery. Most operations are performed manually, making use of the cheap labour available in the country. Crushed raw material is transferred to the cooker, where it is steam cooked. The cooked material is pressed and the liquor is drained off. The solids are then spread out on a cement floor to dry in the sun. The material is then transferred to a mechanical drier to complete the drying process and finally ground to a suitable particle size. When sun-drying is impossible due to bad weather, the material is dried in a room constructed for the purpose until it is ready for transfer to the mechanical drier.

Although small, this plant makes a significant contribution to the tota! fishmeal production of the country. An investigation on process control is essential in order to look into possible modifications needed to improve the quality of the final product.

State-owned plant at Mutwal, Colombo

At present, the fish liver oil extraction plant at the Ceylon Fisheries Corporation Fishery Complex in Mutwal, Colombo uses only shark livers. Livers from the Mutwal Fishery Complex and from fish collecting centres, markets and retail outlets accessible to the plant are used. Private fish distributors also send livers by rail in special containers provided by the Corporation. Medicinal and veterinary oils are produced at the plant; medicinal oil is standardized for vitamin A content at 3 000 i.u/g and veterinary oil for vitamin A at 1000 i.u/g. Oil production of the plant from 1973 to 1977 is shown in Table 3

Table 3

Vitamin oil production: Mutwal Plant

Year	Raw material (lb) a/	Medicinal oil produced (gal) b/	Veterinary oil produced (gal) b/
1973	76 355	3 725	996
1974	55 714	2 905	598
1975	38 491	4 129	278
1976	7 712	475	598
1977	19 302	2 529	306

a/ 1 lb = 0.454 kg
b/ 1 gal = 4.546 l

Fish liver oil: improvement and development

Fish liver oil is used for direct human consumption and, therefore, the entire preparation should be carried out under hygienic conditions. Standardization of the final product with respect to vitamin content is very important. Shark liver is economically suitable for oil extraction but experiments are needed to determine the suitability of other fish livers, particularly those from larger fish. At certain fish landing centres, fish livers are discarded or underutilized at present and an effort is needed to transport as much liver as possible to the state owned Mutwal plant. Meanwhile an investigation is required to establish the feasibility of fish liver oil production in other places.

Utilization of fish liver residues

At the Mutwal plant, liver residues, after extraction of the oil, are currently discarded. This residue contains protein, vitamin B_{12} and other nutritional factors and its utilization would be important. A method of converting this material to a stable hydrolysate has been devised by Gunesekera (1958).

CONCLUSION

Conversion of fish waste and waste fish into useful products is important. Possibilities for the improvement and development of fish meal and fish liver oil industries are mentioned in this paper. The possible introduction of fish silage production is also outlined but experimental trials and testing are essential.

REFERENCES

Disney, J.G., I.N. Tatterson and J. Olley, Recent developments in fish silage. *In* Proceedings of the Conference on 1977 the handling, processing and marketing of tropical fish. London, Tropical Products Institute, pp. 231-41

Gunesekera, C., Utilization of fish liver residues. *Proc.IPFC*, 8(2):89-92 1958

Lantz, A.W. and C. Gunesekara, Liquid fish "meal": biological and technological. Fisheries Research Station, 1955 Colombo, Sri Lanka. *Prog.Rep.Fish.Res.Stn., Colombo*, (1):7-10

_____, Chemical analysis of some Ceylon fishes. *Bull.Fish.Res.Stn.Ceylon.*, (5):34 p. 1957

Peiris, T.S.S. and J. Greco, Chemical and analyses of some Ceylon fishes. 2. *Bull.Fish.Res.Stn.,Sri Lanka*, 23 1972 (1-2):1-7

_____, Chemical analyses of some Sri Lanka fishes. 3. *Bull.Fish.Res.Stn., Sri Lanka*, 24(1-2): 1-12 1973