

COMMERCIAL PRODUCTION OF FISH

MEAL FROM FISH WASTE

by

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ABSTRACT

The importance of fish meal production as a means of reducing fish waste currently being experienced in the fisheries subsector is discussed. Cost estimate of establishing a fish meal manufacturing plant and suggestions on rational execution of the project are presented. If properly located and well managed, the project will serve to convert fish waste to cash in the industrial fishery.

INTRODUCTION

The deficiency of animal protein in the face of growing human population has raised public interest in the need to intensify production so that animal protein supply could meet increasing demand. Fish, an important source of animal protein because of its abundance and low cost is similarly facing a shortfall due to restrictions in importation, decline in domestic production and wastage which alone accounts for 15 - 50% of post-harvest losses in marine and freshwater fisheries. Fish wastage occur as a result of poor handling resulting in spoilage and dumping of 'trash' fish or deliberately discarding fish at sea after capture.

In industrial fisheries, a major portion of catch by fish and shrimp trawlers comprise species known as by-catch that are discarded at sea. An estimated 5 million tonnes per annum of fish by-catch comprising between 70 and 200 species are discarded at sea in the tropics (Allsopp, 1977). In Nigeria, shrimp by-catch estimated at 7,000 tonnes/annum are frozen or jettisoned at sea. Among the discards are small sized adult fish mainly Brachydenterus auritus (Ajayi and Talabi, 1984). Apart from this, tonnes of fish offals and spoiled fish are dumped daily in fishing companies within the industrial marine fishery.

With the reported increase in fish wastage and the alarming estimates of the discards at sea, the need to reintroduce this resource into the human food chain should be of immediate concern to fisheries investors. Processing the spoilt, underutilized or unused fish species into fish meal which could be incorporated into animal feeds is an effective way of expanding the livestock industry and increasing the protein intake of the nation.

Fish meal is a carefully produced component of animal feedstuffs which is mixed with vegetable proteins usually by fish mixing companies and farmers (Barlow, 1976). It is used for feeding poultry especially broilers and layers and for pigs and piglets. It is also used in rearing fish and other livestock. Fish meal is invaluable in the ration of livestock because of its high content of essential amino acids especially lysine and methionine which are limiting in other feed components. Fish meal is also rich in vitamins and minerals which are deficient in the diets of domestic animals. It is very easily digestible and contains an unidentified growth factor (UGF) called also Animal Protein Factor (APF) or vitamin B12 which promotes the growth of livestock more than those fed other protein components by assisting assimilation of vegetable albumin (Kordyl, 1975). Experiments have shown that fish meal supplements to compound feeds can raise the rate of growth of pigs and chickens by up to 20 per cent compared with that of animals fed on an exclusively vegetable diet (Anon, undated). This means that by using fish meal in the feed, the farmer can obtain an increase of about 20% in weight in the course of the same feeding period. Alternatively, he can cut down the feeding period by about 20 per cent and obtain the same weight of meat. This makes fish meal production one of the most efficient ways of utilizing fish protein resources, resulting in products of high acceptability e.g. chicken, eggs, milk and beef which are essential in meeting the current high animal protein demand. It is in realization of this role that one-third of the world's fish catches is devoted to fish meal production (FAO, 1979). Table 1 indicates a higher protein content in fish meal than in other meals commonly used for animal feeds.

Table 1 - Proximate composition of meals frequently used in animal feeds

	Protein %	Fat %	Water %	Salt %	Ash %
Herring meal	72	8	9	2	9
Groundnut meal	50	7	9	0.1	6
Soyabean meal	45	7	9	0.1	6.7

Source: Atlas Stord

MANUFACTURE OF FISH MEAL

Figure 1 shows a diagram of the operation of a typical fish meal and fish oil plant. The process starts at the hasher (A) where large fish are chopped before entering the steam cooker (C) through the feeder (B). The cooking coagulates protein and ruptures the tissues in the flesh so that oil and physiologically bound water are removed during processing.

From the cooker, the product passes by combined stainer conveyor (D) to the twin-screw press (E) which removes oil and water. The press cake and press water so formed are then treated as follows:-

The press cake is disintegrated in a tearing machine (F) dried in a dryer (G) before passing through a vibrating screen with magnet (H) where foreign matter is removed. The meal is ground in a hammer mill (J) weighed (K) and bagged.

The press liquor passes through a decanter (N) which removes insoluble dry matter or sludge. The press liquor enter a buffer tank (O) before oil is extracted by centrifuge (P). The oil-free stickwater which remains is evaporated in a concentrated plant (R) and returned to the drier (G) where it is mixed with the press cake to form whole meal.

Figure 2 shows an outline of a manufacturing process for fish meal. Out of the 1,000 kg of raw fish fed into the plant, 212 kg of fish meal was produced. 108 kg of oil was also produced during the process. The fish oil produced is valuable for the soap, paint and margarine industries and also in the production of leather.

COST ESTIMATE

Table 2 shows the cost estimate for a 12.5-tonne capacity fish meal plant. The costing is based on a model on pre-investment analysis for fish meal plants developed for F.A.O (da Costa, 1975).

The cost of a 12.5 tonne fish meal plant based on a quotation received from a supplier in the United States, estimated at ₦100,000.00 is made up of the following major components including shipping and installation.

- (i) Basic fish meal plant
- (ii) separation unit
- (iii) deodourizing unit
- (iv) evaporating unit
- (v) steam boiler

The cost of building construction for the fish meal plant, fish meal and fish oil store and an office including a stand-by generator, and miscellaneous expenses have been estimated at ₦100,000.00. The total cost is shown in the table. It must be noted that there are bound to be a great difference in all costs depending on unavoidable factors such as inflation, location of the plant, method of payment, supplier, type and make, labour cost, existing rate at the foreign exchange market etc.

Table 2 - Cost Estimate for a 12.5 tonne capacity fish meal plant

Items	Amount N
<u>Capacity per day (24 hours):</u> 12.5 tonnes	
Fish offal with about 8% oil content output per day: (24 hours)	
Fish meal:	2.3 tonnes
Fish Oil:	0.75 tonnes
<u>Operation Costs per Day</u>	
Fuel oil at N0.10/kg (500kg)	N50.00
Plastic bags N0.50/pc. (250 pcs)	125.00
Lubricants, etc.	10.00
Operators: 2 persons per shift (Total 6 persons)	60.00
Operation Costs per Day	= N245.00
<u>Overhead Cost per Year</u>	
10 years depreciation of total investment (Building, plant, generator, Misc.) N200,000	N20,000
Interest of 14% of the total investment (N100,000)	28,000
Maintenance 2% of N200,000	4,000
Insurance, Share of Admin. Cost:	4,000
Total Overhead Cost per Year	= N 56,000
<u>Overhead Cost Per Day</u>	
For 250 working days per year the overhead cost will be:	56,000
	250
	N224.00
<u>Income per Day</u>	
Fish meal at N400/t (2.3 tonnes)	920.00
Fish Oil at N450/t (0.75 tonnes)	337.50
	N1,257.50

Table 2 (contd.)

<u>Total Income per Day</u>	
Less Operation	N245.00
Overhead Cost per day	+ 224.00
Overhead Cost per day =	469.00
Raw Material	
(Fish offal) at N30/tonne 12.5t =	N375.00
Net Profit per day = N1,257.50 - N469.00	
=	N788.50
Net Profit per Year =	<u>N197,125.00</u>

Foot Note:

Fish meal plant without stickwater concentrating plant.
 Plants equipped with stickwater concentrating plant yield
 20 to 30 times more fish meal per day.

SOME USEFUL HINTS TO POTENTIAL INVESTORS

Though the profit margin in the foregoing proposal is quite attractive, potential investors should not lose sight of the following details:-

(i) Raw Material

The price and availability of raw materials at regular intervals determine the feasibility of a fish meal plant. Too costly a raw material will reduce the projected profit margin, and deficiency in regular supply of raw material will lead the industry towards liquidation. The yield of the final product is determined by the quality of raw material. Poor quality raw material will give low fish meal content. Raw materials with high fat content are usually preferred since the fat is held against water and not against protein. The fat after extraction will increase revenue from sale of fish oil.

(ii) Market for fish meal

This must be considered at the initial planning stage. With the prevailing high demand on livestock feeds, there appear to be a ready market for fish meal. Investors must be able to locate the feed mixing companies and work out the potential demand before commencing production. A pilot fish meal plant at the initial stages might be necessary to study the market for fish meal, rather than an outright engagement on large scale production.

(iii) Location of Plant

A fish meal plant should be sited close to the source of raw material to prevent incurring additional cost on transportation. There should be constant supply of electricity and water. The main source of electricity should be from the national power grid and a stand-by generator should be available to serve during power cuts. The plant should be located away from the residential areas to prevent off-odours reaching the areas.

(iv) Packaging Materials

The packaging material should be such that would protect the meal against insect infestation, seepage and rapid movement of water vapour and oxygen which encourages growth of moulds and bacteria. The use of jute bags as packaging materials should be discouraged because the holes in the bag allow destruction of the meal. Plastic bags are safe but the meal must be packed and stored immediately it emerges from the drier.

(v) Storage of Fish Meal

Fish meal with high oil content usually presents a problem during storage due to fat oxidation accompanied by a rise in temperature. This might lead to fire outbreak if the

bags are stacked. Antioxidants could be used to stabilize the meal after leaving the drier. 400-700 ppm ethoxyguine should be added to the dried meal to prevent oxidation.

(vi) Pollution

The breakdown of fish flesh caused by bacterial activity and enzymes produces obnoxious odours which could be unpleasant to those living in the neighbourhood of the plant. Some of the gases produced such as hydrogen sulphide are very harmful. The effluent air could be deodourized before leaving the factory by installing a deodourising equipment.

CONCLUSION

The production of fish meal from fish waste which are of minor value as food for human consumption has been recommended as a profitable means of arresting the losses currently being experienced in the fishing industry. Potential investors should ensure that the raw materials and market for the finished products are guaranteed before investing on large scale production of fish meal.

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Fig. 2. Outline of a Typical Manufacturing process for Fish Meal.

