

A SMALL SCALE FISH MEAL DRYER

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A batch type rotary drum dryer for the production of fish meal suitable for operation in the fishing villages of India has been designed, fabricated and operated successfully. The dryer can be used for production of fish meal from whole lean fish or press-cake from fish body oil extraction plants. The time taken to reach a moisture level below 10% is 5-8 hours depending upon the type of material fed into the dryer.

INTRODUCTION

Fish meal is a valuable feeding stuff with high content of digestible proteins, vitamins and minerals. The diets of domestic animals and poultry are often deficient in protein, vitamins etc. In such cases fish meal can find extensive application as a supplementary item of food for increased production of meat and eggs.

Fish meal is manufactured from lean miscellaneous fish which do not find any ready market, fish wastes such as offals, heads, trimmings etc from fish processing factories and press-cake from fish body oil extraction plants. Trawlers operated for the catch of prawns bring a substantial quantity of miscellaneous fish constituting nearly 65% of the total catch and the same is on the increase with more and more mechanised trawlers being put into operation. In spite of this, the fish meal industry has not grown proportionately

perhaps due to the inadequate transport and preservation facilities. Coupled with the fact that a regular supply of raw material is uncertain, operation of big capacity plants cannot be economic. Under the circumstances only batch type dryers which can handle relatively smaller quantities of material and suitable for operation in fishing villages can provide an answer to the proper and effective utilization of trash fish by converting them into fish meal.

In India, Pillai (1957) has done some pioneering work in the production of fish meal on a pilot plant scale. He designed and put into operation a small dryer which could handle about 100 lbs of fish per charge. It was later felt necessary that a design of a plant which can handle about $\frac{1}{4}$ a ton of raw material per charge will be more suitable under the present conditions and a design for the same was made with

suitable modification to the dryer under reference to make it more efficient and economic in operation. The same was fabricated and put for experimental and demonstration purposes and the results are reported in this paper.

MATERIALS AND METHODS

Dryer

The dryer was a jacketed drum of 153.5 cm length, 76.7 cm internal diameter and 91.21 cm external diameter with 7.5cm jacket, made of 3 mm M. S. plate. 8 baffles of 7.5 cm height were fixed along the entire length at equal distance on the inside surface of the dryer. The outer surface of the dryer was insulated by asbestos rope to reduce heat loss. The drum was provided with a charging door of 30 cm diameter on the body which could be closed at will with a lid and two sampling doors at the two end sides of the drum with closing arrangements. The drum was supported on either ends on ball bearings of 15 cm diameter and rotated by a 5 h. p. motor through a reduction gear to obtain a final 15-20 r.p.m. to the drum. Steam supply to the drum jacket was provided at the drive end of the dryer through a rotary pressure joint. An

exhaust fan of capacity 12-17 cu.m/min. provided at one axial end of the dryer and connected through a regulator drew out moisture and air from the dryer, atmospheric air being drawn through holes provided at the other end of the dryer. The drum jacket was provided with usual steam fittings like pressure gauge, safety valves, drain ducts etc (Fig. 1)

The unit was properly installed in proximity to other auxilliary units like boiler, cooker, screw press, pulverizer etc aligned properly spaced, a typical layout of which is given in Annexure I.

Trash fish landed along with prawns by the trawlers operated by the Institute and country crafts operated from Manassery in the sea off Cochin were utilized in these experiments. In the case of conversion into fish meal without pre-cooking, the fish were fed as such into the dryer. When press-cake was used for drying, especially in the case of oily fishes, the fish were cooked in a steam jacketed kettle for about half an hour at a steam pressure of about 0.7 kg/cm², pressed inside a canvas bag using a screw press and then fed into the dryer. Before

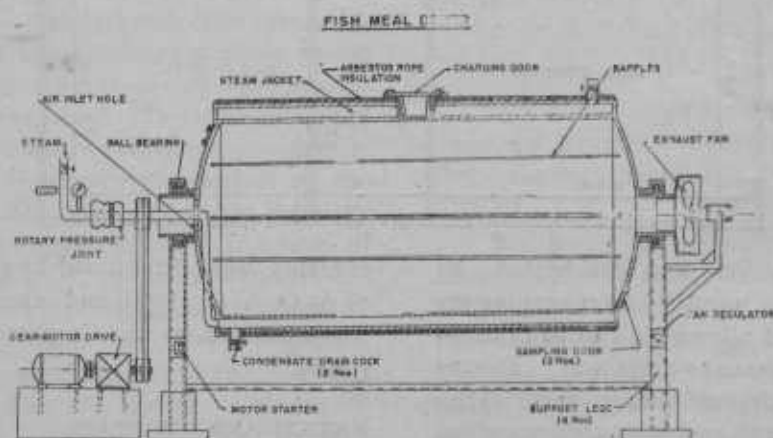
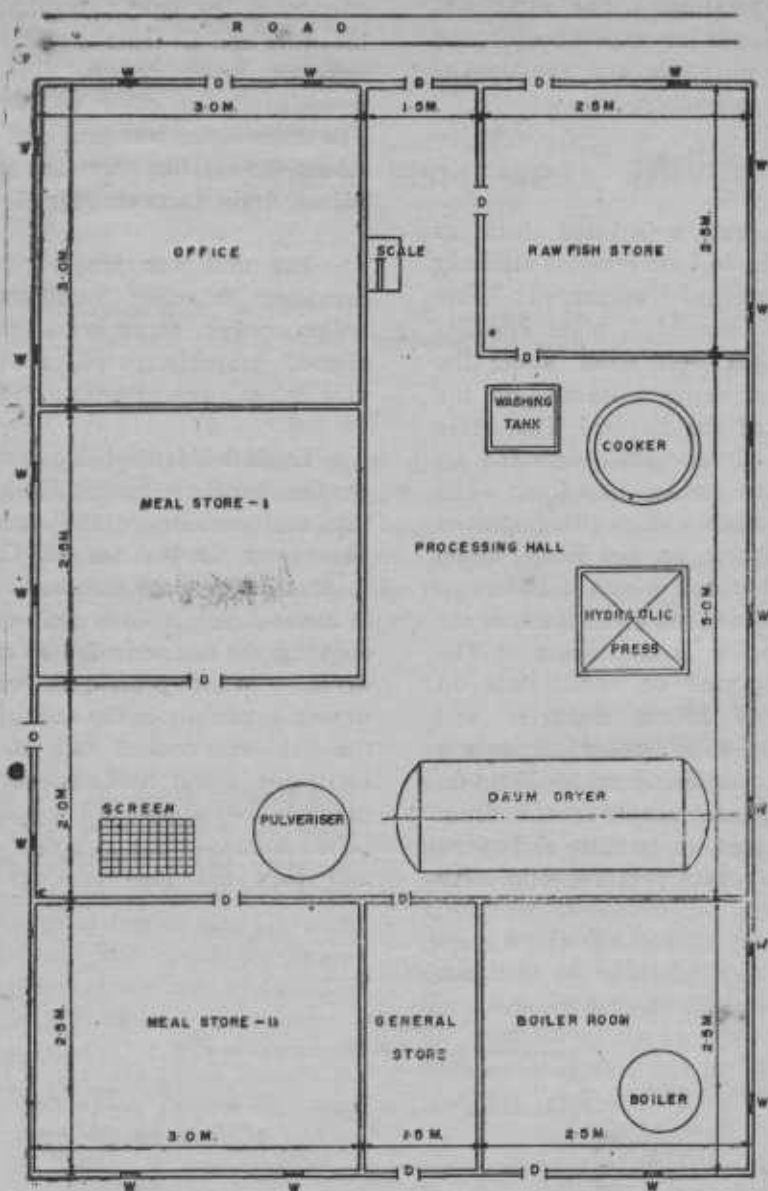


Fig 1.

L A Y - O U T O F F I S H M E A L P L A N T

ANNEXURE I



feeding, the dryer was pre-heated by admitting steam into the jacket keeping the drain duct open allowing air to be expelled and the condensate to drain out. During the course of drying samples were taken at regular intervals and moisture determined to follow the progress of drying.

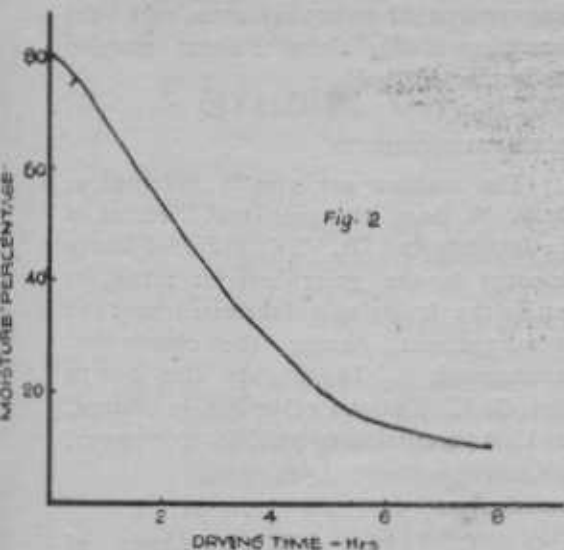
Moisture, fat, ash, sand and protein

contents were determined by the methods of A. O. A. C. (1960) and available lysine was estimated by the Carpenter's method (1960).

RESULTS AND DISCUSSION

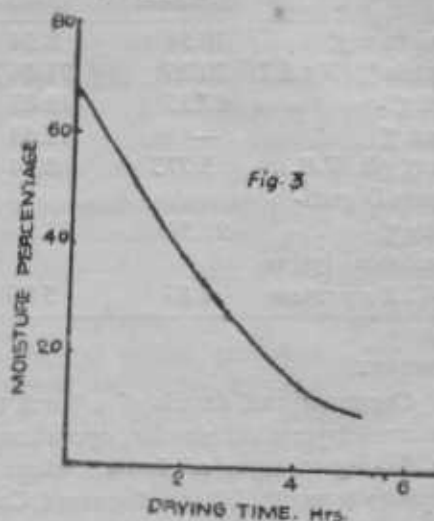
Several experiments were carried out to find out the efficiency of the dryer for

the production of fish meal both from whole fish and press cake. The results obtained in a typical experiment carried out with whole fish is given in Fig 2.



The final product as discharged from the dryer was in a well pulverized form except for some bigger bones. The fish when fed into the dryer and rotated come in contact with the hot walls of the dryer and undergo rapid cooking and simultaneous disintegration of the flesh. Moisture is released from the tissues at a very rapid rate which must be exhausted out at a very high rate as otherwise condensation of the same takes place inside the dryer thereby rendering the process too time consuming. This was achieved by operating the exhaust fan provided at full rate. However, when most of the water has been removed from the material, which is evidenced by the stoppage of visible exhaust of moisture vapour, the exhaust rate must be reduced as otherwise air drawn through the dryer at this high rate cools down the material and increases the time taken for drying. Moreover, there is the likelihood of the fish meal, which will be in a highly pulverized form by this time being blown out by exhaust.

Fig 3 represents the drying curve when similar quantity of press cake obtained by pre-cooking and pressing the fish is fed into the dryer under similar operational conditions.



It is revealed from the figure that the drying time is considerably less than that in the previous method. However, the first method has several advantages viz., considerable saving in labour by avoiding elaborate cooking and pressing operations, prevention of loss of nutrients with the stick water and the overall better appearance of the end product. Hence this method appears to be promising for operation in fishing villages, particularly for lean fish.

A comparison of quality of fish meal prepared by the two different methods from similar lots of fish is presented in Table I.

But for a higher value of fat, the sample prepared from whole fish without cooking and pressing is superior to the other samples, especially as regards the contents of protein, minerals and available lysine. This is only to be expected since much of the nitrogenous matter including available lysine might have been lost during the cooking and pressing operations.

TABLE I COMPARISON OF QUALITY OF FISHMEAL PREPARED BY THE TWO METHODS

	Cooked, pressed and dried	Dried without cooking and pressing
Moisture %	10.54	8.34
Protein % (N x 6.2)	70.26	71.16
Ash %	17.35	19.83
Sand %	—	11.69
Fat % (D.W.B.)	5.775	8.14
Pepsin Digestibility %	91.58	93
Available lysine g N/100 g protein	4.87	5.86

SUMMARY

Constructional details of a batch type fish meal dryer suitable for operation in the fishing villages of India, where its necessity is mostly felt, are discussed. Cooking and drying of the fish take place in a single stage inside the dryer, thereby eliminating the elaborate cooking and pressing required, particularly for non-oily fishes. Oily fishes, however, have to be cooked and pressed before feeding the dryer. The

results of certain experiments carried out with the above dryer are also discussed. Though the amount of water to be evaporated from the whole fish is nearly three times compared to cooked press cake, the time taken is only about 3 hours more in the former method.

ACKNOWLEDGEMENTS

The authors are greatly indebted to Dr. A. N. Bose, the previous Director of the Institute and Dr. V. K. Pillai, Fishery Scientist for the great interest taken in getting the drying unit fabricated and the encouragement during the course of experiments. Thanks are also due to Shri G. K. Kuriyan, Director-in-charge, for kind permission to publish this paper.

REFERENCES

- A. O. A. C. 1960 *Official Methods of Analysis* (Association of Official Agricultural Chemists) 9th Edition.
- Carpenter K. J. 1960, *Biochem J.* 77, 604.
- Pillai, V. K. 1957, *Research and Industry*, 2 (10), 265-266.