Reprinted from "Indian Journal of Fisheries" Vol. X, No. 1, B, 1963

UTILISATION OF WASTE MATERIALS IN THE FROG LEG PROCESSING INDUSTRY

BY D. RAMANANDA RAO AND P. V. KAMASASTRI

(Central Institute of Fisheries Technology (Unit), Bombay-5.)

INTRODUCTION

During recent years the export of frozen frog legs from Kerala and Maharashtra has increased to a great extent. Large quantities of waste materials (Heads and Body portions) at present being thrown into sea. In the year 1963 roughly over 500 metric tons of frozen frog legs were exported to U. S. A., France and other places in the Continent valued at nearly 32 lakhs of rupees. The main varieties of frogs utilised are *Rana Tigrina, Rana Hexadactyla, Rana eatebenicena* (Bull frog). Due to the decreasing trends of prices in the international market there is very little profit in the industry. Utilization of waste materials in the processing of frog legs is of immense value to compensate the processing expenses to a certain extent. With this object in view the waste materials which constitute about 65% of the total weight of the raw material were processed into meal and oil and studied the chemical composition.

It is believed that the frog oil has some curative effect on asthama and is thus administered to some asthmatic patients. The yield of the oil varied from 6% to 8% while the meal ranged from 12% to 14% on the total weight of the frogs. The chemical characteristics and storage changes of the oil and the nutritive value of the meal were studied and the results are presented in this paper.

MATERIALS AND METHODS

The raw material which constitutes the heads and the body portions after the removal of hind legs was boiled in water for 90 minutes. The cooked material was pressed through a canvas cloth. The stick-water was allowed to separate and the clear oil was siphoned out. It was further purified by centrifuging to remove traces of suspended materials and water. The press-cake as dried at different temperatures and pulverised. For dry reduction (Whole meal) the chopped material was dried at 110° by turning from time to time to avoid scorching. But a foul odour was noticed while drying in the case of dry reduction. The clean oil and the meals prepared at different temperatures were taken for analysis.

The proximate chemical composition of the meals and the pepsin digestibility were determined according to the methods of A.O.A.C. (1960). The total volatile nitrogen was determined by Conway and Byrne (1933) while alpha amino nitrogen was determined by Carpenters' method (1960). Methionine was determined by McCarthy and Sullivan's method (1944), modified by Csonka and Denton (1946). The fractionation of proteins and the protein quality index (PQI) were determined according to Almquist *et. al.*(1935). The gross energy values of the meals were determined by the chromic acid oxidation of O' Shea and Maguire (1962). The thiobarbituric acid number (TBA) was determined by the method of Yu and Sinnhuber (1957). The chemical constitutents of the oil samples were determined by A.O.A.C methods (1960).

RESULTS AND DISCUSSION

The proximate chemical composition of the meals prepared by wet reduction process from waste materials and whole meal prepared by dry reduction from heads are given in Table I. From the table it is evident that the meals are rich in proteins, fat and minerals; quite comparable to fish meals from different species of fish. (Kamasastri and Ramananda Rao. *In Press*). The alpha amino nitrogen content in the meals is however less than that of fish meals.

TABLE I

Proximate Chemical Composition of Frog meals

	Sample	Moisture %	Proteins %	Fat Dry Basis %	Ash %	Acid Insolubles %	Calcium as Ca O %	Phosphorous as P_2O_5 %	Total Volatile Nitrogen mg %
1	Waste material (Wet Reduction)	6·21	60·6	8·41	22·03	0·51	6·16	5·42	27·65
2	Whole meal from heads . .	7·27	56·2	12·61	18·49	2·79	4·67	3·45	23·50

As is seen from Table I, the fat content of the whole meal (dry reduction) is more than the wet reduction processed meal. This is only because, much of the oil has been removed by cooking and pressing, along with stick-water in the case of wet reduction process.

In Table II the fractionation of the protein of the meals prepared at different temperatures are given. As the drying temperature has an effect on the nutritive value of the protein the presscake was dried at different temperatures and the meals prepared were subjected to fractionation. From the Table II it can be seen that there is not much of a significant difference in the hot water soluble fraction of the meals, (mainly gelatine) at different temperatures while it is

TABLE II

Fractionation of Proteins of the meals

Serial Number	Drying Temperature °C	Hot Water Soluble N_2 %	Copper precipitable N_2 %	Phosphotungstick acid precipitable N_2 %	Pepsin Insoluble N_2 %	Alpha amino N_2 mg%
1	80	17·72	91·68	21·98	10·50	48·64
2	110	16·62	91·31	19·53	16·07	47.62
3	130	17·77	89·50	16·52	15·03	48.06
4*	105	22·56	96·28	10·70	15·30	105.00

*Whole meal from heads.

more in the case of 'whole meal' prepared from the heads. The copper precipitable nitrogen represent the intact proteins and little of peptids, peptones and amino acids is slightly more which in the case of meals prepared at low temperatures, the phosphotungstic acid precipitable nitrogen which forms the peytides, peptones ann amino acids followed similar trends which

signifies that the damage done to the proteins is less when meals are dried at low temperatures. Similar observations were obtained in fish meals prepared at low temperatures. (Unpublished work.)

Some factors which predict the nutritive value of the meals are given in Table III. The protein quality index which is a measure of digestibility, extent of autolysis and hydrolysis in the nutritional evaluation of fishmeals and foods showed a lower ranges of values as compared to fish meals. Similar trends were observed in available lysine value and pepsin digestibility of the meals. The low values of available lysine showed the possible destruction of this amino acid at high temperatures. June Olley and Watson (1961) observed that pepsin digestibility of more than 89% is associated with an available lysine value of 5.0 to 7.5 gms/16 gms of nitrogen.

TABLE III

Nutritive Value of the meals

Serial Number	Drying Temperature %	Protein Quality Index	Pepsin Digestibility %	Available Lysine gms/16gms of N°	Methionine gms/16 gms or N_2	Gross Energy Values K. Cals/gm
1	80	75·41	89·50	4·87	1·01	3·75
2	110	73·08	83·93	4·76	1·00	3·70
3	130	70·42	84·97	3·75	0·97	3·73
4*	105	71·73	84·70	4·56	0·98	3·91

*Whole meal from heads.

The methionine contents in the different meals ranged from 0·97 to 1.01gms/16 gms of nitrogen. Potter *et. al.* (1962) determined the Gross energy values of the herring meals to evaluate the metabolisable energy which is used for nutritional evaluation. However, the gross energy values in this case were slightly less than that of fish meals.

In Table IV the general characteristics of the frog oil is given. The yield varied from 6 to 8%. The saponification value is within the range of the marine oils. However, the Iodine value is less compared to fish oils. During six months storage in sealed containers the rise in acid

TABLE IV

Chemical Composition of Frog Oil Extracted from Waste material

Sr. No.	Chemical Constituent	Range of Values
1	Colour	Yellow—Light Brown
2	Specific gravity at 20/20	0·9107—0·9122
3	Saponification value	194·0—197·2
4	Iodine value (Hanus)	95·00—98·12
5	Acid value	0·47—1·13
6	Peroxide value	6·14—11·84
7	Unsaponifiable matter	2·53%—2·64%
8	Nitrogen content	0·45%—0·55%
9	Yield of the oil	6%—8%

value and peroxide value from that of the initial value was negligible. The acid value increased to 4.35 after a storage period of one year while the peroxide value during the same period rose

to 67.47. The fall in Iodine value during six months storage was negligible while during one year storage it fell from 97.29 to 92.28. These observations are in agreement with the storage characteristics of sardine oils. (Kamasastri *et. al.* In Press.)

The nature of the fat in the dried meals is given in Table V. Oxidation of fat is less in the meals dried at low temperatures, as revealed by low acid value, peroxide value and thiobarbituric acid number.

TABLE V

Nature of fat in Frog waste meals

Sample dried at °C.	Iodine value (Hanus)	Acid value	Peroxide value	T B A No.
80	105·6	6·63	1·01	6·61
110	98·86	6·80	3·21	6·63
130	95·63	8·03	4.44	7·39

From these investigations it can be concluded that the wet reduction process followed by low temperature drying yields a good quality meal, quite comparable with fish meals in the nutritive value. The dry reduction process is not suitable for Processing due to high fat content in the raw material.

SUMMARY

The waste material in the frog leg processing industry which forms about 65% can be utilised for the production of oil and meal by the wet reduction process. The yield of the oil and meal varied from 6% to 8% and 12 to 14% respectively. The presscake dried at low temperatures produced a good quality meal with little oxidation in the fat component of the meal. There is very little change in the oil when stored for one year in sealed containers.

ACKNOWLEDGMENTS

The authors express their sincere thanks to Dr. A. N. Bose, Director, Central Institute of Fisheries Technology for his keen interest and guidance in the work.

REFERENCES

Almquist H. J.; Stokstad E. L. R., Halbrook E. R. (1935) Supplementary values of Animal proteins concentrates in Chick feed rations. *J. Nutr.* **10**.193.

A O A C (1960) Official methods of analysis of the Association of the Official Agricultural Chemists; 28.

Carpenter K. J. (1960) The estimation of 'Available Lysine' in animal protein foods. *Biochem. J.* **77**,604,

Conway E. J. and Byrene (1933) An absorption apparatus for the micro determination of certain volatile substances. I. The Micro-determination of Ammonia. *Biochem. J.* **27**,419.

Csonka F.A. and Denton C. A. (1946) Methionine determination in Proteins and foods. *J. Biol. Chem.* **163**,329

June Olley and Wtson H. (1961) The 'Available Lysine' content of fishmeals. *J. Sc. Fd. Agric.* **12**,316.

Kamasastri P. V. and Ramananda Rao D. Studies on Indian fishmeals. I. Chemical composition and storage characteristics of fish meals prepared from different types of fishes. (*In press.*)

Kamasastri P.V., P. V. Prabhu and Ramananda Rao D. (1962) Further studies on the Indian Sardine Oil. *Ind. J. Fish*; *Vol. IX No.* (*IB*).

Pope C.G. and Stevens M.F. (1939) Determination of Amino nitrogen using a copper method. *Biochem. J.* **33**,1076.

Potter E. M; Pudelkiewiecz W. J; Webster Lorna and Matterson L. D. (1962) Metabolisable energy and digestibility evaluation of fishmeal for chicken. *Poultry sci.* **41**, 1745.

Yu T. C; and Sinnhuber R. O. (1957) 2-Thiobarbituric acid method for the measurement of rancidity i fishery products. *Food. Tech.* **11**,10k.

GIPN.-3S--1 M. F. R. I. Mand. No. 1[Sec. B.]/64 off print (24)—29-1-69—225.