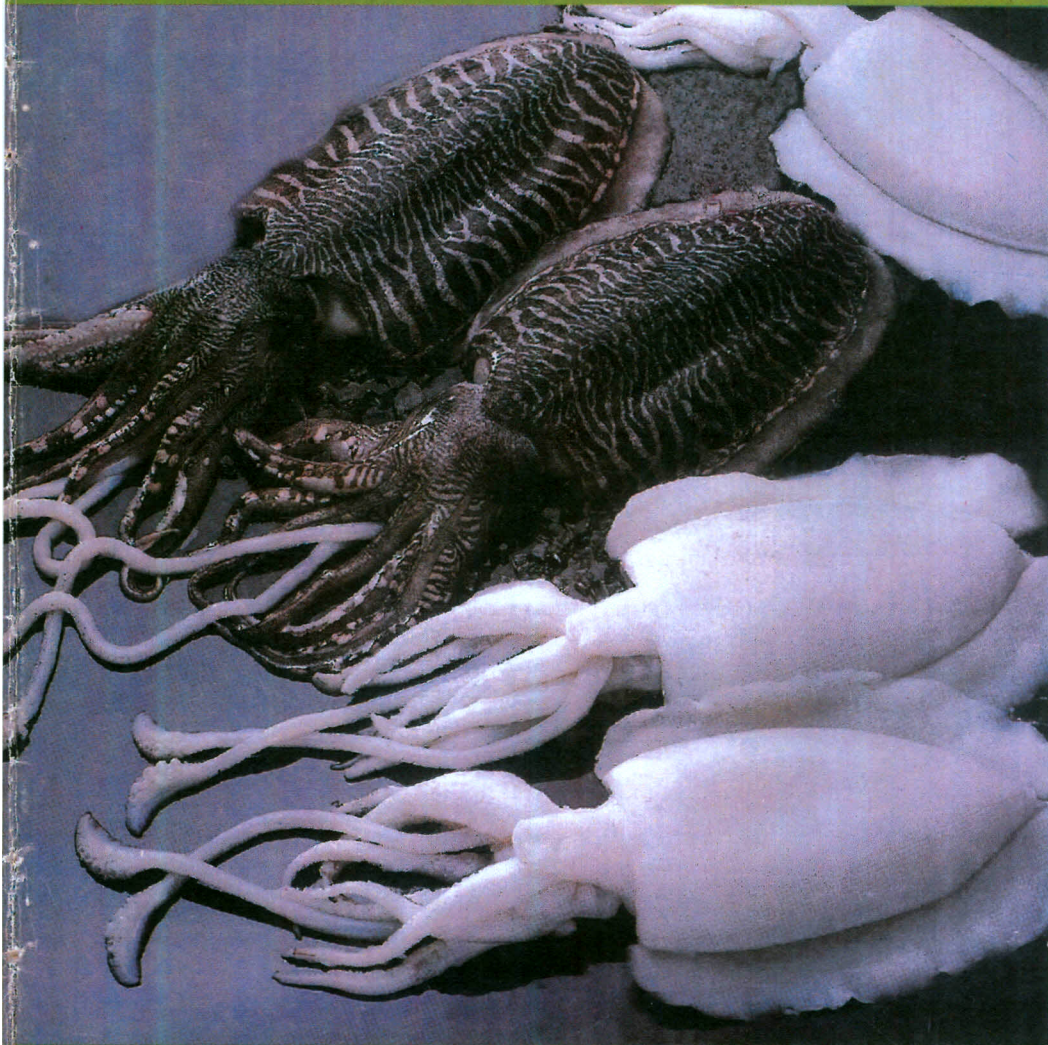




LIVE STOCK FEED FROM CEPHALOPOD PROCESSING WASTE



National Agriculture Technology Project

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Development of Value added products and by-products
from Low cost Fish and processing waste from Fish and Shellfish

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Live Stock Feed From Cephalopod (Cuttle fish and Squid) Processing Waste

Fish is a highly delicious health food. At the same time it is highly perishable also because of its high moisture and nutrient content, ideal for growth of microorganisms. In the case of almost all species of fish nearly 40-50% is thrown away as waste, which is as rich in protein content as the parts separated for edible purposes. So this deserves careful handling to prevent deterioration, as careless handling of the processing waste will cause serious environmental threat. Advent of the methods of processes for extraction of chitin and conversion to several derivatives, which are of high value, the shrimp head and shell, are now collected as a raw material for their production. As there is no organized processing of finfish, the problem of disposal of the waste has not been addressed seriously so far. There may not be sufficient raw material at a place to meet the functioning of even a very small fishmeal plant. More over there are several restrictions by the local administration against fishmeal plants as they may cause environmental problems



CUTTLE FISH PROCESSING WASTE

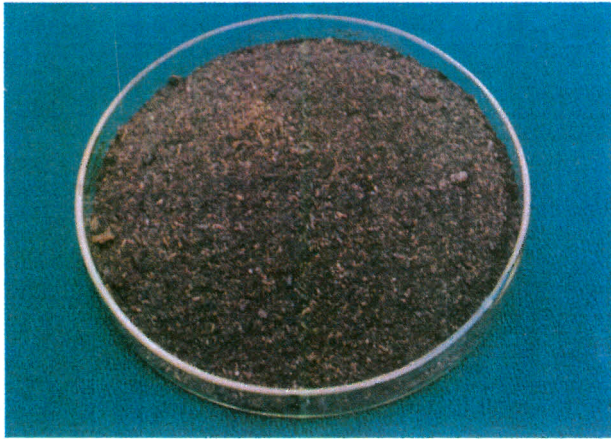
Cephalopods, which amounts to nearly 1.0-lakh tonnes, is processed annually in India. In quantity and in price it is second to shrimp in export. The minimum quantity of the waste available from its processing is more than 30,000 tonnes. Because of its unpleasant appearance and high moisture content nobody has tried to make use of this material for any purpose so far. The processors used to entrust this material to some persons to dispose it for which they have to pay a sizeable amount, nearly Rs.1000/tonne. These persons take the material during night and dispose of in nearby water bodies or roadside. The decaying of the material has created enormous environmental pollution, air and water, making the life of people in the surroundings miserable.



CUTTLEBONE

CIFT has tried to address this problem and a simple environmental friendly process has been developed to convert the squid and cuttle fish waste to live stock feed. The basic principle is lowering the pH by addition of formic acid and allowing it to liquefy by the action of proteolytic enzymes already present in the fish. The liquefaction will be over by 3 to 4 days resulting a product with a pleasant odour. Even though this process was already known it did not become popular as the resulting product is in the liquid state and storage and transportation are not easy. As in the case of fishmeal,

nobody has tried this process in the case of cuttle fish waste. The storage and transportation problems are overcome by mixing with deoiled rice bran or wheat bran and sun drying to moisture content below 10%. Electrical or solar driers can also be used for drying. The liquid silage can be stored as such without any deterioration of quality indefinitely. During the liquefaction process protein undergoes partial hydrolysis thereby increasing digestibility and feed efficiency by the presence of hydrolysed proteins. It will enhance the feed efficiency of feed prepared for poultry, ducks and quails.



CUTTLE FISH SILAGE-RICE BRAN MIXTURE

The product after mixing with rice bran and drying contains 24-26% protein along with calcium and phosphorus, present in the rice bran. Because of the very low fat content the product has very good shelf life. As squid/cuttle fish is considered to be superior to other fish because of higher lysine and methionine this product can be a better substitute for fishmeal in livestock feed. As fishmeal is an essential ingredient in formulation of feed for live stock and as good quality fish meal is in short supply any quantity of this product will be absorbed as feed material. An additional advantage of this product is the available fat which is rich in omega 3 polyunsaturated fattyacids, especially C20:5 & C22:6 present in squid and cuttle fish. This is also free from pathogens like salmonella, Vibrio cholerae E.coli etc and it has a pleasant smell.



The cuttle fish/squid silage based product has been tried in the case of pigs, ducklings, quail and calf for full replacement of fishmeal in their feed. In all these cases the results were encouraging as shown by equal or better growth compared to control feed with fishmeal as the protein ingredient.



Proximate composition of cephalopod processing waste

Moisture	-	80-85%
Protein	-	12-16%
Ash	-	1-1.5%
Fat	-	1-1.5%

Proximate composition of the silage - rice bran mixture

Moisture	-	below 10%
Protein	-	24-26%
Fat	-	3-4%
Ash	-	10-15%
Soluble ash	-	8-10%
Calcium	-	2-3%
Phosphorus	-	1-2%
Sodium	-	1-1.5%
Potassium	-	0.5-1%

Contents of minerals in cuttle fish

Element	Wet weight basis(mg%)
Cadmium	traces
Copper	33.8
Iron	7.3
Aluminium	6.0
Zinc	29.4
Manganese	11.7
Calcium	252.4
Magnesium	64.1
Potassium	158.4
Sodium	123.0
Sulphur	125.6
Phosphorous	202.0
Chlorine	109.4
Iodine	traces

Fatty acid composition of squid and cuttle fish Lipids

(All values are expressed as % by weight of total fatty acids)

Fatty acid	Squid	Cuttle fish
Saturated acids		
13:0	0.9	1.7
14:0	5.9	3.3
15:0	-	1.7
16:0	18	16.3
17:0	0.9	5.9
18:0	11.4	11.8
19:0	0.3	-
TOTAL	37.4	40.7
Mono unsaturated fatty acids		
13:1	-	-
14:1	0.9	0.5
16:1	1.62	3.1
17:1	-	-
18:1	4.6	8.3
20:1	5.9	9.8
22:1	1.5	0.3
24:1	1.8	-
TOTAL	16.3	22.0

Poly unsaturated fatty acids		
18:2 ω 6	0.5	0.7
18:3 ω 3	1.6	0.3
18:4 ω 3	1.6	0.9
20:2 ω 6	-	-
20:3 ω 3	-	0.5
20:4 ω 6	1.1	3.5
20:5 ω 3	11.5	10.3
22:2	0.5	0.2
22:3	0.5	0.6
22:4	0.7	0.7
22:5 ω 3	1.1	1.9
22:6 ω 3	27.2	17.7
TOTAL	46.3	37.3

Amino acids composition cuttle fish

Amino acid	Value (g aminoacid/100g protein)
Aspartic acid	7.68
Threonine	2.83
Serine	2.65
Glutamic acid	8.99
Proline	5.96
Glycine	2.44
Alanine	3.36
Valine	1.36

Cystine	0.65
Methionine	1.17
Isoleucine	2.57
Leucine	5.23
Tyrosine	0.49
Phenyl alanine	0.63
Histidine	3.01
Lysine	7.24
Arginine	5.18
Tryptophan	1.33

Economics of silage production

- | | | |
|----|--|------------|
| 1 | Cost of formic acid for conversion of 1000kg cuttle fish waste 30kg @ Rs.50/kg | Rs.1500/- |
| 2. | Cost of Rice bran - 500kg @ Rs.3.50/kg | Rs.1750/- |
| 3. | Cost of production of 700kg dry silage | Rs.3,250/- |
| | Unit product cost | Rs.4.65/kg |

(Cost of drying and labour are not included)

Cost of fishmeal of protein content above 50% is above Rs.40/kg. So this product can be sold at a minimum price of Rs.15/kg. If the cost of disposal of the waste incurred by the pre-processor is given to those who are taking the material for silage production the cost of production can further be reduced.

This process for preservation and utilization of the hitherto unutilized material was demonstrated to several gatherings of fish processors and local population those who are suffering from the environmental pollution. Many have come forward for the adoption of the process for addressing this problem. M/s East India Fisheries, Aroor, Aleppy has already started production and trial marketing of their product in the trade name 'Turbo Fish meal' to farmers who keep pigs, chicken and Japanese quail. Encouraged by the

performance of this product in their livestock, the farmers are coming forward to use this regularly in feed formulation for poultry, pigs and quail.

If the available cuttle fish/squid wastes are fully utilized 20,000 tonnes of this product can be produced annually, which will fetch Rs.200 million as gross selling price. After deducting the cost of input, the net revenue will be Rs.100 million. By the development of a simple technology from pollution causing material Rs.100 million can be generated annually. In addition to addressing the severe environmental threat this will create employment and provide the most needed animal protein source rich in the limiting essential amino acids required for live stock feeds. The same process can be used for disposal of fish processing waste also.