Proceedings of

The First ASEAN Workshop on Fish and Fish Waste Processing and Utilization

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FOREWORD

The First ASEAN Workshop on Fish and Fish Waste Processing and Utilization was held in Jakarta (Indonesia) 22-24 October 1986 under the joint sponsorship of The ASEAN Working Group on Food Waste Materials and The ASEAN Working Group on Food Technology Research and Development of the ASEAN Committee on Science and Technology. The Workshop aimed at reviewing the R & D activities and the status of the processing and utilization of fish and fish waste in the ASEAN region, providing a venue and developing mechanisms for active participation and exchange of information and sharing of technologies on the processing and utilization of fish and fish wastes. It also aimed to identify strategies for the implementation of successful laboratory or pilot research and development results.

The programme of the workshop included plenary sessions featuring a keynote paper presented by prominent speaker on processing and utilization of proteins from fish and fish wastes, trends in R & D in fish wastes processing and utilization, followed by ASEAN Country reports and technical papers presentations and then concluded by a working session to discuss recommendations.

The Workshop had been held successfully and for this, the organizer would like to thank all participants, sponsors other parties and to the editorial team who worked hard so that these proceedings are now available.

Dr. A.T. Karossi

Organizing Committee
Chairman

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PROCESSING OF FISHERY WASTES INTO MEAL AND SILAGE

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ABSTRACT

Fish meal is one of the most important source of protein in feed formulation in order to support the development of animal husbandry and fish or shrimp culture. Currently, about 50,000 tons/annum; worth about US$ 30 million of fish meal is imported from other countries, especially Thailand, Peru and Chile.

Processing of waste into silage is one of the efforts to utilize fishery waste to reduce dependency from fish meal imports. Silage usually processed by mixing whole or minced fish waste with organic or inorganic acids to decrease the pH of fish and to retard the growth of spoilage bacteria.

Different sources of fish waste have been experimentally processed into fish meal, including shrimp trawl by-catch, fresh water fish waste, frog and shrimp waste; whereas fish silage were prepared from shrimp trawl by-catch, fresh water fish waste and frog waste.

The processing steps of meal involve cooking, pressing, drying and grinding, whereas the processing steps of silage including mincing the raw materials and addition of acid as much as 3% of the raw material weight. The protein content of meal products were in the range of 47.96-68.38 percent (wet basis), while the protein content of silage were in the range of 12.12- 17.35 percent (wet basis)

INTRODUCTION

Fish meal is one of the important nutrient sources for feed formulation, especially poultry, fish and shrimp feed, and it has been known that fish meal contains *Unidentified Growth Factor* (UGF). Currently, with development of poultry, fish and shrimp culture industries the fish meal demand will substantially increase in the future.

At the present, most of the fish meal are imported from other countries, especially Thailand, Peru and Chile, because the current production is inadequate to meet the fish meal demand. In most cases, locally produced fish meal quality is poor, due to inappropriate traditional processing techniques.

Indonesian fish meal consumption is about 75 to 100 thousand tons/annum and about 50 thousand tons/annum valued at US$ 30 millions are imported, as shown in Table 1.

Fish silage processing is one of the alternatives to reduce the dependency from fish meal imports. Fish silage can be prepared using simple technology and equipment and the preparation applied to various raw materials. Further the fish silage processing is independent on weather condition, can be conducted in small scale, non detrimental to environment and requires less investment.

Table 1. Quantity and value of Indonesian imported fish meal in 1980-1983

Year	1980	1981	1982	1983
Quantity (tons)	43,194	53,033	72,088	51,595
Value (US$ x 1000)	15,997	33,626	38,993	28,955

Source : Directorate General of Fishery, 1985

MATERIALS

Shrimp trawl by catch

In the Eastern Indonesian trawlers about 200-300 thousand tons/annum shrimp trawl by catch is not fully utilized, even in most cases, they are thrown back to sea due to economic reasons. However, if this problem can be solved such a huge amount of by-catch offers a tremendous potential for meal or silage processing.

Fresh water fish waste

Fresh water fish processing industries also generate a substantial amount of wastes which are comprised of heads, tails, fins, skins and visceral parts. Although exact Figure is not available, the amount of such waste is quite considerable since it comprised about 50% of the total fish.

Frog waste

Indonesia is one of the leading frozen frogleg exporters in South East Asia. Since only the leg portion are selected and processed, a substantial amount of waste (70% of the total weight) are generated from the frogleg processing plants. Table 2 shows the estimation of total frog waste production.

Table 2. Estimation of total frog waste production during 1979-1983

Year	Frogleg (ton)	Frog waste (ton)
1979	2,657	6,200
1980	1,612	3,761
1981	2,776	6,447
1982	1,517	3,540
1983	3,296	7,619

Source : Directorate General of Fishery, 1985

Shrimp waste

Frozen shrimp industry usually produces shrimp waste (such as head) having a good nutritive value which can be used as one of the feed components. Shrimp waste mainly consists of protein, calcium carbonate and chitin. Shrimp waste proteins compare favorable with casein in amino acid compositions although they show lower sulfur containing amino acids. It is estimated that about 25.000 tons of shrimp waste are available annually.

EXPERIMENTS AND RESULTS

Meal processing

Experimental meal processing were carried out using the above raw materials. Initially, fishery wastes were washed and cooked. Cooked product was then pressed to remove stickwater and oil followed by sun drying until dry enough to be ground. This ground product was dried again until the moisture content about 6-10%, then milled. During grinding phase, stickwater produced at the pressing phase is mixed back to the product.

The critical phase of fish meal processing are cooking and pressing. During cooking phase, protein is coagulated into a firm mass capable of withstanding the pressure required to press out stickwater and oil. Also by coagulation, a high proportion of the bound water is liberated and deposits of lipids are freed from the muscle tissue thereby facilitating removal of water and oil by pressing. A different material usually has different cooking time. With optimal cooking the material should be capable of withstanding the relative pressure required for the efficient removal of oil. Processing steps and cooking time can be seen in Table 3 and Figure 1 respectively.

Table 3. Cooking time of some fishery waste

Raw materials	Cooking time (minutes)
Shrimp trawl-by catch	20
Fresh water fish wastes	20 - 30
Frog waste	15
Shrimp waste	30

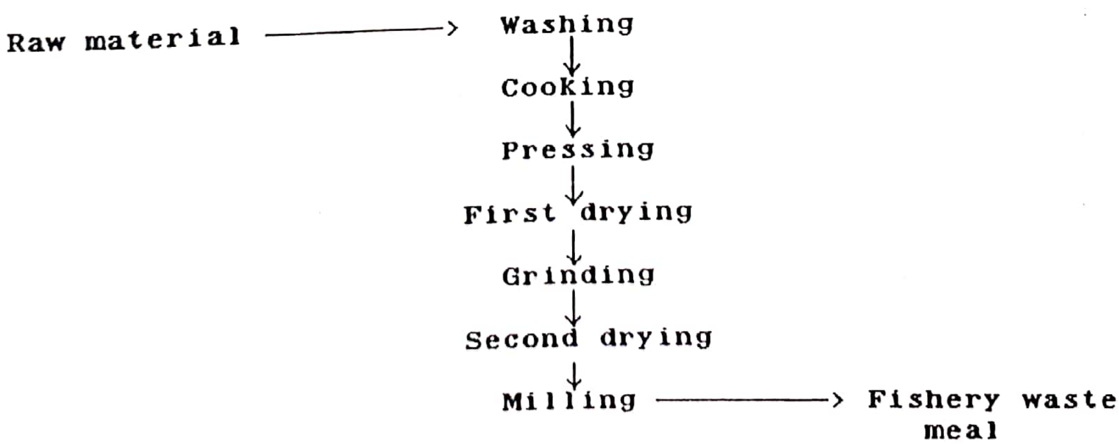

Figure 1. Scheme of fishery waste meals processing.

Nutritive value of meals

Results of the experiment indicated that such fishery wastes produce a comparable quality to imported fish meal. The comparison between fishery waste meals and imported fish meal is given in Table 4.

Most of the fishery waste meals have protein content a more than 50% except common crap waste meal. If their protein content compared with the Indonesian fish meal standard, shrimp trawl-by catch meal, nile tilapia waste meal and frog waste meal can be classified as grade-1, whereas common crap waste meal and whole tilapia meal can be classified as grade-2 (see Appendix 1).

Table 4. Nutritive value of fishery waste meal and imported fish meal (wet basis)

Commodity	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Shrimp trawl by-catch meal	9.27	68.38	6.18	-
Common crap waste meal	6.51	47.96	23.72	16.62
Nile tilapia waste meal	6.25	67.55	17.17	3.05
Whole tilapia	5.76	59.30	4.50	2.63
Frog waste meal	7.25	61.78	10.10	17.42
Shrimp waste meal	14.52	51.90	1.46	-
Imported fish meal	7.50	50.61	9.41	28.26

Storage test of fresh water fish meals and frog waste meal indicated that they can be stored up to 4 and 5 months respectively. The moisture and ammonia content of frog waste meal increased during storage and gave unpleasent odor, and at the end of storage its ammonia content was 0.213%.

Silage processing

The processing steps of fish silage involve washing, mincing, adding of acids and fermenting. All experiments showed that the use of the mixture of formic and propionic acids as much as 3% of the raw material weight is a suitable treatment. Inadequate concentration of acid rendered the silage susceptible to mold attack. The acid-fish mixture must be stirred thoroughly in order to get even distribution and preserving effect of the acid.

The experiment results revealed that fermentation time of shrimp trawl by-catch, fresh water fish waste and frog waste silage were different, i.e. 15 days, 14 days and 7 days respectively. Fish silage should be stirred every day during fermentation, to avoid mold growth.

Scheme of fish silage processing is shown in Figure 2.

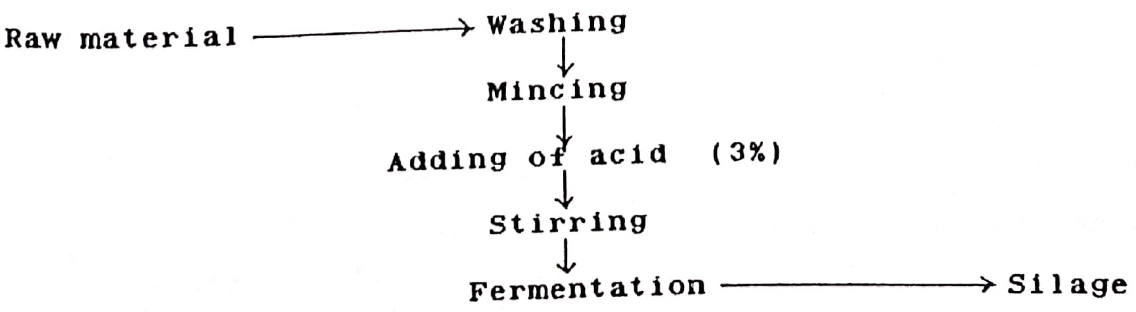

Figure 2. Scheme of fishery waste silage processing.

Nutritive value of silage

Experiments showed that the nutritive value of the silages was considerably good as shown in Table 5. Shrimp trawl by-catch silage indicated the highest protein content.

Storage test of the shrimp trawl by-catch silage using formic acid indicated that after 1 month-storage, mold had grown on the silage. There is evident that fish silage using formic acid should not be stored more than 10 days. A study revealed that fish silage using the combination between formic acid and propionic acid with ratio 1:1 could prevent the mold growth.

Organoleptically (especially odor), frog waste and fresh water fish silage can be stored up to 60 days.

Table 5. Nutritive value of fishery waste silage (wet basis)

Commodity	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Shrimp trawl by-catch silage	-	17.35	-	-
Common crap waste silage	64.59	12.12	17.52	5.28
Nile tilapia waste silage	65.05	12.63	17.53	5.39
Whole tilapia silage	71.57	12.24	9.72	5.04
Frog waste silage	79.17	16.09	2.47	2.30

CONCLUSION

The availability of substantial amount of fish wastes offers a good potential for processing into meal or silage. Although fish waste silage relatively simpler and cheaper process compared to fish meal, various problem remained to be solved, particularly mold attack and excessive oxidative rancidity. In general, fish waste silage is nutritionally comparable to fish meal and are suitable for poultry or fish/shrimp feed.

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Appendix 1. Indonesian fish meal standard

Characteristic	Requirement Quality	
	Grade I	Grade II
Organoleptic, min	7.5	5.6
- Insect	negative	negative
Microbiological test:		
- Escherichia coli (MPN/g.max)	0	0
- Salmolella	negative	negative
- Mold	negative	negative
Chemical test (% w/w,max)		
- Moisture	10	12
- Salt content	1	1.5
- Total ash	18	25
- Protein	60	45
- Fat	10	15
- Crude fibber	1	2

Source : Ministry of Agriculture, 1984 in Saleh *et al*, 1985

Appendix 2. Quantity and value of imported fish meal based on Source Country in 1981 and 1983

Country	1981		1983	
	Quantity (tons)	Value (x1000 US$)	Quantity (tons)	Value (x1000 US$)
South Korea	949	443	-	-
Taiwan	103	55	-	-
People Republic of China	200	104	-	-
Thailand	48,333	31,394	20,947	10,967
Singapore	100	11	600	313
Iraq	250	130	-	-
U S A	520	286	1,783	983
Chile	2,126	1,126	14,021	7,562
Uruguay	130	17	-	-
Peru	100	56	12,007	7,668
West germany	-	-	497	377
Denmark	-	-	1,735	1,084

Source : Centre Bureau of Statistic in Saleh *et al*, 1985