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FISH SAUCE FROM TROPICAL FISH*

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ABSTRACT

Fish sauces were prepared from different fish by salting and fermentation at ambient temperaure. Chemical analysis was carried out on the fish sauces during different stages of maturation. Optimum yield of sauces was obtained after eight to ten months' maturing. Sauces confoming to the standards prescribed by the Food and Drug Administration (1977) could be prepared from all the fishes studied. The sauce from anchovies had the most appealing colour and flavour and barracuda gave a sauce with maximum protein content.

INTRODUCTION

NATURAL fermentation of fish and fishery waste produce fish sauces and pastes, usually included in the menuas hors-d' oeuvre. The fish sauces have strawyellow to amber colour and an appetizing effect. They are readily digested and make an effective amino acid supplement to cereal diets. The variety of fermented fish products available has been reviewed by Amano (1962). These sauces are strictly traditional and use is limited to Southeast Asian countries. Descriptions of some fish sauce processes have been published by Rao (1961), Bersamin and Napugan (1961), Saisithi *et al.* (1966) and Mackie *et al.* (1971). Preparation of fish sauce has been reported as one of the major methods adopted to utilise waste fishes by Olley (1972) and Canonizado (1978). Results of the studies on the production and properties of fish sauces from a few locally available fish are presented in this paper.

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MATERIAL AND METHODS

Fish

Sardines (*Sardinella longiceps*), anchovies (*Stolephorus commersonii*), barracuda (*Sphyraena* sp.), sole (*Cynoglossus* sp.) and lizard fish (*Saurida tumbil*) purchased from the local market were used.

Fermentation procedure

Methods described by Crisan and Sands (1975) and Orejana and Liston (1981) were used with certain modifications. Dirt and other extraneous materials were removed from the fish. The wash liquor was kept aside for addition to the fish salt mixture. The fish were used either whole or were passed through a meat grinder prior to mixing with salt. The fish were mixed with salt in a 4 : 1 ratio, suitable quantities of wash liquor were added and the mixture was allowed to mature at room temperature (30 ± 2°C) in screw capped polythene jars.

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Samples were collected periodically by decanting about 30 ml of the supernatant liquid and filtering through Whatman No. 1 filter paper. This yielded clear amber to yellowish brown liquid. The samples were tested immediately or held at 0°C for further testing.

Yield and quality of the fish sauce were determined by filtering off the liquified portion after ten months' maturing and subjecting the sauce to physico-chemical analysis. Saturated brine was added to the undissolved fish residuum and the mixture let stand for two months at ambient temperature. Yield and quality of the second harvest of fish sauce were also determined.

Analysis

pH, specific gravitiy, salt content, total solids and total nitrogen were determined by standard methods of AOOS (1957) and AOAC (1975). Total volatile base and trimethylamine were determined by microdiffusion technique of Conway and Byrne (1933) as modified by Beatty and Gibbons (1937). Total volatile acids were determined by acidification of 5 ml of the fish sauce to a pH of 2 using 6N sulphuric acid and steam distillation of the acidified sample. 150 ml of the distillate was collected and titrated with 0.01 N sodium hydroxide using Tachiros' indicator.

Organoleptic evaluation

Initial taste panel evaluation was carried out by an expert team which included a specialist from Lorenzana Food Corporation, Philippines and specialists from CIFT. Further periodical organoleptic evaluation was done by the trained panelists of CIFT.

Results and Discussion

Yield of sauces from the first and second stages of extraction is given in Table 1. *Sardinella longiceps, Stolephorus commersonii* and *Sphyraena* sp. gave maximum yield of the product. Yield of sauce from *Cynoglossus* sp. was comparatively low. Extraction of the fish residuum with saturated brine after the removal of the first extract after ten months, fermentation yielded pale yellow to brownish yellow sauces having putrid, off odours, probably due to fungal growth, which was observed during the last stages of maturing of these samples.

Table 1. *Yield of fish sauce*

Fish used	Yield of sauce ml/1000 g wet fish	
	First stage	Second stage
Sardinella longiceps ..	660	230
Stolephorus commersonii ..	840	140
Sphyraena sp. ..	600	210
Cynoglossus sp. ..	350	110
Saurida tumbil ..	510	220

Results of the physico-chemical evaluation of the sauces are presented in Tables 2 and 3. Sauces from *Stolephorus commersonii* and *Cynoglossus* sp. had amber to golden yellow colour and possessed very pleasing odour. Sauces prepared from sardines had low ph and during the second stage of maturing. Difference between quality fish sauce and the putrid variety was studied by Fujii and Sakai (1984 a, b) who fixed a maximum acceptable pH of 6.2 for best quality fish sauce. They have reported that pH above 6.2 was invariably associated with putrification of fish sauce, which is supported by the results presented in Table 3. Specific gravity and sodium chloride content of all the sauces were within the limits prescribed by Food and Drug Administration (1977).

Changes in the total solids, total nitrogen, TVN, TMA and volatile acids of the sauces at different stages of maturing are presented

TABLE 2. *Physico-chemical characteristics of fish sauce (First extract)* [a, b]

Fish used	pH	Specific gravity	Sodium Chloride %	Total solids g/100 ml	Colour	Odour
Sardinella longiceps	6.0	1.21	24.6	37.3	Yellowish brown	Fair
Stolephorus commersonii	6.1	1.21	24.4	36.1	Amber	Very good pleasing
Sphyraena sp.	6.6	1.21	24.4	37.9	Brownish yellow	Fair
Cynoglossus sp.	6.2	1.21	24.2	36.9	Golden yellow	Very good pleasing
Saurida tumbil	6.1	1.21	24.3	37.1	Pale yellow	Good pleasing

a—Fermentation at 30± 2°C for 10 months.
b—Average of two replicates.

TABLE 3. *Physico-chemical characterustics of fish sauce (Second extract)* [a, b]

Fish used	pH	Specific gravity	Sodium Chloride %	Total solids g/100 ml	Colour	Odour
Sardinella longiceps	4.9	1.21	22.1	34.0	Brownish yellow	Off-odour
Stolephorus commersonii	6.8	1.21	23.2	35.3	Pale yellow	Fair
Sphyraena sp.	6.8	1.21	23.0	35.2	Yellow	Putrid
Cynoglossus sp.	6.2	1.21	23.1	35.8	Pale yellow	Slight off odour
Saurida tumbil	7.1	1.21	23.1	35.2	Pale yellow	Slight off odour

a—Fermentation of residue obtained from first stage extract for further 2 months.
b—Average of two replicates.

TABLE 4. *Changes in chemical properties of fish sauces during maturing**

Fish used	Fermentation period	Total solids g/100 ml	Total Nitrogen g/100 ml	TVN mgN/100 ml	TMA mgN/100 ml	Volatile acids ml of 0.01 N NaOH/100 ml
Sardinella longiceps ..	1 week	33.7	0.59	33	Nil	9.6
	4 months	36.2	0.75	241	17	17.0
	8 months	37.0	0.92	221	15	17.0
	10 months	37.3	1.09	202	12	18.0
Stolephorus commersonii ..	1 week	30.4	0.39	28	Nil	12.4
	4 months	35.4	0.80	157	20	18.0
	8 months	35.4	0.98	180	16	17.0
	10 months	36.1	1.08	160	8	16.4
Sphyraena sp. ..	1 week	24.3	0.63	28	Nil	16.0
	4 months	35.4	1.04	—	—	—
	8 months	37.2	1.21	280	21	15.0
	10 months	37.9	1.37	290	17	13.0
Cynoglossus sp. ..	1 week	34.9	0.43	21	Nil	11.6
	4 months	36.6	0.74	201	20	8.8
	8 months	36.8	1.07	220	17	18.2
	10 months	36.9	1.17	190	17	33.2
Saurida tumbil ..	1 week	32.9	0.56	31	Nil	8.4
	4 months	35.8	0.92	202	19	31.0
	8 months	36.8	1.12	240	17	25.0
	10 months	37.1	1.28	220	15	27.0

* Average of two replicates.

in Table 4. It may be seen that the total solids and total nitrogen increased steadily, but the changes after eight months of storage were not appreciable, indicating the cessation of proteolysis. This is in agreement with the observations of Saisithi *et al.* (1966) and Abe and Tsuyuki (1968). Crude protein content (Total N × 6.25) of the sauces falls within the limits for regular to special fish sauces prescribed by the Food and Drug Administration (1977). Protein content was maximum in the fish sauce from barracuda. Initial sampling showed presence of only small quantities of total volatile bases. After four months of storage there was a sharp rise after which the changes were not very appreicable. Volatile bases reached a maximum by the eighth month and then showed a decrease towards the tenth month.

TABLE 5. *Effect of grinding on fish sauce production**

Description of sample	Total N g in whole sauce produced from 1000 g fish
Sardinella longiceps whole	7.2
Sardinella longiceps whole, ground	8.0
Stolephorus commersonii, whole	8.4
Stephorus commersonii whole ground	8.6
Sphyraena sp. whole	8.2
Sphyraena sp. whole, ground	12.9

* Average of three replicates.

This observation is in conformity with that of Saisithi *et al.* (1966) who have reported that the volatile bases reached a maximum by the ninth

month and thereafter showed a decrease towards the twelfth month. Only slight increase in volatile acids was observed except in sample No. 4 where the change was sharp.

Effect of grinding the fish on the solubilisation of protein is presented in Table 5. Grinding the fish leads to better and more effective solubilisation and this effect is especially marked with the bigger fish *viz.* barracuda.

Sauces conforming to FDA standards and possessing excellent colour and odour can be produced from tropical fish by salting and allowing to mature between 8 to 10 months at ambient temperatures.

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