Processing of Fish Sauce by Natural Fermentation

Fishery Technological Development Division
- Department of Fisheries
- Ministry of Agriculture and Cooperatives
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by Natural Fermentation


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Contents

Introduction i

Research on Fish Sauce Fermentation 1

Natural Fermentation of Fish Sauce 6

Factors Affecting Fermentation Process 11

Quality Analyses 22

References 25

Appendices 31


Appendix II Thai Industrial Standard for Local Fish Sauce TIS 3-2526 (1983) 39

Appendix III Community Product Standard (CPS 673/2004) Local Fish Sauce 50

Appendix IV STANDARD FOR FISH SAUCE CODEX STAN 302-2011 58

Appendix V Measurement of Fish Sauce Color 68

Appendix VI a* b* chromaticity diagram 69
Processing of Fish Sauce by Natural Fermentation

Introduction

Fish sauce is a traditional fish product of Thailand, used as a condiment. It is a well-known and popular product. Fish sauce can be made from both marine and freshwater fish. It is produced in provinces; where there are rivers, reservoirs or dams; by villagers who live along rivers or in flooded areas. The freshwater fish used as raw material for fish sauce are mud carp or Thai river sprat or any small fish. The most popular marine fish for production of fish sauce is anchovy because it yields a product of high quality with a strong nice aroma and reddish brown color. Fish sauce from anchovy is produced in provinces along coastal lines in a commercial scale for selling domestically and also for export. Since 2002, the government under ‘‘The One Tambon, One Product (OTOP)’’ project had supported groups of villagers to produce fish sauce from both marine and freshwater fish. The processing methods of fish sauce in each area are different since they had
followed the method done in their family from generation to generation. In the old time, fish sauce was produced for own use not for selling. The general method used starts with a mixing of fish with salt in a ratio of fish to salt from 2:1 to 5:1 (by weight). Fish-salt mixture is kept in an earthen jar for 6-18 months. During fermentation, chopped pineapple or sugar cane or dried stem of garlic and onion may be added because it is believed that the color, odor and flavor of fish sauce will be better. At the end of fermentation, the mixture of liquid and residue or only the liquid obtained may be boiled. In some area, sugar is added or sometime it is boiled to caramelize before adding to the fish sauce. Generally, fuel used for boiling is cut woods. After boiling, fish sauce is filtered through a cotton bag which will take a few days and sometimes it must be filtered for a few times until the clear liquid is obtained. Fish sauce is usually packed in glass bottles. Normally, color of fish sauce from freshwater fish is dark brown to black. Flavors are different due to the ingredients such as sugar added by the processors. Furthermore, the residue from the first fermentation is used for the second fermentation by adding brine and it is left for some time. Then the mixture is filtered and the liquid is bottled. However, quality of liquid from the second fermentation is lower than that of the first one. Sometimes, the residue from the second fermentation is used for the third round. From the survey and inquiry with the processors, it was found that some processors will mix the liquid from the first and second or third fermentation but some processors will sell the liquid
separately because they did not know that the quality of the second and third rounds was lower. The mixing of the first and second rounds liquid increases yield and reduces production cost. At the present time, fish sauce from marine and freshwater fish is produced at a small industrial scale as well as at a village scale by the farmer groups. Provinces where fish sauce is produced commercially are Nakornawan, Pitsanulok, Sukhothai, Ubolratchathani, Kalasin, Nakornpanom, Ayuthaya, Rayong, Chantaburi, Trad, Chumporn, Prachuabkirikhan, Krabi and Satoon, etc. In addition, the quality of fish sauce for selling in a market must meet the Notification of the Ministry of Public Health (No. 203) B.E. 2543 (2000) Re : fish sauce. However, the Thailand Industrial Standard Institute has issued the voluntary standard to elevate the quality of fish sauce as well. It can be concluded that there are 2 types of standard for fish sauce, i.e.,

1. **Compulsory Standard** The Notification of the Ministry of Public Health (No. 203) B.E. 2543 (2000) Re : fish sauce. This standard concerns with the quality of commercial fish sauce. In this standard fish sauce is defined as a liquid product with salty taste used as condiment. Fish sauce is categorized into 3 types, namely, authentic fish sauce, fish sauce from other kind of animal and blended fish sauce (Appendix I)

2. **Voluntary Standard** There are 2 types of standard, the Thai Industrial Standard for Local Fish Sauce TIS 3-2526 (1983) and the Community Product Standard (CPS 673/2004) for Traditional Fish Sauce. Fish sauce that meets these standards will
be able to display the specific quality mark. The Government body responsible for these standards is the Thailand Industrial Standard Institute, Ministry of Industry.

2.1 Thai Industrial Standard for Local Fish Sauce TIS 3-2526 (1983) states that fish sauce is a liquid product obtained from fermentation of fish or parts of fish with salt or from residue of fish sauce fermentation with brine. In this standard, fish sauce is graded into 2 classes namely, first grade and second grade fish sauce according to their chemical and physical characteristics. The detail of this standard is shown in Appendix II.

2.2 Community Product Standard (CPS 673/2004) for Traditional Fish Sauce states that traditional fish sauce is a product obtained from fermentation of fish or parts of fish with salt or from residue of fish sauce fermentation with brine. During fermentation, other ingredients, such as pineapple or sugarcane or sugar, can be added to accelerate the fermentation or to improve its flavor. In addition, fish sauce in this standard can be produced by diluting original fish sauce and adjusting flavor. Therefore, fish sauce in this standard is classified into 2 types, i.e., authentic fish sauce and blended fish sauce. The detail of this standard is shown in Appendix III.

In addition to the Thai Standards, fish sauce standard is adopted as a Codex Standard which is Standard for Fish Sauce CODEX STAN 302-2011 in 2011 (Appendix IV).
Research on Fish Sauce Fermentation
Research on Fish Sauce Fermentation

Fish sauce is produced by natural fermentation of fish with salt for 12-18 months. Salt concentration used is more than 20% or the ratios of fish:salt are 2:1-5:1 (by weight) to prevent spoilage by microorganisms. Owing to the high salt concentration, the fermentation process takes long time to hydrolyze fish protein. After completing the process, liquid product obtain is varied in color from light yellow, amber to dark reddish brown. Products from proteins hydrolysis are soluble proteins, peptides and amino acids. Enzymes from fish, bacteria or exogenous enzymes play major role in fermentation process (Orejana, 1978; Beddows et al., 1979; Mclver et al., 1982). Fermentation time can be divided into 3 steps. At the first step (0-3 weeks), soluble nitrogen and free amino acid contents increase rapidly due to the activities of exopeptidases, during the second step (3-20 weeks), endopeptidases play a major role to increase free amino acid content. During the last step (20-50 weeks), halophilic bacteria can survive but free amino acid content is stable (Tongthai and Okada, 1981). During fermentation process, pH changes slightly, salt concentration is quite stable at 30% but soluble nitrogen, lactic acid and volatile acid contents increase continuously. Ammonical nitrogen increases during the first 6 months and is stable until the end of fermentation while bacterial counts are gradually decreased due to the high salt concentration (Kasemsarn, 1963; Saisithi, 1983). Amino nitrogen, soluble proteins and peptide nitrogen increase significantly during the first and second months but ammonia, volatile bases and free
fatty acids increase during the whole fermentation period (Orejana, 1978).

It is found that flavors of fish sauce originate from bacterial activities on proteins or products from protein hydrolysis (Kasemsarn, 1963). Major free amino acids found in fish sauce samples made from Thai river sprat, Siamese mud carp and anchovy are glutamic acid, lysine, aspartic acid and alanine (Kongpun and Somboonyarithi, 2009; Somboonyarithi et al., 2000). It could be concluded that glutamic acid is a major flavor contributor in fish sauce. It is reported that odors of Thai fish sauce from anchovy are from volatile fatty acids such as formic, acetic, propionic and iso-butyric acids (Saisithi et al., 1966). Dougan and Howard (1975) reported that aroma of fish sauce could be classified into 3 types; namely, cheesy aroma from butyric acid; ammonical odor from ammonia and amine and meaty aroma which is a complex odor caused by oxidation of precursor compounds in fish sauce. Ooshiro et al. (1981) concluded that volatile organic acids are the major source of fish sauce odor.

Fish sauce color varies from straw color, amber to reddish brown. Color of fish sauce might come from non-enzymatic Maillard reaction between ribose and amino acids (Saisithi, 1967) or carbonyl compounds from oxypolymerization of lipids (Orejana, 1978). In addition, salt concentration also affects on color intensity i.e., fish sauce with lower salt concentration has darker color than that with higher salt. This is due to the effect of salt on formation of free amino acids which are precursors of browning reaction (Raksakulthai, 1986). Decarboxylation of amino acids by bacterial
enzyme yields amine in fish sauce. Some amines can be hazardous, for example, tyramine and 2-phenylethylamine can cause high blood pressure, headache and heart failure (Smith, 1980); histamine can cause food allergy (Eitenmiller et al., 1982). Generally, biogenic amines in fish sauce are originated from raw material rather than from fermentation process (Yongsawatdigul et al., 2004). Higher content of histamine in fish sauce is usually due to improper handling of raw material (Tsai et al., 2006). Furthermore, reaction between amines and nitrite contaminated in sodium chloride salt can form carcinogenic amines (Warthesen et al., 1975).

Fishery Technological Development Division, Department of Fisheries, Ministry of Agriculture and Cooperatives is a government body responsible for researches on fish post-harvesting technology and development of fishery products as well as providing knowledge to groups of farmer community in order to improve the standard of processes and product quality. Research on fish sauce had been carried out by Somboonyarithi et al. (2000). They had studied on characteristics and quality of fish sauce produced in Thailand and had concluded that the authentic characteristics of Thai fish sauce are good aroma which might be like shrimp paste, meat or fish broth; salty with sweet taste; clear reddish brown color without precipitate; color values measured by a chromameter as $L^*$, $a^*$ and $b^*$ are between 69.56 to 73.73, +16.38 to +24.76 and +83.72 to +99.38, respectively. Total nitrogen content is more than 10 g/L. Amino nitrogen content is 50-60% of the total nitrogen content. Salt content is higher than 200 g/L. Kongpun and Somboonyarithi (2009) had surveyed on
quality of fish sauces from freshwater and marine fishes produced by groups of farmer community and small and medium entrepreneurs (SME). They reported that 24 samples of fish sauce from freshwater fish, only 7 (29.2%) and 6 samples (25%) could be classified as authentic and blended fish sauce, respectively, while 11 samples (45.8%) could not be classified as fish sauce. From 20 samples of fish sauce from marine fish, 12 samples (60%) met the requirement standard of authentic fish sauce and 8 samples (40%) did not meet the standard of authentic or blended fish sauce. The reason why most of the fish sauce samples did not meet the standard was due to the total nitrogen, amino nitrogen and salt contents as well as the physical quality including color, odor and flavor were lower than the standard requirement. It was found that the processors did not conduct the quality control of the processing and ingredients i.e., raw materials (fish and salt); mixing of fish with salt, fermentation time, filtration process. Besides, there was no hygienic control during processing. In this study, the authors also conducted fish sauce fermentation, comparing fish sauce from Thai river sprat, Siamese mud carp and anchovy. The ratio of fish to salt was 3 to 1 by weight and the fermentation time was 12-18 months. The results showed that fish sauce produced from 3 kinds of fish met the standard of authentic fish sauce of the Notification of the Ministry of Public Health (No. 203) B.E. 2543 (2000) Re : fish sauce, except for the ratio of glutamic acid/ total nitrogen (G/N ratio) which was higher (0.59-0.93 for Thai river sprat fish sauce, 0.60-0.78 for Siamese mud carp and 0.89-0.90 for anchovy fish sauce) than that of the standard
(0.4-0.6). Thus, groups of farmer and SME could use this work as a guideline in production of good quality fish sauce.

Natural Fermentation of Fish Sauce

1. Raw Materials
   - **Freshwater fish**: namely, Thai river sprat (*Clupeichthys aesarnensis*, Wongratana, 1983) 4-6 cm in length and Siamese mud carp (*Hemicorhyynchus siamensis*, Sauvage, 1881) 10-12 cm in length.
   - **Marine fish**: anchovy (*Engrasicholona* spp.) 8-10 cm in length.
   - **Salt**
   - **Saturated brine**: prepared by weighing 26 g salt in 100 ml water

2. Processing Materials
   - **Earthen jars**
   - **Filtration set** with 10, 5 and 1 micron filter
   - **Bottles** 750 and 350 ml capacity

3. Methods
   Fish was mixed thoroughly with salt at the ratio of 2:1 to 5:1 by weight, and then packed tightly in earthen jars. Before packing the mixture of fish and salt, some salt was poured over the bottom of jars and after packing, salt was also used to cover
the top. Jars were covered with nylon net before closing with tiles or jar covers. During fermentation, to accelerate the process, covers were taken out twice a month to let mixture of fish and salt under the sunlight. After 12-18 months, liquid obtained was filtered through fish residue in a jar using a cylindrical shape basket made from bamboo strips. Bamboo basket, lined with cheesecloth, was push in a jar until it touched jar bottom but the top of the basket was over the content in a jar. Only liquid part would pass through cheesecloth into the basket and was taken out. Then the liquid obtained was poured back over the residue around the basket and passed through cheesecloth into the basket again. This procedure was carried out 2-3 times a day and 2-3 days per week for one month. It was found that fish sauce obtained was clear with nice color and odor. Filtered liquid was kept in a clean jar with cover for 2-4 weeks. Due to a very high salt content, salt crystal was precipitated which would improve the taste. Fish sauce was filtered one more time, using filtering machine, before bottling. This first extract was classified as a first grade fish sauce.

After taking out the first extract, fish-salt residue left was about \( \frac{1}{2} \) to \( \frac{1}{3} \) of a jar. Fish-salt residue from one jar was combined to another jar without taking out the bamboo basket. Saturated brine (26% w/w) was prepared, filtered through cheesecloth and added to the residue. The brine should be about 15 cm over the fish-salt residue. Fermentation time to produce the second extraction was 3-6 months. During fermentation, liquid obtained should be cycled, as same as for the first extraction, 1-2 times a week until liquid obtained was almost the same as the first
extraction then it was filtered and bottling. However, quality of the second extraction fish sauce was lower than that of the first extraction. Since fish sauce is a food product that must be controlled of quality standard under the Food Laws, processors must label grade of fish sauce as authentic or blended before selling in a market. Therefore, fish sauce must be analyzed for quality to classify its grade. In some case, the second extract was combined with the first extract to upgrade its quality to authentic fish sauce grade which would reduce the production cost.

The analysis of fish sauce from the first and second or third extraction is necessary in order to know which category it is and the results can be used for the blending of the extracts to get the desired grade. If processors lack of knowledge on Notification of the Ministry of Public Health (No. 203) B.E. 2543 (2000) Re : fish sauce and that the quality index must be analyzed in a laboratory with specific instrument and analyst, they will sell their products even though the quality does not meet the requirement. This will affect on consumer’s interest, therefore before buying fish sauce, consumers should check the label on the product grade and also the registration number of the Food and Drug Administration, Ministry of Public Health.

Fish-salt residue from the fermentation could be sold for fertilizer.
Unprocessed fish

Mixed with salt fish: salt = 2:1 to 5:1 by weight

Poured the mixture in the jar after putting some salt over the bottom of jars and also covered on the top

Covered the jar with nylon net before closing with tiles plate

Put the jar under the sunlight for 12-18 months

Took the obtained liquid passed through bamboo basket lined with cheesecloth in a jar 2-3 times a week

kept clear liquid in a clean jar with cover for 2-4 weeks for salt precipitation

Fish Sauce (first extract) with nice color and odor

Filtering

Bottling

fish-salt residue mixed with saturated brine fermented for 3-6 months

Fish Sauce (second extract)

Figure 1 Flow chart of fermentation of Fish Sauce
Mixed fish and salt thoroughly

Poured in the earthen jar and leaved for 12-18 months

Bamboo basket, lined with cheesecloth, was push in a jar

Filtering & Bottling

Figure 2 Fermentation of fish Sauce
Factors Affecting Fermentation Process

The process for making fish sauce is a natural fermentation process, therefore, processors should have know-how to get product that meet quality standard. Factors affecting fermentation process are as follows:

1. Raw Materials

1.1 Fish

Traditional process:
• Use various kinds of fish with various sizes together, especially for freshwater fish.

Modified process:
• Suitable kinds of freshwater fish for making fish sauce are Thai river sprat and Siamese mud carp. For marine fish, anchovy is the most appropriate kind. Each fermentation tank should use only one kind of fish. Suitable sizes of Thai river sprat, Siamese mud carp and anchovy are 4-6 cm, 10-12 cm and 8-10 cm, respectively.
Suitable sizes of fish

Thai river sprat 4-6 cm

Siamese mud carp 10-12 cm

Anchovy 8-10 cm
Rationale:

• These 3 kinds of fish can be harvested in large quantity which is suitable for making fish sauce. Similar sizes of fish should be used, hence, the mixing with salt and hydrolysis of fish protein will be the same.

1.2 Salt

Traditional process:

• Use various salt crystal sizes and unclean salt.

Modified process:

• Medium size salt crystal should be used. Use clean salt without contaminants.

Rationale:

• If small size salt is used, the outer skin of fish will rapidly loose moisture and salt burn can occur (Robert, 1986) which will prevent salt penetration into the fish. Consequently, inner of fish can be spoiled. On the other hand, too small salt crystal can be dissolved easily and quickly penetrates into fish body thus it can inhibit growth of microorganisms which assist in hydrolyzing fish protein. In case of too large salt crystal, it can slowly penetrate, thus fish might be spoiled before preservation effect of salt occurs. Fish sauce fermented with unclean salt contaminated with sands or dirt or with high moisture content can have off-flavor such as bitter taste and off-odor due to the growth of haloduric or halophilic microorganisms which produce pink or red pigment (Burgess et al., 1967).
Dirty salt

Salt powder

Large salt crystal

Clean and suitable size of salt crystal
2. Mixing of Fish with Salt

**Traditional process:**
- Methods of mixing fish with salt can be varied by mixing before packing in earthen jar or put salt and fish in alternative layers in jar without mixing.

**Modified process:**
- Fish and salt are thoroughly mixed until fish are soft before packing in jar.

**Rationale:**
- Mixing fish with salt before packing enhances salt penetration to prevent spoilage of fish.
3. Packing Fish-Salt Mixture in Jars

**Traditional process:**
- No control on how tight the packing is.

**Modified process:**
- The packing must be controlled that fish-salt mixture is tightly packed without air space and extra salt is spread over the top.

**Rationale:**
- Bacteria which help hydrolyzing fish protein are facultative anaerobe therefore only small amount of oxygen is required.

4. Fermentation Time

**Traditional process:**
- Fermentation time is not specified, it can be shorter or longer than 1 year. During fermentation, mixture of fish and salt is stirred once in awhile. Pineapple, sugarcane or dried stems of garlic and red onion may be added.
**Modified process:**

- Fermentation time should be 12-18 months. Stirring during fermentation as well as the addition of pineapple or sugarcane are not necessary.

**Rationale:**

- The three kinds of fish used for fish sauce fermentation are fatty fish, thus a natural fermentation process requires long time. Too short fermentation time results in incomplete hydrolysis of fish protein. Since fish and salt are mixed thoroughly, stirring the mixture is unnecessary. In addition, stirring will add oxygen to the mixture which will darken the color of end product.
5. Filtration

**Traditional process:**
- After fermentation is end, mixture is boiled then filtered through cotton cloth or mixture is filtered before boiling with sugar to adjust the taste. After filtration, fish sauce is bottled. Filtration process takes very long time. Boiling with sugar can cause darker color due to the browning reactions. Rancidity from oxidation of fish lipid can be accelerated from oxygen and sunlight.

**Modified process:**
- Two steps filtration is used without boiling.

  Step 1-Filtration is carried out by letting fish sauce pass through bamboo basket inside fermentation jar for about 2 weeks. The clear liquid obtained is put in a new jar and left to let salt precipitate.

  Step 2-Fish sauce from step 1 is filtered using a filtering column before bottling.

**Rationale:**
- Filtration through fish-salt residue yields clear liquid with nice color and natural odor of fish sauce. Precipitation of salt help improving taste and the final product obtained has consistent quality.
Filtration through fish-salt residue

Siamese mud carp Fish Sauce

Thai river sprat Fish Sauce

Anchovy Fish Sauce
Filtering column used at 5 and 1 micron can get rid of very small suspension; therefore fish sauce obtained is clear, clean and safe for consumption.
6. Packaging

Traditional process:

• Both glass and plastic bottles are used but plastic bottles are more popular because of light-weight which is convenient for transportation.

Modified process:

• Both glass and plastic bottle can be used but it is found that glass bottle is better because in case of unopened bottle, color change will be very slow. If plastic bottle is used, fish sauce should be sold and used as soon as possible because fish sauce in plastic bottle will get darker or change to black color within 1 month, even though it is unopened.

Rationale:

• Plastic is not a good barrier for air and water vapor but both air and water vapor cannot pass through glass. Air will accelerate oxidation reaction thus color of fish sauce is darker.
Quality Analyses

Fish sauce is a food product controlled by the Food Laws for quality standard therefore, it is necessary to analyzed for quality before selling. The physical, chemical and microbiological analyses are as follows:

1. Physical analysis

Fish sauce is sensory evaluated for odor, flavor and color. The trained panelists with experience in testing fish sauce will be assigned. Samples preparation and sensory evaluation method are described by Somboonyariti et al. (2000). For color testing, if possible, it is recommended that a colorimeter should be used in combination with testing by panelists.

In case of colorimeter, fish sauce color is measured using a Chromameter for liquid sample in the L*, a* and b* system. L* value is lightness measuring from 0-100, for black to white color. a* value is for red (+) to green (-). b* value is for yellow (+) to blue (-). In general, fish sauce color will have a positive a* value which means color of fish sauce is in a red shade as same as positive b* which showed that its color is yellowish. L* will show the lightness of fish sauce in the red and yellow range. In addition,
paleness, lightness, clarity, turbidity or darkness of fish sauce can be compared by $C^*$ (chroma) value which is calculated from $a^*$ and $b^*$ value as follows:

$$C^* = \sqrt{(a^*)^2 + (b^*)^2}$$

2. Chemical analysis

Fish sauce is analyzed for chemical quality, namely, total nitrogen content (AOAC, 1980), salt content (FAO, 1981), formaldehyde nitrogen, ammoniacal nitrogen and amino acid nitrogen contents (TISI, 1983), pH and free amino acid content using HPLC (Instruction Manual for the Shimadzu 10A VP).

3. Microbiological analysis

Microbiological quality for food safety is conducted according to FDA (1995), namely, total viable count, *Escherichia coli*, Salmonella, *Vibrio cholerae*, *Staphylococcus aureus*, yeast and mold and *Clostridium perfringens*. 
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Appendices
Appendix I

(Unofficial)
Notification of the
Ministry of Public Health (No. 203)
B.E. 2543 (2000)
Re : Fish Sauce

It deems appropriate to amend the notification of the Ministry of Public Health, Re : Fish Sauce. By the virtue of provisions of Sections 5 and 6 (3) (4) (5) (6) (7) and (10) of the Food Act B.E. 2522 (1979), in which contain provisions in relation to the restriction of Rights and Liberties of the Persons, in respect of which Section 29 and in conjunction with Section 35, Section 48 and Section 50 of the Constitution of the Kingdom of Thailand so permit by virtue of provisions of law; the Minister of Public Health hereby issues the notification as follows:


Clause 2. Fish sauce, except Budu sauce, is prescribed food to have qualities or standards.
Clause 3. Fish sauce means products in liquid form, having salty taste, and is used as food seasoning. Fish sauce shall be divided into three categories:

(1) Genuine fish sauce means fish sauce, which is obtained from fermentation, or digestion of fish, or parts of fish or residue of fish remaining from the fermentation, by fish sauce production process.

(2) Fish sauce made from other animal means fish sauce which is obtained from fermentation or digestion of other animal besides fish, or parts of other animals, or residue of other animal remaining from the fermentation, by fish sauce production process, and shall to include fish sauce which is made from other animals mixed with genuine fish sauce.

(3) Mixed fish sauce means fish sauce as stipulated in (1) or (2) in which some other constituents of non hazardous to consumption is added, or diluted, or for seasoning. The fish sauces as stipulated in (1) (2) or (3) shall include the dehydrated fish sauces as well.

Clause 4. Genuine fish sauce and fish sauce made from other animals shall be of qualities or standards as follows:

(1) Colour, odour and flavour inherent of that specific characteristics of genuine fish sauce or fish sauce made from other animals, as the case may be.

(2) Clear and free of sediment, except natural sediment not more than 0.1 g per 1 liter of fish sauce.
(3) Salt content in one liter of fish sauce shall be as follows:

   (3.1) Sodium chloride not less than 200 g

   (3.2) In case the usage of potassium chloride is mixed with salt as stipulated in (3.1) or potassium chloride is individually used, then the quantity of individually or the total quantity of both salts used shall not be less than 200 g

(4) Total nitrogen not less than 9 g per 1 liter of fish sauce.

(5) Nitrogen from amino acid not less than 40% and not more than 60% of total nitrogen.

(6) Glutamic acid per total nitrogen not less than 0.4 and not more than 0.6

(7) No colour added, except brown sugar or caramel colour

(8) Usage of artificial sweetener shall follow to Food Standards of Joint FAO/WHO Codex, Re : Food additives, and the amended version. In case where no standards is prescribed in the first phrase, the Food and Drug Administration shall prescribe according to an approval of the Food Committee.

**Clause 5.** Mixed fish sauce shall be of qualities or standards as follows:

(1) Colour, odour and flavour inherent of that specific characteristics of mixed fish sauces.

(2) Clear and free of sediment, except natural sediment not more than 0.1 g per 1 liter of fish sauce.
(3) Salt content in 1 liter of fish sauce shall be as follows:
   (3.1) Sodium chloride not less than 200 g
   (3.2) In case the usage of potassium chloride is mixed with salt as stipulated in (3.1) or potassium chloride is individually used, then the quantity of individual or total quantity of both salts shall not be less than 200 g
(4) Total nitrogen not less than 4 g per 1 liter of fish sauce.
(5) Glutamic acid per total nitrogen not less than 0.4 and not more than 1.3
(6) No colour added, except brown sugar or caramel colour.
(7) Usage of artificial sweetener shall follow to Food Standards of Joint FAO/WHO Codex, Re: Food additives, and the amended version and may be used in single or in combination with sugar. In case where no standards is prescribed in the first phrase, the Food and Drug Administration shall prescribe according to an approval of the Food Committee.

Clause 6. For dehydrated fish sauce, which is recombined, the recombined fish sauce shall be of the qualities or standards for such kind of fish sauce, as the case may be.

Clause 7. Usage of food additive shall follow to the notification of the Ministry of Public Health, Re: Food additives.
**Clause 8.** Fish sauce producers or importers for sales shall follow to the notification of the Ministry of Public Health, Re: Production processes, production equipments and foods storages.

**Clause 9.** Usage of containers for fish sauce shall follow to the notification of the Ministry of Public Health, Re: Containers.

**Clause 10.** Labels of fish sauce:

1. Shall follow to the notification of the Ministry of Public Health, Re: Labels, except for the display of fish sauce name shall be as follows:

   1.1 Fish sauce as stipulated in 3(1) shall be named “genuine fish sauce”

   1.2 Fish sauce as stipulated in 3(2) shall be named “fish sauce made from……%” (the blank space is to specify the name of other animals used to produce fish sauce) or “fish sauce made from……% and mixed with genuine fish sauce……%” (the blank space is to specify the name of other animals used to produce fish sauce and the quantity) or “fish sauce made from……% and mixed with fish sauce made from ………%” (the blank space is to specify the name of other animals used to produce fish sauce and the quantity), as the case may be.

   1.3 Fish sauce as stipulated in 3(3) shall be named “mixed fish sauces” and in case mixed fish sauces are made from other animals must be accompanied by the following statement “obtained from fish sauce made from…….” (the blank space is to specify the name of other animals used to produce fish sauce).
(2) Declaration of “potassium chloride is used, and unsuitable for kidney disease patient”, shall be expressed in red bold color and alphabets height of not smaller than 2 mm., in case potassium chloride is used.

(3) Fish sauce which utilizes of artificial sweetener shall declare that “use .......... as an artificial sweetener” (the blank space is to specify the name of artificial sweetener), in red bold color and alphabets height of not smaller than 2 mm.

(4) Other declarations prescribed by Food and Drug Administration (if any)

**Clause 11.** Food Registration or Food Labeling, which are issued to follow the notification of the Ministry of Public Health No. 118 B.E. 2532 (1989), Re: Fish sauce, dated 8th February B.E. 2532 (1989), prior to this notification, shall be valid for 2 years as from the come into force date of this notification.

**Clause 12.** Fish sauce producers or importers, whose permits issued prior to this notification, shall apply for food serial number within one year as from come into force date of this notification. After applying for food serial number, the fish sauce producers or importers shall be abated from stipulation in Clause 8 for a period of 2 years after this notification come into force. As a result, the remaining labels are allowed to be used until last but not to exceed 2 years after this notification come into force.
**Clause 13.** This notification shall come into force after 180 days as from the day following date of its publication in the Government Gazette.

Notified on 19th September 2000

(Signed) Korn Thupparungsri  
(Mr. Korn Thupparuagsri)  
Minister of Public Health

(Published in the Government Gazette Vol. 118, Special Part 6 Ngor, dated 24th January 2001)

Note: This English version of the Notification is translated to meet the need of the non-Thai speaking people. In the case of any discrepancy between the Thai original and the English translation, the former will take priority.

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THAI INDUSTRIAL STANDARD
FOR
LOCAL FISH SAUCE
TIS 3-2526 (1983)
Revision of TIS 3-2513 (1970)

IN THE EVENT OF ANY DOUBT OR
MISUNDERSTANDING
ARISING FROM THIS TRANSLATION,
THE STANDARD IN THAI
WILL BE HELD TO BE AUTHORITATIVE
THAI INDUSTRIAL STANDARDS INSTITUTE
MINISTRY OF INDUSTRY
RAMA VI STREET, BANGKOK 10400
TEL.246-1174


The determination of this standard was published in the Government Gazette, Special Issue, Vol. 10, Past 33, dated 11th March B.E. 2526 (1983).

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Thai Industrial Standard
TIS 3-2526 (1983)
Standard for Local Fish Sauce

1. Scope
1.1 This standard specifies grades, requirements, food additive, containers, quantity, marking and labelling, sampling and criteria for conformity, and test and analysis of local fish sauce.

2. Definition
For the purpose of this standard, the following definition applies.

2.1 FISH SAUCE: Liquid product obtained from fish or pastes of fish by means of salting process, or from fish residues by brining process in accordance with the method of fish sauce.

3. Grades
Fish sauce is available in 2 grades as follows.

3.1 Grade 1
3.2 Grade 2

4. Requirements
4.1 Fish sauce shall be clear and free from sediment except for crystal of sodium chloride. When tested as clause 10.1.1, the test result shall be unanimously accepted.
4.2 The colour, flavour and odour of the product shall be examined and the score assigned in accordance with the criteria given in clause 10.1.2 Fish sauce grade 1 and grade 2 shall obtain the total scores not less than 70 and 80, respectively, and the scores of each individual characteristic of either grade shall not be less than 50% of the full marks.

4.3 Fish sauce shall have physical and chemical properties conforming to those given in Table 1.

Table 1
Physical and chemical properties
(Clause 4.3)

<table>
<thead>
<tr>
<th>Item</th>
<th>Requirement</th>
<th>Grade</th>
<th>Analysis referring to clause</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>Relative density at 27/27°C, Min.</td>
<td>1.20</td>
<td>1.20</td>
</tr>
<tr>
<td>2</td>
<td>pH</td>
<td>5.0 to 6.0</td>
<td>5.0 to 6.0</td>
</tr>
<tr>
<td>3</td>
<td>Sodium chloride, g/dm³, Min.</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>4</td>
<td>Total nitrogen, g/dm³, Min.</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Glutamic acid/total nitrogen</td>
<td>0.4 to 0.6</td>
<td>0.4 to 0.6</td>
</tr>
<tr>
<td>6</td>
<td>Amino acid nitrogen, g/dm³, Min.</td>
<td>10</td>
<td>7.5</td>
</tr>
</tbody>
</table>
5. **Food additives**

5.1 Any food preservative is not permitted.
5.2 Apart from sugar, any sweetener is not permitted.
5.3 Only caramel shall be used as colour agent.

6. **Containers**

6.1 Containers shall be clean and resistant to leaching.

7. **Quantity**

7.1 The net volume shall not be less than that declared on the label.

8. **Marking and labelling**

8.1 There shall be at least figures, letters or mark clearly and legibly indicating the following information on each container.

1) The term “Fish sauce”
2) Grade
3) Net volume in cm$^3$
4) Name and address of manufacturer, factory, packer or distributor
5) Country of origin if exported

In case foreign language is used, the meaning shall correspond to that in Thai.

8.2 Any person who manufactures product complying with this standard may use the Standard Marks in connection with his product only after having received a licence from the Industrial Product Standards Council.
9. Sampling and criteria for conformity

9.1 Definitions

9.1.1 Lot: Fish sauce of the same grade, packed in container of the same size, and bearing the same brand name, mark or trade mark.

9.1.2 Sample size: The number of containers of fish sauce taken from the lot for inspection.

9.2 Sample shall be taken in accordance with the sampling plan given or its technically equivalent.

9.2.1 Sampling procedure

9.2.1.1 Sample shall be drawn at random from the same lot in accordance with the sample size given in Table 2.

9.2.1.2 In case the product is supplied in bulk, a volume of 1,000 cm$^3$ of fish sauce shall be taken from each sample unit drawn in accordance with Table 2, and return the remainder to the factory.

9.2.2 Criteria for conformity

Provided the sample meets all the requirements, the lot shall be deemed as conforming to this standard.
Table 2
Sampling plan (clause 9.2.1.1)

<table>
<thead>
<tr>
<th>Lot size container</th>
<th>Sample size container</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not more than 150</td>
<td>3</td>
</tr>
<tr>
<td>151 up to 280</td>
<td>5</td>
</tr>
<tr>
<td>281 up to 500</td>
<td>8</td>
</tr>
<tr>
<td>501 up to 1,200</td>
<td>13</td>
</tr>
<tr>
<td>1,200 up to 3,200</td>
<td>20</td>
</tr>
<tr>
<td>3,200 up to 10,000</td>
<td>32</td>
</tr>
<tr>
<td>more than 10,000</td>
<td>50</td>
</tr>
</tbody>
</table>

10. Test and analysis

10.1 Each sample unit shall be tested for clearness, odour, flavor and colour by a panel comprising at least 5 inspectors shall independently examine and assign score for each characteristic.

10.1.1 Clearness shall be checked by visual inspection.

10.1.2 Odour, flavor and colour shall be judged by rating scale.

10.1.2.1 Apparatus

1) White porcelain bowls
2) Stainless steel spoons

10.1.2.2 Scores shall be assigned in accordance with the criteria given in Table 3.
Table 3
System of scoring
(clause 10.1.2.2)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Requirement</th>
<th>Full score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>Pleasant smell natural to characteristic of fish sauce</td>
<td>50</td>
</tr>
<tr>
<td>Flavour</td>
<td>Pleasant</td>
<td>40</td>
</tr>
<tr>
<td>Colour</td>
<td>Reddish brown</td>
<td>10</td>
</tr>
</tbody>
</table>

10.2 Relative density
The relative density shall be measured at $27 \pm 2^\circ C$, using a hydrometer.

10.3 pH
The pH shall be measured, using a pH meter

10.4 Sodium chloride
10.4.1 Preparation of sample
An equal portion of fish sauce shall be taken from each sample unit to make up the total volume of not less than 1 dm$^3$. The composite sample shall be then mixed in a dry, clean container, and one portion of the sample diluted with 10 times of water.

10.4.2 Procedure
Proceed as described in AOAC (1980), clauses 18.034 to 18.035.
10.5 Total nitrogen

The composite sample prepared as clause 10.4.1 shall be used and examined by means of the method specified in clause 2.061 of AOAC (1980) or in ISO 8171.

10.6 Glutamic acid/total nitrogen

The glutamic acid shall be determined using amino acid analyzer. The obtained value shall then be divided by the value of the total nitrogen.

10.7 Amino acid nitrogen

Amino acid nitrogen is the difference in g of formaldehyde nitrogen and ammoniacal nitrogen in 1 dm³ of fish sauce.

10.7.1 Formaldehyde nitrogen

10.7.1.1 Apparatus

pH meter

10.7.1.2 Solutions

1) Sodium hydroxide solution, 0.1 mol/dm³

2) Formaldehyde solution, adjusted to pH 9 by using sodium hydroxide

10.7.1.3 Procedure

Adjust 10 cm³ of dilute sample (as clause 10.4.1) to pH 7, using sodium hydroxide solution. Add 10 cm³ of formaldehyde solution and titrate with sodium hydroxide solution until the pH is 9
10.7.1.4 Calculation

The formaldehyde nitrogen shall be calculated by means of the following formula.

\[ x = 14yM \]

Where

- \( x \) is content, in g, of formaldehyde nitrogen in 1 dm\(^3\) of sample;
- \( y \) is volume, in cm\(^3\), of sodium hydroxide solution used in titration.
- \( M \) is concentration, in mol/dm\(^3\), of sodium hydroxide solution.

10.7.2 Ammoniacal nitrogen

10.7.2.1 Reagents and solutions

1) Magnesium oxide

2) Boric acid, 6.5 mol/dm\(^3\) (4% by weight)

3) Sulfuric acid solution, 0.05 mol/dm\(^3\)

4) Methyl red-bromocresolgreen indicator (methyl red and bromocresolgreen, 0.1% by weight 1:5)

10.7.2.2 Procedure

Transfer 50 cm\(^3\) of dilute sample (as clause 10.4.1) into a distillation flask, add 3 g of magnesium oxide and 100 cm\(^3\) of distilled water. Distill the produced ammonia
in the flask containing 50 cm$^3$ of boric acid and 6 to 10 drops of methyl red-bromocresolgreen indicator until the volume of the solution in the flask remains ¼ of its original volume. Titrate the distilled ammonia with sulfuric acid solution until the solution is changed from green to gray.

10.7.2.3 Calculation

Ammoniacal nitrogen shall be calculated by means of the following formula.

$$x = 5.6yM$$

Where  
- $x$ is content, in g, of ammoniacal in 1 dm$^3$ of sample;
- $y$ is volume, of sulfuric acid solution used in titration in cm$^3$;
- $M$ is concentration of sulfuric acid solution in mol/dm$^3$. 
Appendix III

Community Product Standard (CPS 673/2004)
Local Fish Sauce

1. Scope
   1.1 This community standard covers only fish sauce made from fish and packed in a packaging

2. Definition
   The meanings of words used in this standard are as follows:
   2.1 Local fish sauce means a product obtained from fermentation of fish or parts of fish with salt or from the residue of fish sauce fermentation with brine or by diluting original fish sauce and adjusting its flavor. Other ingredients such as pineapple might be added to accelerate the fermentation process and flavor could be adjusted by adding sugarcane, sugar, etc.
   2.2 Authentic fish sauce means fish sauce obtained from fermentation of fish or parts of fish with salt or from the residue of fish sauce fermentation with brine.
   2.3 Blended fish sauce means fish sauce obtained by diluting original fish sauce and adjusting its flavor.
3. Kinds
   3.1 Local fish sauces are divided into 2 kinds
   3.1.1 Authentic fish sauce
   3.1.2 Blended fish sauce

4. Required characteristics
   4.1 General characteristics: clear without precipitation except natural salt crystal
   4.2 Color: color must be a good natural color of local fish sauce
   4.3 Odor: good natural odor of local fish sauce without any other off-odor such as putrid or fishy odors
   4.4 Taste: good natural taste of local fish sauce
       The average sensory evaluation score according to item 9.1 of this standard for each characteristic must be not less than 3 and the score of any characteristic from any judge must not be 1.
   4.5 Foreign matters: Any other foreign matters such as, hair, soil, rock or part or feces from animal, must not be found
   4.6 Total nitrogen
       4.6.1 Authentic fish sauce must have not less than 9 g/dm³ of total nitrogen
       4.6.2 Blended fish sauce must have not less than 4 g/dm³ of total nitrogen
   4.7 Ratio of glutamic acid and total nitrogen
       4.7.1 For authentic fish sauce, it must be between 0.4-0.6
       4.7.2 For blended fish sauce, it must be between 0.4-1.3
4.8 Food additives
   4.8.1 Synthetic color is not allowed
   4.8.2 Food preservatives can be used according to the food regulations
   4.9 Salt (sodium chloride) must not less than 200 g/l

5. Sanitation
   5.1 Sanitation must be as recommended in Appendix A

6. Packaging
   6.1 Local fish sauce must be packed in clean packaging with tightly closure to protect from outside contamination
   6.2 The net content of fish sauce in each packaging must be not less than the quantity stated on the label

7. Marks and label
   7.1 The label on all units of fish sauce package must be clearly seen of number, letter or mark to clarify these details:
      (1) Product name such as, local fish sauce, anchovy fish sauce
      (2) Kind of product
      (3) Main ingredients
      (4) Kind and amount of food additive (if used)
      (5) Net content
      (6) Manufacturing and expiration dates or the phrase “Best before … (day-month-year)
(7) Storage suggestion

(8) Processor or processing place including address, registered trademark. In case of using foreign language, the meanings must be similar to the statement in Thai

8. Sampling and criteria

8.1 Lot in this standard means the same kind of fish sauce that produced at the same time.

8.2 Sampling and acceptance are according to the following sampling plan:

8.2.1 Sample for testing of foreign matters, packing and labeling are randomly sampling from 3 packaging units of the same lot. The test result of all samples must be as in items 4.5, number 6 and 7 to be lot accepted.

8.2.2 Sample for testing of general characteristics, color, odor and taste are those left from the testing in 8.2.1 from 3 packaging units. The test result of all samples must be as in item 4.1-4.4 to be lot accepted.

8.2.3 Sample for testing of total nitrogen content, ratio of glutamic acid to total nitrogen, food additives, and salt content are randomly sampling from 3 packaging units of the same lot to be combined. The total quantity must not be less than 300 cc. If it is less than 300 cc., sample must be drawn from the same lot to be at least 300 cc. The test result must be as in item 4.6-4.9 to be lot accepted.
8.3 To pass this CPS 673/2004, local fish sauce must meet the standard criteria of all items 8.2.1, 8.2.2 and 8.2.3

9. Testing procedures

9.1 General characteristics, color, odor and taste

9.1.1 At least 5 panelists who are acquainted with local fish sauce testing must be assigned to conduct the test and score the product separately.

9.1.2 Local fish sauce must be poured into a white porcelain dish for visual and sensory evaluations.

9.1.3 Criteria for scoring are according to Table 1.

9.2 Foreign matters, packaging and label testing are conducted by visual inspection.

9.3 Total nitrogen, ratio of glutamic acid to total nitrogen, food additives and salt content are determined by AOAC or any other acceptable methods

9.4 Net content is examined using an appropriate measuring apparatus.
Appendix A

Sanitation (Item 5.1)

A 1. Location and Processing Area

A 1.1 Building and adjacent area where product is produced could protect product from contamination:

A 1.1.1 Building and adjacent area should be clean and dry without flooded area.

A 1.1.2 It should be far from area with excessive dust or smoke.

A 1.1.3 It should not be close to displeasure places such as animal farm or garbage collecting or discarding site.

A 1.2 Building should be of appropriate size. It should be designed and built for an easy maintenance, cleaning and operating:

A 1.2.1 Floor, wall and ceiling of the building should be built with durable, smooth surface material should be cleaned and maintained in a good condition all the time.

A 1.2.2 Production area should be separated and not closed to a toilet. Unused materials should be taken out from this area.

A 1.2.3 Working area should not be cramped, with sufficient lighting and appropriate air flow.
A 2. Tools, machines and utensils
   
   A 2.1 Containers or utensils that are contacted with product should be made from smooth surface and rustless materials and easily be cleaned.

   A 2.2 Tools, machines and utensils should be clean and appropriate for using, causing no contamination, installed easily, sufficient and thoroughly cleanable.

A 3. Process control

   A 3.1 Raw materials and ingredients should be clean, good quality, and should be washed properly before using.

   A 3.2 Processing, storage, transferring and transportation should protect the product from contamination and deterioration.

A 4. Hygiene, maintenance and cleaning

   A 4.1 Water for cleaning of tools, machines, utensils and worker hands should be potable water and in sufficient quantity.

   A 4.2 Appropriate prevention and method for riddance of disease carrier animals, insects and dust to get into the production area should be available.

   A 4.3 Garbage, sewage, and waste water should be properly discarded to prevent them from recontamination to the product.

   A 4.4 Chemicals for cleaning or riddance of disease carrier animals and insecticide should be appropriately used and kept separately from production area.
A 5. Good personal hygiene of processors should be controlled e.g., wearing clean clothes, using hair net to prevent hair falling into products, long nails are prohibited, washing hands every time before working, after using toilet or when hands are dirty.

Table 1: Criteria for scoring (item 9.1.3)

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Criteria</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Very good</td>
</tr>
<tr>
<td>General characteristics</td>
<td>Clear without precipitation except natural salt crystal</td>
<td>4</td>
</tr>
<tr>
<td>Color</td>
<td>Good natural color of local fish sauce</td>
<td>4</td>
</tr>
<tr>
<td>Odor</td>
<td>Good natural odor of local fish sauce without any other off-odor such as putrid or fishy odors</td>
<td>4</td>
</tr>
<tr>
<td>Taste</td>
<td>Good natural taste of local fish sauce</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix IV

STANDARD FOR FISH SAUCE
CODEX STAN 302-2011

1. SCOPE
This standard applies to fish sauce produced by means of fermentation by mixing fish and salt and may include other ingredients added to assist the fermentation process. The product is intended for direct consumption as a seasoning, or condiment or ingredient for food. This standard does not apply to fish sauce produced by acid hydrolysis.

2. DESCRIPTION
2.1 PRODUCT DEFINITION
Fish sauce is a translucent, not turbid liquid product with a salty taste and fish flavour obtained from fermentation of a mixture of fish and salt.

2.2 PROCESS DEFINITION
The product is prepared by mixing fish with salt and is fermented in covered containers or tanks. Generally, the fermentation process takes not less than 6 months.

Succeeding extractions may follow by adding brine to further the fermentation process in order to extract the remaining protein, fish flavour and odour. Other ingredients may be added to assist the fermentation process.
2.3 PRESENTATION

Any presentation of the product shall be permitted provided that it meets all requirements of this standard; and is adequately described on the label to avoid confusing or misleading the consumer.

3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

3.1 Raw material

3.1.1 Fish

Fish sauce shall be prepared from sound and wholesome fish or parts of fish in a condition fit to be sold fresh for human consumption.

3.1.2 Salt

Salt used shall be of food grade quality and conform to the Standard for Food Grade Salt (CODEX STAN 150-1985).

3.1.3 Water

Water for preparing brine shall be potable.

3.2 Other ingredients

All other ingredients used shall be of food grade quality and conform to all applicable Codex standards.

3.3 Quality criteria

3.3.1 Organoleptic criteria shall be acceptable in terms of appearance, odour and taste as follows:
Appearance

Fish sauce must be translucent, not turbid and free from sediments except salt crystals.

Odour and taste

Fish sauce shall have odour and taste characteristic of the product.

3.3.2 Foreign matter

This product shall be free from foreign matter.

3.4 Chemical properties

- Total nitrogen content: not be less than 10 g/l. Competent authorities may also specify a lower level of total nitrogen if it is the preference of that country.

- Amino acid nitrogen content: not less than 40% of total nitrogen content.

- pH: between 5.0-6.5 typical for a traditional product; but not lower than 4.5 if ingredients are used to assist fermentation.

- Salt: not less than 200g/l, calculated as NaCl.

3.5 Final product

The product shall meet the requirements of this Standard when lots examined in accordance with Section 11 comply with the provisions set out in Section 10. The products shall be examined by the methods given in Section 9. The packaging for the final product shall be free from any integrity defects, such as cracks, leakage, or loose pieces of the packaging units.
4. **FOOD ADDITIVES**

Only those food additive classes listed below are technologically justified and may be used in products covered by this Standard. Within each additive class only those food additives listed below, or referred to, may be used and only for the functions, and within limits, specified.

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>INS No.</th>
<th>Additive</th>
<th>Maximum level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acidity regulators</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>334; 335(i), (ii); 336(i), (ii); 337</td>
<td>Tartrates</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>330, 331 (i), (iii) 332 (i), (ii)</td>
<td>Citrates</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>296, 350 (i), (ii) 351 (i), (ii) 352 (ii)</td>
<td>Malates</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>Ascorbic acid</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>325</td>
<td>Sodium lactate</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>260</td>
<td>Acetic acid</td>
<td>GMP</td>
</tr>
<tr>
<td><strong>Flavour enhancers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>621</td>
<td>Monosodium glutamate</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>630</td>
<td>Inosinic acid</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>631</td>
<td>Disodium Inosine 5’monophosphate</td>
<td>GMP</td>
</tr>
<tr>
<td></td>
<td>627</td>
<td>Disodium 5’guanylate</td>
<td>GMP</td>
</tr>
<tr>
<td><strong>Sweeteners</strong></td>
<td>950</td>
<td>Acesulfame K</td>
<td>1,000 mg/kg</td>
</tr>
<tr>
<td></td>
<td>955</td>
<td>Sucralose</td>
<td>450 mg/kg</td>
</tr>
<tr>
<td></td>
<td>951</td>
<td>Aspartame</td>
<td>350 mg/kg</td>
</tr>
<tr>
<td>Functional Class</td>
<td>INS No.</td>
<td>Additive</td>
<td>Maximum level</td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Colours</td>
<td>150c</td>
<td>Caramel III-Ammonia caramel</td>
<td>50,000 mg/kg</td>
</tr>
<tr>
<td>Emulsifiers and Stabilizers</td>
<td>466, 468</td>
<td>Carboxymethyl cellulose and crosslinked carboxymethyl cellulose</td>
<td>GMP</td>
</tr>
<tr>
<td>Preservatives</td>
<td>210-213</td>
<td>Benzoates</td>
<td>1,000 mg/kg</td>
</tr>
<tr>
<td></td>
<td>200-203</td>
<td>Sorbates</td>
<td>1,000 mg/kg</td>
</tr>
</tbody>
</table>

5. CONTAMINANTS

5.1 The products covered by this Standard shall comply with the Maximum Levels of the *General Standard for Contaminants and Toxins in Foods and Feed* (CODEX STAN 193-1995).

5.2 Raw material fish for fish sauce shall not contain marine biotoxins (e.g. Ciguatoxin, Tetrodotoxin and PSP) in amounts which could present a risk to human health.

5.3 Product made using aquaculture fish shall comply with the maximum residue limits for veterinary drugs established by the CAC.

6. HYGIENE AND HANDLING

6.1 The final product shall be free from any foreign material that poses a threat to human health.
6.2 It is recommended that the products covered by provisions of this standard be prepared and handled in accordance with the appropriate sections of the *Code of Practice-General Principle of Food Hygiene* (CAC/RCP 1-1969), *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003) and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

6.3 The products should comply with any microbiological criteria established in accordance with the *Principles for the Establishment and Application of Microbiological Criteria for Foods* (CAC/GL 21-1997).

6.4 The product shall not contain more than 40 mg histamine/100 g of fish sauce in any sample unit tested.

7. **WEIGHTS AND MEASURES**

7.1 **Fill of Containers**

7.1.1 **Minimum Fill**

(a) The container should be well filled with fish sauce, which should occupy not less than 90% (minus any necessary head space according to good manufacturing practices) of the water capacity of the container. The water capacity of the container is the volume of distilled water at 20°C which the sealed container will hold when completely filled.

(b) Flexible containers should be filled as full as commercially practicable.
7.1.2 Classification of “Defectives”

A container that fails to meet the requirement for minimum fill of section 7.1.1 should be considered as a “defective”.

7.1.3 Lot acceptance

A lot shall be considered as meeting the requirement of section 7.1.1 when the number of “defectives” as defined in Section 7.1.2, does not exceed the acceptance number (c) of the appropriate sampling plan with an AQL 6.5. In addition, the average net weight or net volume shall be equal or greater than the declared net weight or net volume.

8. LABELLING

In addition to the provisions of the General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985) the following specific provisions apply:

8.1 Name of the product

The name of the product shall be “fish sauce” or other names, in accordance with the law and custom of the country in which the product is sold, and in a manner not to mislead the consumer. The name of the product may be preceded or followed by the common or usual name of the fish.

8.2 Labelling of non-retail containers

Information on the above provisions shall be given either on the container or in accompanying documents, except that the name of the product, lot identification, and the name and address of the manufacturer or packer, as well as storage instructions shall
appear on the container. However, lot identification, and the name and address of the manufacturer or packer may be replaced by an identification mark provided that such a mark is clearly identified with the accompanying document.

8.3 Labelling of Nitrogen Content

Competent authorities may require that total nitrogen (refer to 3.4) be declared on the fish sauce label in g/l. Competent authorities may also require descriptors that reflect the total nitrogen level as an indicator of quality of the fish sauce.

9. SAMPLING, EXAMINATION AND ANALYSIS

9.1 Sampling of lots for examination of the final product shall be in accordance with the General Guidelines on Sampling (CAC/GL 50-2004). A sample unit is the individually packed product (bottle) or a 1l portion from bulk containers.

9.2 Sensory and Physical Examination Samples taken for sensory and physical examination shall be assessed by persons trained in such examination in accordance with the Guidelines for the Sensory Evaluation of Fish and Shellfish in Laboratories (CAC/GL 31-1999) as follows:

- Complete external packaging unit examination for the presence of any integrity defects, particularly cracks or leakage or loose pieces of the packaging units.
- Examination of the product for translucence and foreign matter.
- Evaluation of odour and taste.
9.3 Test methods for chemical properties

9.3.1 Determination of total nitrogen: AOAC 940.25

9.3.2 Determination of amino acid nitrogen by determining formaldehyde nitrogen (AOAC 2.066) and subtracting by ammoniacal nitrogen (AOAC 2.065)

9.3.3 Determination of pH: AOAC 981.12 (Codex general method). The pH shall be measured in a sample of fish sauce diluted with water to 1:10 using a pH meter. The dilution of fish sauce is necessary because of the high ionic strength in the undiluted sauce.


9.3.5 Determination of histamine: See AOAC 977.13 or other scientifically equivalent validated method.

10. DEFINITION OF DEFECTIVES

The sample unit shall be considered as defective when it exhibits any of the properties defined below.

10.1 Foreign Matter

The presence in the sample unit of any matter which has not been derived from salt and fish, does not pose a threat to human health and is readily recognized without magnification or is present at a level determined by any method including magnification, that indicates non-compliance with good manufacturing and sanitation practices.
10.2 Appearance

The presence of any sediments (except NaCl crystals) and/or cloudiness.

10.3 Odour

A sample unit affected by distinct objectionable odour, e.g. rotten, putrid, rancid, gamey, pungent etc.

10.4 Taste

A sample unit affected by distinct objectionable taste, e.g. bitter, sour, metallic, taint, etc.

11. LOT ACCEPTANCE

A lot shall be considered as meeting the requirements of this Standard when:

(i) the total number of defective sample units as classified according to Section 10 does not exceed the acceptance number (c) of the appropriate sampling plan (AQL-6.5).

(ii) the essential composition and quality factors, food additives, contaminants, hygiene and handling and labelling requirements of Sections 3, 4, 5, 6 and 8 are met.
Appendix V

Measurement of Fish Sauce Color

Visual measurement

by Chromameter
Appendix VI

$a^*\ b^*$ chromaticity diagram

at a constant $L^*$ value

Lightness ($L^*$) and Chromaticity
Processing of Fish Sauce
by Natural Fermentation

Fishery Technological Development Division
- Department of Fisheries
- Ministry of Agriculture and Cooperatives