

Good Manufacturing Practice (GMP) for Small and Medium-sized Traditional Fish Products Processing Establishments in ASEAN

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Southeast Asian Fisheries Development Center

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Introduction

Many small and medium-sized fish processing establishments (SME) in ASEAN member countries find it difficult to implement quality assurance systems due to economic and technical constraints. They comprised largely of pre-processing establishments (PPE), which produce semi-processed raw materials for main processing establishments and traditional fish products processing establishments (TPE). PPE supply semi-processed raw materials such as shrimp, crab, squid, fish and bivalve mollusc to main fish processing establishments. The processes carried out in these establishments may include peeling, de-heading, degutting, de-skinning, cooking, picking, filleting or shucking depending on the raw materials involved. Thus, PPE can play a significant role in determining the quality and safety of raw materials and subsequently of the finished products. In the ASEAN region, traditional fish products represent a significantly large part of total fish utilization and are a major source of animal protein. As a result, traditional fish products are vitally important to food security, especially considering that the marginalized and poorer segments of the population consume most of these products. In view of the importance of these products to the people's diet in the ASEAN region and

the importance of a safe food supply to food security, it is imperative that the TPE apply appropriate GMP programs to assure quality and safety of these products. Therefore, to help the small and medium-sized fish processing establishments (SME) in the ASEAN member countries meet food safety and quality assurance requirement, MFRD proposed a project in 2007 under the Japanese Trust Fund II (JTFII) programme on 'Quality Assurance Systems for Small and Medium-sized Fish Processing Establishments in ASEAN member countries' to develop GMP in PPE and TPE as a first step towards implementation of HACCP-based quality assurance systems.

The first regional project activity to develop GMP for selected PPE was conducted in 2007/2008 and in 2008/2009, MFRD in collaboration with nine ASEAN member countries, namely, Brunei Darussalam, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam, conducted a second regional project activity to develop GMP for selected TPE in these countries. The selected TPE were involved in the processing of various traditional fish products as shown in Table 1.

Table1: List of ASEAN Countries and selected TPE

Country	TPE
Brunei	Tiny shrimp paste (<i>Belacan</i>)
Indonesia	Salted boiled fish (<i>Pindang</i>)
Lao PDR	Dried fish (<i>Pa heang</i>)
Malaysia	Fish cracker (<i>Keropok lekor</i>)
Myanmar	Fermented fish (<i>Ngachin</i>), Fish sauce (<i>Ngan pya ye</i>)
Philippines	Shrimp sauce (<i>Alamang</i>), Smoked fish (<i>Tinapa</i>)
Singapore	Fish balls/fish cakes
Thailand	Dried shrimp, Fish sauce (<i>Nam pla</i>)
Vietnam	Fermented tiny shrimp paste (<i>Mam tom</i>), Fish sauce (<i>Nuoc mam</i>)

This publication is the output of the second regional project activity and it describes the GMPs developed for the selected TPE as well as outlines of the processing steps involved.

GMP can cover every aspect of food production, employee/personnel hygiene and training, plant and equipment/utensils design and specifications, cleaning and sanitation, and even warehousing and distribution of the finished products. In this publication the emphasis is on GMP for production and process controls, which are specific to the selected TPE.

GMP for the other areas are also covered when they have an impact on the production and processes involved. This publication should be used in conjunction with other important references such as the Codex Alimentarius Commission's Recommended International Code of Practice- General Principles of Food Hygiene (CAC/RCP 1-1969, Rev 4-2003) and US FDA's Code of Federal Regulation Title 21 Part 110 Current GMP in Manufacturing, Packing or Holding Human Food, as well as other relevant national regulations.

Background on Selected Traditional Fish Product Processing Establishments (TPE)

Brunei Darussalam

Tiny shrimp paste (*Belacan*)

Tiny shrimp paste or *Belacan* in the local language is a semi-fermented/cured shrimp product in the form of a paste. The species of tiny shrimp used is the *Acetes spp.* *Belacan* is used as a condiment or ingredient in many vegetable dishes and dips. It can be chilled, frozen or stored at room temperature. It is often packaged in polyethylene plastic bags or containers for sale at local markets in Brunei Darussalam.

The major concerns for *Belacan* include reducing microbial counts, and preventing oxidation, discoloration and desiccation. The majority of traditional establishments producing *Belacan* are cottage industries. These cottage industries not only lack the appreciation and understanding of the importance GMP for food safety and quality, they also lack the capability to enforce such strict manufacturing practices. In an effort to improve the safety and quality of the *Belacan*, governmental agencies in Brunei have made special effort to improve the monitoring and surveillance of products and practices. Focus is now being placed on providing enhanced and group-directed technical assistance and guidance. In order to disseminate information more effectively, training programs are currently being conducted for all relevant stakeholders.

Indonesia

Salted boiled fish (*Pindang*)

In Indonesia, most of the fish processing industries are TPE commonly operated by small to medium scaled processors and cater mostly to the needs of the domestic market. They are scattered all around the provinces of Indonesia with sixty percent of them in the Java Island.

A large portion (40%) of the 7.71 million tonnes of catch each year are processed in TPE. These TPE are predominantly engaged in fish curing methods such as salting/drying (85%), salting-boiling (11%), smoking (3%) and fermentation (1%). Approximately 50% of the catch is sold as fresh fish while another 10% is processed by large-scale processors and sold as frozen fish, canned fish or others.

It is common that traditional fish products fail to meet the hygiene requirements of Indonesia. These traditional fish products are predominantly consumed by the middle level of society. The inability to meet the hygiene requirements is mainly attributed to the many constraints faced by processors. These constraints include the lack of infrastructure and equipment and the lack of appropriate handling and processing area that comply with the hygiene requirements.

In order to improve the quality of traditional fish products such that they comply with the hygiene requirements and are safe for human consumption, the TPE must be provided with adequate and appropriate processing equipment. TPE must also be trained on how to implement GMP. In order to achieve

that, it is essential that the GMPs are first established.

In Indonesia, salted boiled fish is known as *Pindang*. *Pindang* plays an important role in the staple diet of the local population due to its low cost and high nutritional value particularly that of proteins. The storage life of *Pindang* can however, be compromised by poor sanitation and hygiene during the processing steps.

Salted boiled fish is preserved in a process that involves boiling fish in the presence of salt. This traditional preservation technique is relatively easy to do and does not depend on the natural drying conditions or mechanical drying equipment that may sometimes pose a problem in the production of salted boiled fish.

The GMP for salted boiled fish is created with the intention that they be applied to small-medium sized establishments to allow them to meet the standard of processing and to improve the quality of their products. Similarly, the training and supervision of these small-medium sized traditional product establishments is expected to help produce fish products of higher quality that are safe for consumption and are more competitive in the market.

The production figures of salted boiled fish in Indonesia, mostly in the Java Island is shown in Table 1. However, data on the export volume is currently not available. The main reason for this is that most of the products are consumed in Indonesia, in particular that of the Java Island. The export volume is almost negligible.

Table 1: Production of *Pindang*

No.	Year	Production (tonnes)
1	2000	66,475
2	2001	134,071
3	2002	124,826
4	2003	121,491
5	2004	122,807
6	2005	95,776
7	2006	124,260
8	2007	131,560

Lao PDR

Dried fish (*Pa heang*)

The Government of Lao places a strong emphasis on economic growth of the agricultural and food production sector of the economy. It seeks to promote rural development as a key component in its effort to reduce poverty in the country.

In the past decade, the fisheries have played a major role in providing a crucial source of income and employment for the rural men and women. They have also contributed greatly to the national food supply. In the year 2006, the fisheries produced more than 97,400 tonnes of fish and fishery products. This is expected to increase at around three to five percent each year.

The fishing industry of Lao is particularly active during the rainy season of the year. The rainy season usually spawns an abundance of fish and fishery products. As such the collection of aquatic animals is an important activity for the country folk during the raining season. Most of the fishes are caught from natural fresh water resources which originate from the Mekong River, reservoirs and its tributaries (40%); ponds, swamps, wetlands, flood plains (26%); rice fields (32%) and cage culture (2%).

Although the fish and fishery products produced in Lao have increased, most of these products are consumed domestically due to the high domestic demand. As such, very little are exported. The surplus products are preserved in a variety of methods according to cultural preferences and prevailing local traditions.

These TPEs are predominantly small scaled and its processors belong to traditional fish processing families or communities. The most common forms of traditional products are fish sauce, fermented, pickled, dried and smoked fish.

The Government of Lao greatly supports the small and medium sized food processing enterprises. In recent years, many food factories have been established to ensure sufficient food for the domestic population as well as for exports.

Nonetheless, the fish processing industry in Lao is yet to be well established. This could be attributed to the underdeveloped management system of fish processing industries in particular that of traditional processing enterprises.

Processors' and consumers' knowledge and understanding of food quality and safety, food-borne diseases is still very low. This lack of awareness has become the leading cause of illness and death. These, accompanied by other food safety related issues continue to have a negative impact on public health and economic development. The outbreaks of food borne and food-transmitted diseases continue to rise. As such, the government of Lao has to address an expanded list of possible food-borne diseases.

Unfortunately, at the present moment, the necessary regulatory tools are still not in place. There are only some regulations and decrees related to food safety control. Though there is currently a laboratory, the animal disease diagnosis laboratory situated at the National Animal Health Center, it is currently being shared amongst the fish testing, animal

parasites and disease testing and certification of the safety of meat products units of the government.

Moreover, the technical personnel often lack the knowledge of methods in food analysis and quality assurances. They also lack the essential and specialized equipment required for more specialized tests. Therefore, they are unable to test for pesticide residues and mycotoxins. They are also unable to test and monitor chemical contamination in food products.

The lack of trained manpower, food inspectors and skills in terms of food analytical techniques pose a major problem in ensuring food safety in Lao. This is particularly true in places where there are rough terrains, and an absence of proper roads. Communication with the remote rural areas is difficult in such areas. Communication is made even more difficult by the presence of inadequate operational funding.

The villages in Lao PDR started fish processing in 1978 after the Nam Ngum reservoir was built. As part of the FAO project initiative, the fish-processing group was officially established between 1998-1999. As there are three main kinds of traditional fish processing methods, the fish-processing group targets to provide three kinds of training to twelve particular villages. The group also provide equipment to these villages.

In addition to that, the fish-processing group has tried to incorporate GMP in four targeted villages. The four villages are Tha Heua Tai, Tha Heua Neua, Seng Savang and Donxary Oudom.

In Lao PDR, the most common forms of traditional processed products are fish sauces, fermented fishes, pickled fishes, dried fishes and smoked fishes. Dried fish or *Pa heang*, as it is known locally, are produced by the following procedure. The fresh fishes are first washed in fresh water. They are then gutted and washed again before being mixed with seasoning. The seasoned fishes are then dried

under the sun and smoked. The completed *Pa heang* are hung on bamboo strings and sold in the markets.

The fisheries industry of Lao PDR is not highly developed. As such, the export of fishes to foreign markets is insignificant. There are also very limited fish processing activities occurring in the country. The trade of fishes is predominantly domestic and this commodity is a very important source of protein for the local population.

The Department of Livestock and Fisheries (DLF) has decided to place its emphasis on improving the hygiene practices in fish handling and processing. Presently, there are no national standards for fish products. However, DLF is considering using the national standards of Thailand or other neighboring countries as the basis for establishing the national Lao standard.

Malaysia

Fish cracker (*Keropok lekor*)

Keropok lekor is a traditional Malaysian fish product. It is a popular snack food that is widely consumed by all communities in Malaysia. *Keropok lekor* is produced predominantly in the coastal areas of Malaysia in particular the east coast of the Malaysian Peninsula mainly in the states of Kelantan, Terengganu and Pahang.

At present, there are about two thousand operators involved in the production of *Keropok lekor* in Malaysia. *Keropok lekor* is traditionally made in small backyard operations in fishing villages. However, in recent years, some of these operations have been up scaled up using large semi-automatic machinery to produce large amounts of *Keropok lekor*. At present, there are about two thousand operators involved in the production of *Keropok lekor*. Currently, there are five establishments practicing GMP in the production of *Keropok lekor*. These five establishments are located in Kuala Lumpur

and are estimated to produce 2.5 tonnes of *Keropok lekor* a day. The total production of *Keropok lekor* in Malaysia is estimated to be about 30,000 to 60,000 a month. Though most of these are sold domestically, some are exported to Brunei and the Middle East.

Keropok lekor is made from a mixture of fish, shrimp and starch. The fishes used in the production of *Keropok lekor* are mainly low value pelagic fishes such as *Dussumieria hasellti* (Round hering, Ikan Tamban), *Chirocentrus dorab* (dorab wolf herring, Ikan Parang), *Decapterus maruadsi* (Round Scad, Ikan Selayang), *Decapterus macrosoma* (slender scad, Ikan Selayang) and *Atule mate* (Yellow tail Scad, Ikan Selar).

Keropok lekor is known for its versatility and ability to be formed into many different shapes and sizes. These forms include oval, cocktail, ball or sliced. There are also the newly formulated crispy and spicy forms. These new versions of *Keropok lekor* are already sold in markets. The Department of Fisheries and a University are now conducting a joint study on the product development and packaging of *Keropok lekor*.

Myanmar

Myanmar is endowed with an extended coast line that stretch along the Indian Ocean, Bay of Bengal and Andaman Sea. This extensive coast line provide Myanmar with diverse fisheries resources. As of 2009, Myanmar has a population of 56 million. The people of Myanmar rely heavily on fish and fishery products as their main source of animal protein. Due to significant growth in the fishery industry, the per capital domestic consumption of fish has also increased significantly in the past two years.

As a result of the favorable geographical conditions of Myanmar, the fisheries in Myanmar have expanded. This is true for the marine (coastal and off-shore) fisheries, inland fisheries and aquaculture industry in

Myanmar. Apart from ensuring food security for the people, the government also places strong emphasis on developing its fisheries as they play an important role in earning foreign income for the country through export.

As a result of strong governmental support, the fishery production of Myanmar reached about 3.168 million metric tonnes in 2008. Of these, marine fisheries account for almost 1.679 million metric tonnes of the fishes, freshwater fisheries account for another 0.625 million metric tonnes, 0.675 million metric tonnes from aquaculture, and 0.189 million metric tonnes from less able fisheries. These values indicate that the marine fisheries play an important role in ensuring food supply security and the livelihood of the community people in the coastal regions.

In Myanmar there are 496 licensed and registered small and medium sized establishments. Of these 496 establishments, 117 are small sized establishments, while 379 are medium sized establishments. These 379 medium sized establishments have been trying to develop the GMP for the TPE of Myanmar.

A total of 136 fish processing plants including TPE were licensed between the period of 2009-2010. The factories that complied with the rules and regulations of the EU were permitted to export their products to the EU countries especially United Kingdom that has a bilateral agreement with Myanmar.

Fermented fish (*Ngachin*)

As recorded by the division fishery offices in the years 2009 and 2010, there are 104 *Ngachin* producers registered in the states of Pegu and Tanintheri. Annual production of *Ngachin* is approximately 900-1000 tonnes. The product is produced from small whole fishes or marine shrimp (*Metapeneaus* spp.) The fish or shrimps are mixed with salt and boiled rice. The product may be consumed as cooked/fried *Ngachin* as well as raw *Ngachin* mixed with onion, chilli, garlic and oil. The shelf life is about a week at ambient temperatures.

Though the GMP for each of the production steps has been formulated, there are still problems and challenges involved in the implementation of the GMP. For one, the budget set aside for the implementation of GMP is limited. There is also insufficient resources and time to train the personnel involved in the production of *Ngachin*. Some recommendations to overcome these issues include providing more and frequent training to the TPE to increase awareness of GMP.

Fish sauce (*Ngan pya ye*)

Fish sauce, or *Ngan pya ye* in Myanmar, is one of the basic ingredients in Myanmar cooking. It is used liberally in nearly all Myanmar dishes. It is often used as a marinade for fish and meat. It is also often mixed with fresh-cut or dried chilli and used as a condiment. *Ngan pya ye* has a rich and translucent reddish-golden brown color.

As of 2010, the division fishery offices has recorded 56 registered fish sauce processors. The annual production for fish sauce is approximately 130,000 -190,000 tonnes.

Fish sauce is made from a mixture of fish and salt that has been allowed to ferment over a period of six months to a year. Traditionally, freshwater fishes are used in the production of *Ngan pya ye*. However, some fish sauces are made using marine fish or even squids. The basic ingredients of *Ngan pya ye* are fish, water and salt. Sugar may also be added for extra taste, though it is not a necessary ingredient. As *Ngan pya ye* is fermented, it does not require refrigeration and is best stored in a cool, dark place.

Philippines

Shrimp sauce (*Alamang*)

Shrimp sauce is one of the popular traditional fish and fishery products of the Philippines. It is used as a condiment in many Filipino recipes. It is also used as a dip and as a

flavoring agent in many Filipino noodle dishes.

Shrimp sauce is particularly popular in the Cavite areas of the Philippines. Despite its popularity, the production of *alamang* is mostly confined to cottage industries. These homemade *Alamang* are sold within the Cavite areas and also to visiting clientele from other parts of the Philippines. They are also sold directly to restaurants or sent overseas to Filipino Overseas Workers.

Alamang's main raw material, the tiny shrimp *Acetes* spp., is only abundantly available during the months of May and September. As such, there is a need to assist producers by teaching them how to sustain the supply of shrimp sauce all year round. There is also a need to offer assistance to the industry to allow it to flourish and become more competitive in the market.

To ensure that the *Alamang* produced is of high quality and safe for human consumption, it is very important to impart GMP to the TPE. The government plans to achieve this by not only providing technical support but also financial support. This is in consideration of the financial status of these small and medium-size producers.

Smoked fish (*Tinapa*)

Smoked fish, known locally as *Tinapa*, is fresh fish that has been soaked in brine, sun-dried and treated with hot smoke generated from burning hardwood inside a smoke house. The smoke house is usually constructed using drums or concrete tiles.

Tinapa is one of the most popular ready-to-serve fish product available in the market all year round. This statement is particularly true in the Tagalog region; Manila, Malabon, Navotas and some municipalities of Cavite, Bulacan, Batangas and Quezon. It is believed that it is in Quezon that smoked fish is first accepted as a common dish to be consumed

with rice. The average rate of consumption of dried and smoked fish in the Philippines is 4 kilos per capita per annum.

Salted, dried and smoked fishes are widely produced by a system of small-scale units and cottage industries. These fish products account for a significant proportion of the national production of fishery products.

Though the sale of smoked fish occur predominantly at central markets, the process of smoking the fish occur mostly at the villages, towns and cities. As transport of smoked fish is fairly inexpensive and easy to do, the smoking process can occur at a site away from the point of sale.

Based on the Bureau of Fisheries and Aquatic Resources (BFAR) Fisheries Profile 2007, smoked fish has a very low FOB value compared to other fishery exports. This could be attributed to the fact that many small and medium-size fish smoking plants in the Philippines find it difficult to implement GMP due to their economic and technical constraints.

To date, the safety standards for smoked fish has already been prepared and submitted for consultation with the industries and other institutions. After the standards have been reviewed, they will be submitted to the Bureau of Product Standards for approval.

Singapore

Fish balls and fish cakes

Fish balls and fish cakes are widely consumed in Singapore as ready to eat snacks as well as ingredients in many local dishes especially that of noodles and vegetable dishes. Traditionally, fish balls and fish cakes are made from fresh fish but inconsistent and insufficient supplies of fresh fish has led processors in Singapore to favor the use of *surimi* as the chief raw material. *Surimi* is fish meat that has been minced, leached by washing with water, thoroughly mixed with sugar and

polyphosphate and then frozen. The *surimi* is imported predominantly from Thailand, Vietnam, Indonesia, Malaysia, India and Myanmar.

The scale of production varies from one-man stalls that are fully manually operated, to large plants producing up to ten or more tonnes per day. The large amount of fish balls and fish cakes produced are for both the domestic and export markets. About 45-50 fish processing establishments in Singapore are involved in the production of fish balls and fish cakes. They produce an estimated 30,000-50,000 tonnes of products annually valued at S\$80-90 million and are mainly for domestic consumption. However, in recent years, there are a few companies that have increased their exports to neighboring countries, US, EU and Australia.

The core of the industry lies in the production of fish balls and fish cakes for the numerous noodles stalls in Singapore. Fish balls and fish cakes are sold to noodle stalls and served with noodles. Fish cakes are usually cut into thin slices and added to noodles, soup and vegetables dishes. Deep-fried fish balls and fish cakes are also sold as snacks. These snacks have become increasingly popular in Singapore. The use of fish balls and fish cakes in other dishes is also gaining popularity. Fish balls and fish cakes are also sold directly to household consumers at wet markets and supermarkets. Fish balls and fish cakes sold in supermarkets are usually packed in styrofoam trays wrapped with polyethylene (PE) sheet. Fresh fish balls are packed in PE bags with chilled water and displayed on refrigerated cabinets.

Thailand

Dried shrimp

Salting and drying are probably the oldest and easiest methods of food preservation.

Dried shrimp is a traditional fishery product that is popular not only amongst the Thais but also amongst the people of South East Asia. It can be made from either marine shrimp, aquaculture shrimp or freshwater shrimp. The production of dried shrimp is located at coastal provinces such as that of Trad, Chantaburi, Chonburi, Samuthsakorn, Samuthprakarn and some regions in the south of Thailand. Dried shrimp are usually produced in cottage industries where the processing practices and hygiene practices are less than ideal.

Fish Sauce (*Nam-Pla*)

There are three main groups of fermented fishery products in Thailand. They are liquid products, paste products and products that retain the original size and form of the raw materials. Fish sauce (*Nam-pla*) belongs to the first group of fermented fishery products. Shrimp paste (*Kapi*) is a common example of product belonging to the second group and fermented fish products such as *Pla-ra*, *Pla-jao*, and *Pla-jom* are examples of the third group of fermented fishery products.

Fish sauce is a major fermented product which is consumed daily in almost every household and restaurant in Thailand. There are many small and medium scaled cottage factories producing fish sauce in Thailand. In 1991, there were 110 fish sauce manufacturing plants in Thailand. The quantity of raw material used was 127,152 metric tonnes in weight with a value of 308.7 million baht (Dept. of Fisheries, 1993).

Both marine and freshwater fishes such as anchovies, sardine and mud carp (*Cirrhina jullieni*) can be used in the production of fish sauce. In 1986, the National Statistical Office conducted a survey on household expenses and found out that approximately 37% of the total money spent on condiments was on fish sauce. As such, the study concluded that fish sauce was the condiment that incurred the highest expenses no an average household's expenditure on condiments.

The Department of Business Economics under the Ministry of Commerce also conducted a survey on fish sauce consumption on the Thai population and found that the average Thai consumed approximately twenty milliliters of fish sauce a day. If we assume that the population that consumer fish sauce is 50 million, the amount of fish sauce required would be approximately 1,330,000 bottles of 750 milliliters a day.

Vietnam

In recent years, the annual average rate of growth for the fish processing industry in Vietnam has reached seven to twenty percent. There are over 530 large-scale processing establishments and 4 billion US dollars worth of exports in 2008. Though there is a push to export fishery products, over fifty percent of the fishery products are consumed domestically.

In Vietnam, the technologies used in the processing of fishery products include, freezing, frying slating, fermenting and the production of fish sauce. Up to date, there are thousands of establishments of different scales. These establishments are predominantly located along the coastal areas and southern delta. Fish paste and fish sauce are also produced in these establishments.

There are two main types of production methods. The majority of fish processing establishments are household establishments. The major setback for this production method

is that the productivity is not high. Only about one to five tonnes of finished products are produced per household per year. There are also large-scale production establishments. This group of production units has an annual yield of about 10 tonnes per unit. This is significantly higher than that of the household establishments.

Fermented Tiny Shrimp Paste (*Mam Tom*)

Fermented tiny shrimp paste (*Mam tom*) is produced predominantly in the costal areas of Vietnam. The ingredients of mam tom are tiny shrimps and salt added at a percentage of 10-13%. The fermentation time is about two to six months. The fermented shrimp paste produced should have a very fine texture. Depending on the technology used in its production, the product can be very fine and have a distinct flavor. Though it is produced mostly for domestic consumption, *Mam tom* is also exported.

Fish sauce (*Nuoc mam*)

Fish sauce or *nuoc mam*, as it is known locally, is also produced in the coastal areas of Vietnam and its islands. The ingredients used to produce *Nuoc mam* are marine fishes and salt. The latter is mixed to the fish and the mixture left to ferment for a period of six to twelve months. The finished product is a liquid that has a light or reddish brown color depending on the method used during its production. Fish sauce also possesses a clear and distinct flavor. Fish sauce is produced for domestic consumption and export.

GMP FOR SELECTED TPE



Brunei Darussalam

Product Name

Tiny shrimp paste – *Belacan*

Product Description

Shrimp paste is a traditional product that is commonly used in Brunei Darussalam as a condiment or an ingredient in many dishes, particularly that of vegetable dishes. It is a semi-fermented/ cured shrimp product in paste form.

The tiny shrimp *Acetes spp.* is first washed and sorted. After that, the shrimp is mixed with salt and stored for 8 to 10 hours before it is being dried in the sun for 7 to 9 hours, depending on the product and the heat of the sun. After drying the shrimp is put in a grinder machine before being pounded into a paste. Lastly, shaping or forming is done and the product is packaged according to market requirements.

Process Flow Diagram



Outline of Processing Steps

1. Receipt of Raw Materials

a. Receipt of *Acetes spp.* shrimps

Fresh shrimps are received from fishermen in plastic containers. The shrimps is preserved with ice at low temperatures not exceeding 5°C.

b. Receipt of Salt

The salt used must be of food grade.

2. Washing and Sorting

The shrimps are placed in a plastic container or in a basket with small holes to allow for water to drain through it. The shrimps are then washed with portable water and sorted before further processing.



Figure 1A & 1B
Washing and Sorting of *Acetes*

3. Mixing with Salt

Salt is added and mixed thoroughly with the shrimps.



Figure 2
Mixing with salt

4. Curing Overnight

After mixing with salt, the shrimps are placed in a container with small holes at its bottom and left overnight to allow for fermentation to take place. The purpose of this step is to preserve the taste of the shrimps.



Placed in container with small holes



Cured overnight
to preserve the
taste

Figure 3A & 3B

5. Sun Drying

The semi-fermented/cured shrimps are covered with plastic nets and left out in the sun to dry for 7 to 9 hours.



Figure 4A & 4B
Sun drying

6. Grinding and Pounding

After the drying process, the shrimps are put into the grinding machine. The ground shrimps are then pounded into a paste using a traditional pounding equipment called *lesung*.



Figure 5A & 5B
Grinding and Pounding

7. Forming/Shaping, Packing and Storage

The shrimp paste is then moulded manually into the required shapes and sizes and packaged in food grade plastic bags or plastic containers. These bags or containers of shrimp paste are then stored refrigerated (5°C or less) or frozen (-18°C or less) before being sold to the customers.



Forming



Packing



Storage in Freezer



Storage in Chiller

Figure 6A, 6B, 6C & 6D



GMP for Shrimp Paste (*Belacan*)

Section 1 Receipt of Raw Materials

GMP 1A.1 Receipt of Ice

Ice should be contained and transported in clean and well-designed containers.

Reason

Ice contained and transported in dirty and unsanitary containers will become a source of contamination.

Compliance

1. Ice containers must be made from non-corrodible materials, which are durable and easy to clean.
2. Ice containers must have tight fitting covers that are not damaged.
3. Shipments of ice delivered in unsanitary containers will be rejected and returned to the supplier.

GMP 1A.2 Manufacture of Ice

Ice must be manufactured using from potable water from approved sources.

Reason

Ice that comes into direct contact with the product during processing must be produced in a manner that reduces the possibility of contamination with bacteria or toxic substances. This will in turn reduce possibility of contamination of the final product.

Compliance

1. The ice used must be manufactured using approved portable water.

GMP 1B.1 Receipt of Shrimp

The condition and quality of the shrimp should be evaluated on receipt. Documentation and records on the condition and quality of the shrimp should be maintained and stored properly.

Reason

The condition and quality of the shrimp should be evaluated to ensure that tainted, decomposed or unwholesome shrimp are not used for processing. Records should be kept to identify specific lots in case the final product fails to meet specifications.

Compliance

1. The following details of the shipment are recorded and kept:
 - a. Date of receipt from supplier
 - b. Name and address of supplier
 - c. Name of transport
 - d. Date of catch
 - e. Average temperature of shrimp upon receipt
 - f. Quality of the shrimp
2. The requirements for the quality of the shrimp are as follows:
 - a. Freshness
 - b. Natural smell, with no off-odors

GMP 1B.2 Handling of Shrimp

Raw shrimps are to be stored in suitable containers at low temperatures.

Reason

Storage of raw shrimps at low temperatures reduces bacterial growth rate and also slows down many of the enzymatic reactions involved in spoilage.



Compliance

1. Shrimps are stored at low temperatures by refrigeration or chilling with water and ice.
2. Shrimps should be kept at temperatures not exceeding 5°C at all times.

GMP 1C.1 Receipt of Salt

The supplier must provide certification to prove that the salt is of food grade standard and has conformed to safety and quality requirements. Packaging of the salt must also be intact and undamaged.

Reason

Contaminated salt can affect the quality of the finished product. Salt produced from marine sources may contain halophilic bacteria, which may continue to live in the salt and the subsequent salted *acetes*.

In order to minimize other forms of microbial contamination, salt with damaged packaging material should be rejected. Damaged packaging will not provide the desired protection to the salt and may lead to contamination from by micro-organisms, insects, chemicals and foreign extraneous materials. The packaging should have clear labels to help in the identification of them salt thus ensuring that the correct ingredient is used.

Compliance

1. Only food grade salt with appropriate certification should be accepted and used.
2. Salt in damaged packaging without proper labelling should not be accepted for use in processing.

3. Labels should include the following information:
 - a. Name of ingredient
 - b. Name of manufacturer or importer
 - c. Country of origin
 - d. Expiry date/use by date

GMP 1C.2 Storage of Salt

Boxes or bags of salt should be stored above ground level in a specially assigned clean and dry room. They should be stored in a neat and tidy manner.

Reason

Storage of salt in an open area in a haphazard manner may result in contamination by extraneous materials such as microorganism, insects, chemicals and foreign materials (e.g. dust, dirt, sand etc). It might also lead to the deterioration of the quality of the salt.

Compliance

1. A clean and dry room that is insect free must be provided for the storage of salt. This room should be designed and construct to:
 - i. Permit adequate maintenance and cleaning
 - ii. Avoid pest access and harbourage
 - iii. Enable minimal likelihood of contamination
2. Proper non-wooden shelving racks should be put in place for storing of the salt above ground level.
3. Salt that has been removed from their packaging should be stored in clean and dry containers with proper covers and labels
4. Salt must be used on a First-In-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule. Salt used should not be beyond their expiry/used by date.



Section 2 Washing and Sorting

GMP 2.1 Washing and Sorting

The raw shrimps should be washed using chilled water from approved potable water sources and sorted out from unwanted foreign materials.

Reason

The purpose of washing is to minimize contamination by removing all extraneous foreign materials. The use of approved potable water sources will prevent possible contamination of the product during the washing process. Using chilled water will prevent or reduce microbial growth during the washing process.

Compliance

1. The water used must be from an approved potable source.
2. The temperature of the water should be maintained at below 5°C by refrigeration or with the addition of ice.
3. Washing containers or tanks should be made of non-corrodible materials and designed properly to allow for a constant change of water with good circulation that allows the drainage of excess water.

Section 3 Mixing with Salt

GMP 3.1 Mixing with Salt

Mixing should be carried out hygienically in a cool and clean area at low temperatures. Shrimps should not be placed directly on the floor or in direct contact with the walls. The amount of salt, time and temperature should be carefully controlled to attain the desired product.

Reason

Mixing with salt should be carried out hygienically in clean containers at low temperatures to prevent contamination and help control the growth of microorganisms such as halophilic bacteria and moulds.

Compliance

1. Mixing with salt should be carried out in a clean and properly sanitized area at low temperatures below 10°C.
2. All workers must observe good personal hygiene practices.
3. Utensils and containers used for mixing must be properly sanitized before and after use.
4. Utensils and containers used must be constructed from food grade materials and free from corrosion.



Section 4 Curing Overnight

GMP4.1 Curing Overnight

Curing should be carried out a cool and clean room at low temperatures.

Reason

The careful control of temperature and environment is necessary to prevent

contamination and reduce growth of microorganisms.

Compliance

1. Curing should be carried out in a clean and properly sanitized area at low temperatures below 10°C.

Section 5 Sun Drying

GMP 5.1 Sun Drying

The sun drying should be carried out in a clean environment and protected from contamination. Shrimps should not be placed directly on the floor.

Reason

The careful control of the environment is necessary to prevent contamination and reduce growth of microorganisms.

Compliance

1. The processing area should be free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The shrimps should be covered with custom-designed nets for drying.
3. All utensils, containers and materials used must be easy to clean and of food grade.

Section 6 Grinding and Pounding

GMP 6.1 Grinding and Pounding

Grinding and pounding of the shrimps into a paste should be carried out in a clean environment and as quickly as possible.

Reason

The careful control of the environment is necessary to prevent contamination and reduce growth of microorganisms. The process should be carried out quickly to maintain the product quality.

Compliance

1. The processing area should be free from pest such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The traditional pounding equipment used should be made of suitable materials that are easy to clean and maintain.



Section 7 Forming/Shaping, Packing and Storage

GMP 7.1 Forming/Shaping, Packing

The shrimp paste should be formed/shaped and packed as quickly as possible into clean food grade plastic bags or suitable plastic containers.

Reason

The process should be carried out quickly to maintain the product quality. Packaging materials are designed to preserve the quality of the product and to protect the product against mechanical damage, dust, dirt, other extraneous foreign materials, insects and microbial contamination.

Compliance

1. Plastic bags or plastic containers used in packing should be clean and of food grade.
2. All workers must observe good personal hygiene practices.

GMP 7.2 Storage

The shrimp paste should be properly stored at low temperatures.

Reason

Storage at low temperatures will extend the shelf-life of the product.

Compliance

1. The shrimp paste should be stored refrigerated (10°C and below) or frozen (-18°C and below).



Indonesia

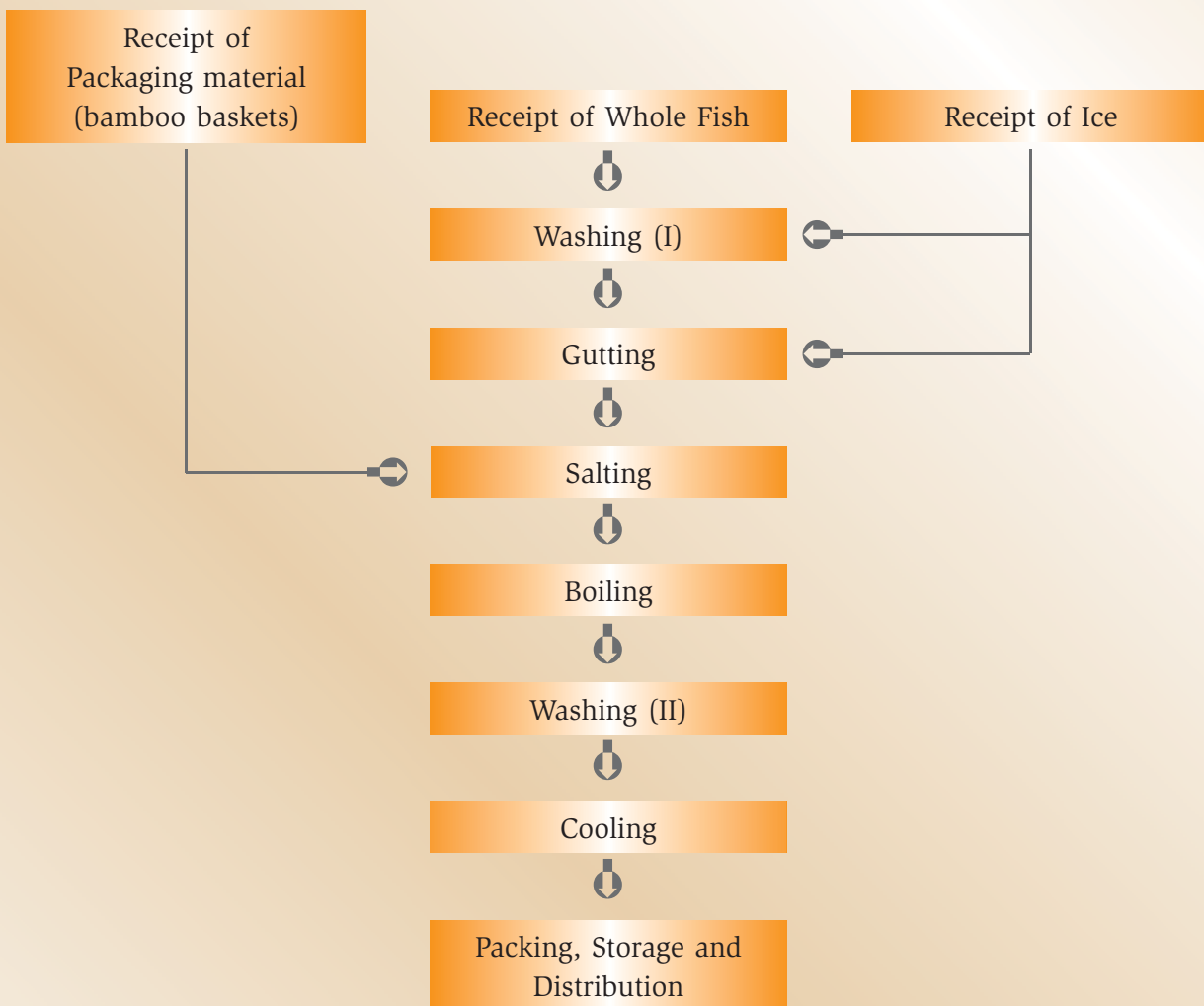
Product Name

Salted Boiled Fish – *Pindang*

Product Description

Pindang is a traditional salted boiled fish product in Indonesia. *Pindang* plays an important role in the staple diet of the local population due to its low cost and high nutritional value particularly that of proteins. Fresh whole fish is washed, gutted, salted and boiled in brine to make the product. The production of *Pindang* is mainly in the Java Island and largely meant for local consumption. The export volume is almost negligible.

Process Flow Diagram



Outline of Processing Steps

1. Receipt of Raw materials

a) Receipt of Ice

Ice functions as a cooling agent during the washing of the raw fish. It reduces the temperature of the water to a temperature not exceeding that of 5°C. Ice is transported to the pre-processing establishments in clean and well-designed containers, which are made of non-corrodible materials and are handled in a sanitary manner so as to prevent any contamination from occurring.

b) Receipt of Packaging material

Bamboo baskets or containers are the traditional packaging materials used in the packaging of the salted boiled fish for storage and distribution.

c) Receipt of Salt

Food grade salt is used as an ingredient for the salting of the fish. Salt is added in between the layers of fish and also into the boiling water (brine).

d) Receipt of Whole Fish

Every shipment of raw whole fish should be recorded and evaluated for its organoleptic quality to ensure that the fishes are safe and suitable for processing. Fish is preserved at low temperatures not exceeding 5°C using ice.



Figure 1
Receipt of Whole Fish

2. Washing (I)

The fishes are washed in clean and potable iced water before they are further processed. This can be done in batches and ice is added to lower the temperature of the water.



Figure 2
Washing of fish

3. Gutting

This step will remove all the contents of the gut cavity or belly cavity of the fish. This step is usually performed manually.

4. Salting

In this step, the fishes, together with salt, are arranged in bamboo baskets and salt (15 - 25% of fish weight) is added in between the layers of fish.



Figure 3
Salting of fish

5. Boiling

The fishes are boiled by immersing the bamboo basket containing the salted fish into the boiling brine water (20 – 25% salt) for 15 to 30 minutes.



Figure 4
Boiling of salted fish

8. Packing, Storage and Distribution

Pindang is packed in packaging materials made from bamboo (bamboo baskets/ cartons) and stored at room temperature prior to distribution.



Figure 6
Pindang packed in bamboo cartons

6. Washing (II)

Salted boiled fish are washed with hot brine water.

7. Cooling

Each basket of salted boiled fish is drained and cooled on the shelves in air.



Figure 5
Cooling of salted boiled fish

GMP for Salted Boiled Fish (*Pindang*)

Section 1 Receipt of Raw Materials

GMP 1A.1 Receipt of Ice

Ice should be contained and transported in clean and well-designed containers.

Reason

Ice contained and transported in dirty and unsanitary containers will become a source of contamination.

Compliance

1. Ice containers must be made from non-corrodible materials, which are durable and easy to clean.
2. Ice containers must have tight fitting covers that are not damaged.
3. Shipments of ice delivered in unsanitary containers will be rejected and returned to the supplier.

GMP 1A.2 Manufacture of Ice

Ice must be manufactured using potable water from approved sources.

Reason

Ice that comes into direct contact with the product during processing must be produced in a manner that reduces the possibility of contamination with bacteria or toxic substance. This will in turn reduce possibility of contamination of the final product.

Compliance

1. The ice used must be manufactured using approved portable water.

GMP1B.1 Receipt of Packaging Materials

Packaging made of bamboo (bamboo cartons) that are dirty and/or damaged should be rejected/refused.

Reason

Dirty and damaged packaging material will not provide the necessary protection against contamination and may itself become a source of contamination.

Compliance

Dirty or damaged packaging materials should be rejected and refused entry into the plant so as to present no risk of contamination to the other packaging materials.

GMP1B.2 Storage of Packaging Materials

Packaging materials (bamboo cartons) that are intended to contain the final product should be kept clean and safe for their intended use through storage under proper conditions.

Reason

Packaging materials have an important function of protecting the finished products from contamination. Damaged packaging materials will not provide the desired protection and dirty packaging materials may contaminate the product.

Compliance

1. Packaging materials used shall be kept in clean and hygienic conditions.

2. A clean and dry room that is insect-free shall be provided for the storage of packaging material. The storage room should be designed and constructed to:
 - a. Permit adequate maintenance and cleaning,
 - b. Avoid pest access and harbourage; and
 - c. Enable minimal likelihood from contamination by locating the storage room for packaging materials away from areas where raw or food products are handled.
3. Proper shelving rack shall be put in place for the storage of the packaging materials away from the ground.
4. Packaging materials shall be used on a First-In-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule.

GMP 1C.1 Receipt of Salt

A certification from the salt supplier should be provided for every shipment of salt to indicate that the salt has conformed to the safety and quality requirements (i.e. microbial limit, free from any physical contaminants). This must be done before the salt is accepted for use in the processing plant. Salt as an ingredient in the final product needs to be of food grade.

Every shipment of salt should also have their packaging intact and undamaged upon receipt and with proper labels.

Reason

Contaminated salt can affect the quality of the finished product. Salt produced from marine sources may contain *halophilic* bacteria, which continues to live in the salt and salted fish. In order to minimise such microbial contamination in salted fish, used and/or contaminated salt should be removed from the plant.

Damaged packaging will not provide the desired protection and may lead to contamination by extraneous materials such as microorganisms, insects, chemical and foreign materials (dust, dirt, sand etc). Clear labelling would help in their identification thus ensuring that the correct ingredient is used.

Compliance

1. Only salt shipments with the appropriate certification should be accepted for use in the plant.
2. Salt in badly damaged packaging without proper labelling should not be accepted for use in processing.

GMP 1C.2 Storage of Salt

Bags of salt should be stored above ground level in a neat and tidy manner in a specifically assigned clean and dry room.

Reason

Storage of salt in an open area in a haphazard manner will result in contamination by extraneous materials such as microorganisms, insects, chemicals and foreign materials (e.g. dust, dirt, sand etc) as well as deterioration in the quality of the salt.

Compliance

1. A clean and dry room that is insect-free must be provided for the storage of salt. It should be designed and constructed to:
 - a. Permit adequate maintenance and cleaning
 - b. Avoid pest access and harborage
 - c. Enable minimal likelihood from contamination
2. Proper non-wooden shelving racks should be put in place for the storage of salt away from the floor.
3. Salt that have been removed from its packaging should be stored in clean and dry containers with proper covers and labels.



4. Salt must be used in a First-in-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule. Salt should not be used beyond their expiry/use-by date.

GMP1D.1 Receipt of Whole Fish

Every incoming shipment of unprocessed whole fish should be evaluated for condition and quality. The condition of fish should be noted on receipt. Documented records of the quality received should be maintained and properly kept.

Reason

The incoming shipment of raw materials should be evaluated to ensure that no tainted, decomposed, or unwholesome fish is utilised for further processing. Records are documented in order to identify lots that may not meet specifications.

Compliance

1. The following details are recorded and maintained:
 - a. Species name
 - b. Date of receipt of shipment
 - c. Name and address of supplier
 - d. Name of delivery vessel or transport company
 - e. Date of harvest
 - f. Average temperatures of the fish upon receipt
 - g. Quality in the shipment
2. The following quality parameters should be evaluated:
 - a. Odour :
Presence of stale odour associated with taint or decomposition.

- b. Belly cavity :
Presence of burns through to skins or breakdown of belly wall.
- c. Physical damage :
Presence of splitting or mutilation of the fish.
- d. Texture :
Presence of soft and mushy texture.
- e. Eyes :
Presence of sunken, dull white or red eye or centre of eye liquefied.
- f. Gills :
Presence of uncharacteristic and stale odours associated with taint or decomposition. Presence of dark brown to yellow brown or white-yellow colour and slimy appearance of gills.

Lots with the presence of these observations should be rejected.

GMP 1D.2 Handling of Whole fish

Whole fish are to be stored in suitable containers at temperatures not exceeding 5°C.

Reason

Storage of whole fish at low temperatures slows down the rate of bacterial growth and also the enzymatic reactions involved in spoilage.

Compliance

1. Whole fish are stored at low temperatures achieved through refrigeration or by cooling with ice.
2. Whole fish should be kept at a temperature not exceeding 5°C at all times.

Section 2 Washing (I)

GMP 2.1 – Washing

The whole fish should be washed using chilled or iced water from an approved, potable water supply.

Reason

The purpose of washing is to minimise the possibility of contamination by removing any foreign materials. The use of approved potable water will prevent contamination to the product. At low temperatures, bacterial growth is reduced.

Compliance

1. The water used must be from an approved potable source.
2. The temperature of the water is maintained below 5°C by refrigeration or with the addition of ice.
3. Washing containers or tanks should be made of non-corrodible materials and designed to provide a constant change of water with a good circulation system that permits drainage. It has to also be easily cleaned.

Section 3 Gutting

GMP 3.1 Gutting

The fishes are gutted to remove the gut contents. They are then washed in an approved, portable water supply to remove all remnant guts, blood and organs from their belly cavity.

Reason

Remaining guts, blood and organs from the belly cavities of the fishes can be a source of contamination for the fishes. The use of

approved potable water supply will prevent contamination to the product. Proper disposal of waste is important to prevent cross-contamination.

Compliance

1. The equipment and utensils used should be made of non-corrodible materials that are easy to clean and sanitize.
2. Waste should be collected in covered pedal-operated bins, which are removed and emptied regularly.

Section 4 Salting

GMP 4.1 Salting

Arrangement of the fish in bamboo baskets and salting should be done as quickly as possible under sanitary conditions. Salt is added in between the layers of fish and spread on the fish surface to prevent the skin from peeling during boiling.

Reason

Arranging and salting of fish into the bamboo

basket is a slow process that will make temperature abuse of fish more likely. This will thus speed up bacteria growth rate. Therefore, this process has to be completed as quickly as possible to reduce microbial growth and spoilage.

In addition to that, humans can be a source of contamination, thus there should be strong emphasis on good personal hygiene practices.



Compliance

1. The fishes are arranged into the bamboo quickly and salting in between the layers are carried out under sanitary conditions.
2. The bamboo baskets used is easy to clean and sanitize. If the bamboo used is accompanied by the presence of other materials, those materials should be easy to remove from the bamboo or should be easy to clean.
3. The personal hygiene of workers is well maintained and monitored accordingly. All workers should comply with good personal hygiene practices.

Section 5 Boiling

GMP 5.1 Boiling

The fishes are boiled by immersing neatly arranged bamboo baskets into boiling brine. The concentration of brine used is 20-25 % of salt. The brine is heated to a boil before the bamboo baskets are placed inside it to boil for 30 minutes. The boiling time may vary according to the size of the fish.

Reason

The brine is heated to a boil prior to the immersing of the bamboo baskets of fish. This is done to accelerate the cooking of the fishes so that the fishes are not immersed for prolonged periods of time in boiling brine. The formula concentration of salt in water

and the period of boiling are very important parameters to control in order to reduce microbial growth and to preserve the taste of fish.

Compliance

1. The brine is first brought up to a boil before the fishes in bamboo baskets are added.
2. The concentration of brine used contains 20-25 % of salt; this is to reduce microbial growth and to keep the taste of fish.
3. The time allocated for the boiling of the fishes is approximately 30 minutes. This time may vary according to the size of the fishes.

Section 6 Washing (II)

GMP 6.1 Washing

The boiled salted fish are then washed in hot brine to remove all foreign materials.

Reason

The purpose of washing (II) after the boiling process is to remove any foreign materials. Hot brine water is used to prevent contamination to the products.

Compliance

1. Washing (II) is carried out using hot brine water to minimise the possibility contaminant.
2. The hot brine water must be made from potable water.

Section 7 Cooling

GMP 7.1 Cooling

Each bamboo basket of salted boiled fish is drained and cooled on the shelves under ambient room temperature and sanitary conditions.

Reason

After boiling, the hot salted boiled fishes should be drained or cooled in order to minimize the possibility of fungus growth.

Compliance

1. The cooling step is carried out in an area or room that is clean and properly maintained.
2. The hot salted boiled fish must be cooled to minimize the possibility of growth of fungus.

Section 8 Packing, Storage and Distribution

GMP 8.1 Packing, storage and distribution

Salted boiled fishes are packed into bamboo cartons and stored at ambient temperatures under sanitary conditions prior to distribution. However, the storage should not be for prolonged periods of time.

Reason

Holding of salted boiled fish for prolonged periods of time prior to distribution will cause deterioration in the quality of the product.

Compliance

1. Packing and storage should be carried out in a clean and enclosed area or room.
2. Workers should observe good personal hygienic practices.
3. Each bamboo pack of salted boiled product should be labeled with the following information:
 - a. Species name
 - b. Date of production
 - c. Name and address of processor
3. Distribution vehicles should be maintained in a clean and sanitary condition.



Lao People Democratic Republic

Product Name

Dried Fish – *Pa heang*

Product Description

Dried fish or *Pa heang*, as it is known locally, are produced in the following procedure. The freshwater fishes are first washed then gutted and washed again before being mixed with seasoning. The seasoned fishes are then dried under the sun and smoked. The completed *Pa heang* are hung on bamboo strings and sold in the markets.

Process Flow Diagram



Outline of Processing Steps

1. Receipt of Whole Fish

Fresh fishes are purchased daily from the local fishermen. The same suppliers are used to ensure consistency in fish quality. The fishes are delivered twice a day – once at about 9 am in the morning and the second time at approximately 3-4 pm in the afternoon. Prior to being delivered to the TPE, the fishes are kept on the fishing boat for approximately two hours. In these two hours, the fishermen keep the fish cool by storing them in iceboxes and ice sacks. The ice used by the fishermen is provided by the TPE. It is purchased from an ice – producing company in Huamo Village. This ice is delivered every afternoon.

The fishes purchased in the morning are processed within the same day. The fishes purchased in the afternoon are kept in insulated boxes until the next day.



Figure 1
Insulated boxes with whole fish in ice

2. Washing

The fishes are washed in clean tap water before being further processed. This is usually be done in batches.



Figure 2
Washing the fish with clean tap water

3. Gutting

In this step, the internal organs of the fishes are removed from their belly cavities. The fishes are cut open from their spinal fins to their tails and all their gut contents are removed. This step is usually performed manually. The gutted fishes are then washed in clean water.



Figure 3
Gutting of the whole fish



Figure 4
Washing of the fish after gutting



Figure 5
Gutted and washed fish

4. Drying/Smoking

The fish is dried by smoking. The gutted fishes are arranged on a bamboo net and smoked for approximately 6-8 hours before they are ready for selling.



Figure 6
Fish drying/smoking



Figure 7
Dried Fish, Pa heang

5. Packing

As the dried fishes are hung on strings for sale in the traditional markets, no additional packaging is required.



Figure 8
Dried fish hung on string for sale



GMP for Dried Fish (*Pa heang*)

Section 1 Receipt of Raw Materials

GMP 1A.1 Receipt of Ice

Ice should be contained and transported in clean and well-designed containers.

Reason

Ice contained and transported in dirty and unsanitary containers will become a source of contamination.

Compliance

1. Ice containers must be made from non-corrodible materials, which are durable and easy to clean.
2. Ice containers must have tight fitting covers that are not damaged.
3. Shipments of ice delivered in unsanitary containers will be rejected and returned to the supplier.

GMP 1A.2 Manufacture of Ice

Ice must be manufactured using from potable water from approved sources.

Reason

Ice that comes into direct contact with the product during processing must be produced in a manner that reduces the possibility of contamination with bacteria or toxic substances. This will in turn reduce possibility of contamination of the final product.

Compliance

1. The ice used must be manufactured using approved portable water.

GMP 1B.1 Receipt of Whole Fish

Every incoming shipment of unprocessed whole fish should be evaluated for condition and quality. The condition of fish should be noted on receipt. Documented records on the quality received should be maintained and properly kept.

Reason

The incoming shipment of raw materials should be evaluated to ensure that no tainted, decomposed, or unwholesome fish is utilised for further processing. Records are documented in order to identify lots that may not meet specifications.

Compliance

Before accepting each lot of fishes, checks on the underside of the fishes are conducted to ensure that the fishes are fresh. In order to be determined fresh, the fishes have to be totally white on its stomach. Spoilt fishes have red spots under their skin. The fishes should be evaluated for their organoleptic quality to ensure that they are safe and suitable for processing.

Section 2 Washing

GMP 2.1 Washing

The whole fish should be washed using chilled or iced water from an approved, potable water supply.

Reason

The purpose of washing is to minimise the possibility of contamination by removing any foreign materials. The use of approved potable water will prevent contamination of the product. At low temperatures, bacterial growth is reduced.

Compliance

1. The water used must be from an approved potable source.
2. The temperature of the water is maintained below 5°C by refrigeration or with the addition of ice.
3. Washing containers or tanks should be made of non-corrodible materials and designed to provide a constant change of water with a good circulation system that permits drainage. It has to also be easily cleaned.

Section 3 Gutting

GMP 3.1 Gutting

The fishes are gutted to remove their gut contents. They are then washed in an approved, portable water supply to remove all remnant guts, blood and organs from their belly cavity.

Reason

Remaining guts, blood and organs belly cavity can be a source of contamination to the fish. The use of approved potable water supply will

prevent contamination of the product. Proper disposal of waste is important to prevent cross-contamination.

Compliance

1. The equipment and utensils used should be made of non-corrodible materials that are easy to clean and sanitize.
2. Waste should be collected in covered pedal-operated bins, which are removed and emptied regularly.

Section 4 Drying/Smoking

GMP 4.1 Drying/Smoking

The drying by smoking should be carried out in a clean environment and protected from contamination. Fishes should not be placed directly on the floor.

Reason

The careful control of the environment is necessary to prevent contamination and reduce spoilage of the product.

Compliance

1. The drying/smoking area should be free from pest such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. All utensils, containers and materials used must be easy to clean and well maintained.

Malaysia

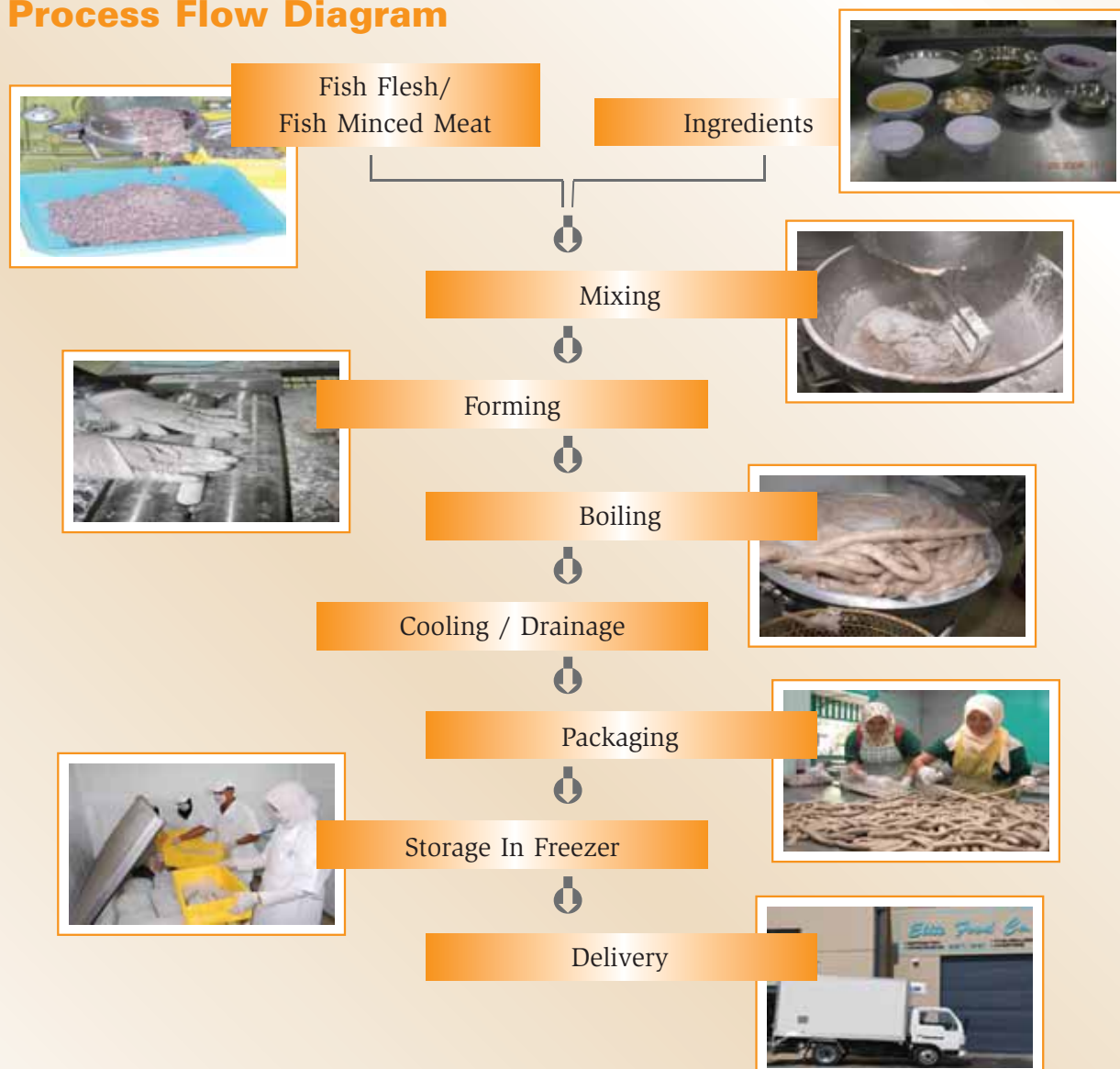
Product Name

Fish cracker – *Keropok lekor*

Product Description

Keropok lekor or *Keropok batang* is a traditional Malaysian fish product that is popular amongst the Malay community especially in the east coast of Peninsular Malaysia particularly in the states of Trengganu, Kelantan and Pahang. *Keropok lekor* is a popular snack food which has become widely accepted not only amongst the Malay community but also amongst all other races in Malaysia. *Keropok lekor* is a tube-shaped product and resembles sausages but is usually cut or sliced into smaller and shorter pieces. It is made of fish, flour, salt and other ingredients and can be deep fried to make it crispier. It can be eaten alone or with local chilli sauce or dip.

Process Flow Diagram



GMP for Fish Cracker (*keropok lekor*)

Section 1 Raw Materials

GMP 1.1 Receipt of Raw Materials

To ensure the quality and safety of the raw materials received, each shipment of fish flesh/fish minced meat and other raw materials are ordered only from registered suppliers with quality guarantee. All raw material quality assurance records should be recorded neatly and orderly.

Reason

The quality of the final product is heavily dependent on the quality of the raw materials. Therefore, in order to ensure the quality of each delivered shipment, the fish flesh/fish minced meat and raw material should be inspected and graded to ensure that they conform to the specifications. The inspection process is also important to ensure that the raw materials have gone through good handling practices during the receiving process.

Compliance

1. Selection is conducted on each batch of raw material received.
2. Non-conforming raw materials are rejected.
3. Records are maintained for a minimum of three (3) years. The records should contain the following information:
 - a) Species of fish
 - b) Date of catch
 - c) Nature of raw material
 - d) Delivery date
 - e) Name and address of supplier
 - f) Name of Delivery Company.
 - g) Average temperature of raw material received
 - h) Quality of load/shipment.
 - i) Percentage of non-conforming raw material, which have been rejected.

GMP 1.2 Storage of Wet Raw Materials

All wet raw materials received should be stored in suitable conditions in order to adhere to good handling practices. Frozen raw materials such as fish flesh must be stored at temperatures not exceeding -18°C while chilled raw materials at temperatures not exceeding 5°C.

Reason

Wet raw materials received should be stored at suitable temperatures to maintain their quality and to minimize the growth of bacteria. Stainless steel trays and HDPE boxes are used as handling mediums for the raw materials. The freezer or chiller must be functioning properly and the temperatures should be monitored.

Compliance

1. The raw materials received that are not used immediately are stored properly pending usage.
2. The equipment used in the handling of the raw materials is free from contamination.
3. The temperature of the raw materials is maintained at temperatures not exceeding 5°C (chilled) or -18°C (frozen).

GMP 1.3 Storage of Dry Raw Materials

Dry raw materials like flour, salt, sugar, sodium bicarbonate, monosodium glutamate (MSG) etc. must be kept in a special store at ambient temperature to prevent them from spoilage and also to avoid cross contamination.

Reason

Dry raw materials should be stored at ambient temperature to maintain their quality. Airtight HDPE containers are used as handling mediums. The dry raw materials should be kept in a clean store. The store must also be kept in functioning order complete with HDPE pallets.

Compliance

1. The raw materials received that are not used immediately are stored properly pending usage.
2. The equipment used in the handling of raw materials is free from contamination.

GMP 1.4 Usage of Raw Materials

When using dry raw materials in the store, the First In First Out (FIFO) principle should be applied.

Reason

The FIFO principle can help ensure that raw material usage is in order. In addition to that, it can also prevent the usage of raw materials beyond their expiry date.

Compliance

1. Raw materials with the closest expiry date are used first.
2. Proper and accurate inventories and records of raw material usage are kept.

Section 2 Processing (Mixing, Forming, Boiling, Cooling/Drainage)

GMP 2.1 Mixing

The mixing machine used during the mixing process is made entirely of stainless steel. Before using the machine, it is essential to clean it using approved chemicals. After the cleaning process, the machine must go through a rinsing process using potable water that has been approved by the government. The mixing process should be done according to the designated formula.

Reason

The best material to use in the production of quality and safe products is stainless steel as it can be easily washed and is rust resistant. Standard operating procedures and designated formula are being adhered to to ensure that all the products produced are made through similar processes.

Compliance

1. The mixing process is done according to the designated formula.

2. The machine/equipment is cleaned before and after the mixing process.
3. The source of water and ice used is approved as safe for human consumption by the government.

GMP 2.2 Forming

The forming process should be done either using manual, semi-auto or fully automatic methods depending on the availability of operating equipment. All equipment that is involved in the forming process should be made of stainless steel and must be cleaned before and after used. Workers who are involved in the forming process must wash their hands using bactericidal soap. In addition to that, they must also wear non-toxic rubber gloves.

The manual process of forming the dough should be done on stainless steel tables using hands. In the semi-auto method, a blender machine is used to form the dough. Finally, in the fully automatic process, a conveyer-



forming machine is used in the forming process. After the forming process, the dough is arranged on stainless steel trays.

Reason

Stainless steel machines are rust-resistant and easy to clean. Workers who are involved in the manual process must wash their hands and wear rubber gloves to avoid cross contamination. In addition to that, they must also follow good personal hygiene.

Compliance

1. The forming process is done using the manual, semi-automatic or fully automatic method.
2. Cleaning is done after completing every load.
3. Workers who are involved in the forming process wash their hands and change their gloves each time they proceed to a different processing procedure.

GMP 2.3 Boiling

The boiling process should be done using water that must be maintained at 100°C at all times. The boiler machine must be made from stainless steel. This process must be done using potable water that has been approved by the government. Water temperature must be recorded at suitable frequencies. The recommended boiling time for each batch is 30 minutes. After completing each batch, the water must be changed to ensure the quality.

Reason

Stainless steel machines are rust-resistant and easy to clean. During the boiling process, the water temperature must be maintained at 100°C to ensure that the bacteria is eliminated. This process can also increase the strength of the dough binding thus preventing easy spoilage. The recommended boiling time for each batch is 30 minutes so that the heat can be absorbed into the middle part of the dough that has been formed.

Compliance

1. Boiling is carried out at 100°C for at least 30 minutes.

GMP 2.4 Cooling/Drainage

The cooling/drainage process can be carried out on a stainless steel drainage table. This method allows the dough to cool by itself at room temperature or by using fan. The Cooling/Drainage room must be closed and separated from the other rooms. All workers must observe good hygienic practices.

Reason

The stainless steel drainage table is rust-resistant and easy to clean. The purpose of using a drainage table is to ensure that the excess boiling water can flow smoothly without causing any damage to the finished products.

Compliance

1. The process is carried out as quickly as possible in a clean room.
2. Stainless steel table(s) and gloves are used.

Section 3 Packing

GMP 3.1 Packing

Packing of products should be done immediately after the cooling/drainage. In addition to that, the labelling on the packaging must provide information on the storage and handling of the product

Reason

Packing should be carried out in a separate room from raw materials and semi-processed products to prevent cross contamination. Good packaging is essential to ensure the quality of products and to extend the shelf-life of the product.

Compliance

1. Packing of finished products should be carried out quickly and with minimal delay to minimize any possibility of cross-contamination and microbial growth.
2. Products should be packed on stainless steel tables.
3. Staff should be properly attired with clean uniforms, disposable head covers, facial masks and hand gloves to pack the finished products.
4. New, clean packaging materials should always be used.

Section 4 Storage

GMP 4.1 Storage

Finished products should be stored, chilled or frozen.

Reason

Finished products should be stored, chilled or frozen to ensure the quality of the product and to lengthen its shelf life.

Compliance

1. Chilled products are stored at temperatures not exceeding 5°C.
2. Frozen products are stored at temperatures not exceeding -18°C.

Section 5 Delivery

GMP 5.1 Delivery

Finished products should be handled properly during delivery.

Reason

Proper handling during delivery will prevent cross contamination and product deterioration by temperature abuse or improper handling practices.

Compliance

1. Products should not be left in the open

at ambient temperatures for prolonged periods during loading/delivery. They should be left in the cold ante-room.

2. Chilled products should be transported in refrigerated vehicles at temperatures not exceeding 5°C.
3. Frozen products should be transported in freezer vehicles at temperatures not exceeding -18°C.
4. Temperature recorders should be available on all delivery vehicles.

Myanmar

Product Name

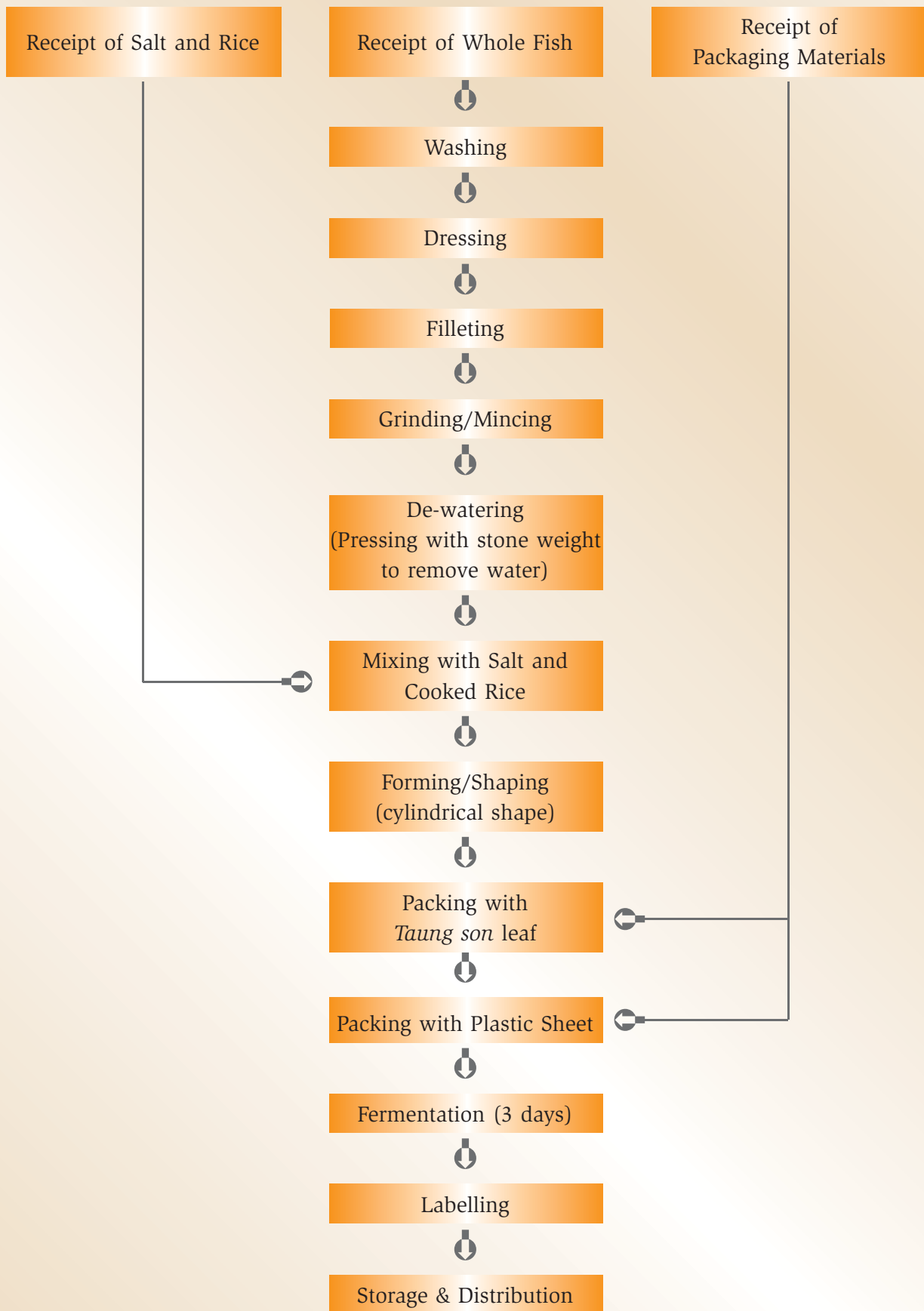
Fermented fish – *Ngachin*

Product Description

Fermented fish or *Ngachin*, as it is called locally, is a traditional fermented fish product of Myanmar. The main raw materials for *Ngachin* are fish, salt and rice. This product is produced through the salting and fermentation of the fish. At room temperature, *Ngachin* has a shelf life of about a week. However, if it is refrigerated, its shelf life can be extended up to a month. *Ngachin* is considered a delicacy in Myanmar and when it is ripened it has a sour taste.



Process Flow Diagram



Outline of Processing Steps

1. Receipt of Raw Materials

a. Receipt of Fish

Every lot of fish received is recorded and evaluated for organoleptic parameters to ensure that they are safe and of good quality.

b. Receipt of Salt

Every lot of salt received is recorded and checked for the appropriate documents or certificates attesting to its quality and grade. Packaging of the salt must also be clean, intact and undamaged.

c. Receipt of Rice

Each batch of rice received is recorded and checked for the appropriate documents or certificates attesting to its quality and grade. Packaging of the rice must also be clean, intact and undamaged.

d. Receipt of packaging materials

Every lot of packaging material is recorded and checked to ensure that they are clean and not damaged.

2. Washing, Dressing and Filleting of Fish

The whole fishes are washed thoroughly with water and de-headed. The fishes are then gutted and their scales removed. The fishes are then filleted.

3. Grinding/Mincing

The fish fillets are passed through a grinder/mincer to produce ground/minced fish meat



Figure 1
Grinding/Mincing of fish fillets

4. De-watering

The ground/minced fish meat is wrapped in a clean cloth and de-watering is carried out either by placing a heavy weight (stone) on top to press on it for half an hour to drain off excess water or by using a screw press.



Figure 2
De-watering of ground/minced fish meat using screw press

5. Mixing with Salt and Cooked Rice

The ground/minced fish meat is mixed with cooked rice in the range of 35-65% of the fish weight according to the quality required. The higher the proportion of rice used, the lower the quality of the product. Normally, 1-1.5% of salt is added and the meat is knead by hand. It is important to note that if the fish is fresh, less salt is required.



Figure 3
Mixing with Salt and Cooked Rice

6. Forming/Shaping

The fish and rice mixture is then formed into a cylindrical shape.



Figure 4
Forming into cylindrical shape

7. Packing and Labeling

Products are packed in green leaves (preferably of *Taung-son* or banana or sugar cane) and tied with bamboos strips before being wrapped with plastic sheets and labels.



Figure 5
Packing in Taung-son leaves

8. Fermentation

The packed products are fermented over a period of 3 days in the shade, while protecting the products from flies and insects.



Figure 6
Wrap in plastic sheets and labels



GMP for Fermented Fish (Nga-chin)

Section 1 Receipt of Raw Materials

GMP 1A.1 Receipt of Fish

The condition and quality of the fishes should be evaluated on receipt. Documentation and records on the condition and quality of the fishes should be maintained and stored properly.

Reason

The condition and quality of the fishes should be evaluated to ensure that tainted, decomposed or unwholesome fishes are not used for processing. Records should be kept to identify specific lots in case the final product fails to meet specifications.

Compliance

1. Any lot of fish that is tainted, decomposed or unwholesome should be rejected.
2. The following details are recorded and kept for future reference:
 - Species name
 - Date of receipt of shipment
 - Name and address of supplier
 - Name of delivery vessel of transport company
 - Date of harvest
 - Quality of the fish

GMP 1B.1 Receipt of Salt

The salt supplier should provide a certification for every batch of salt delivered. Only salt that is safe and of good quality is accepted for use in the processing plant. Packaging of the salt must also be intact and undamaged.

Reason

Contaminated salt can affect the quality of the finished product. Damaged packaging will not provide the desired protection to the salt and

may lead to contamination from by microorganisms, insects, chemicals and foreign extraneous materials. The packaging should have clear labels to help in the identification of the salt thus ensuring that the correct ingredient is used.

Compliance

1. Only food grade salt with appropriate certification should be accepted and used
2. Salt in badly damaged packaging and without proper labeling should not be used in the processing.
3. Packaging labels should contain the following information:
 - Name of Ingredient
 - Name of Manufacturer
 - Expiry Date

GMP 1B.2 Storage of Salt

During storage, the bags of salt should not come into contact with the floor. They should be stored in a neat and tidy manner in a specifically assigned clean and dry room.

Reason

Storage of salt in an open area might result in contamination by microorganisms, insects, chemicals and foreign materials.

Compliance

1. An insect free clean and dry room must be provided for the storage of salt.
2. Salt must be used on a first in - first out (FIFO) basis before they reach their expiry date.



GMP 1C.1 Receipt of Rice

The rice supplier should provide a certification for every batch of rice delivered. Only rice that is safe and of good quality is accepted for use in the processing plant. Packaging of the rice must also be intact and undamaged.

Reason

As rice is an important ingredient for this product, contaminated rice can affect the quality and safety of the finished product.

Compliance

1. Rice should be of good quality and should be free from all pesticide residues.
2. Rice in badly damaged packaging and without proper labeling should not be used.

GMP 1D.1 Receipt of packaging materials

All damaged and dirty (moldy) packaging materials (especially *Taung-son* leaves) should be rejected.

Reason

Damaged and dirty packaging materials are unable to protect the food against contamination and may be a source of contamination to the product.

Compliance

1. Damaged and dirty packaging materials should not be used.
2. *Taung-son* leaves should be washed and sanitized before use.

Section 2 Washing, Dressing and Filleting of Fish

GMP 2.1 Washing of Fish

The fish should be washed in clean, potable running water.

Reason

The purpose of washing the fishes is to remove the microbial and physical contamination from the surfaces of the fishes. Only approved water sources should be used to prevent any contamination of the fishes from the washing process. Clean and suitable containers should

also be used to minimize contamination of the fishes.

Compliance

The water used should be potable water. If ground or well water is used, it should be adequately treated and sanitized before it is being used to clean the fishes. The water treatment process should involve filtration and chlorination.



Section 3 Grinding/Mincing

GMP 3.1 Grinding/Mincing

The equipment used in the grinding/mincing process should be kept clean and well maintained.

Reason

Dirty and/or poorly maintained equipment may become a source of contamination to the products.

Compliance

1. The equipment must be thoroughly washed and sanitized at the end of each processing day and as often as necessary.
2. The food-contact surfaces of the equipment must be made of non-toxic materials and should not be corroded or damaged in any way. The food contact surfaces must be smooth and free from crevices.

Section 4 De-watering

GMP 4.1 De-watering

The equipment used in the de-watering process shall be kept clean and well maintained.

Reason

Dirty and/or poorly maintained equipment may become a source of contamination to the products.

Compliance

1. The equipment must be thoroughly washed and sanitized at the end of each processing day and as often as necessary.
2. The food-contact surfaces of the equipment must be made of non-toxic materials and should not be corroded or damaged in any way. The food contact surfaces must be smooth and free from crevices.

Section 5 Mixing with Salt and Cooked Rice

GMP 5.1 Mixing with Salt and Cooked Rice

Mixing of the fish meat, salt and rice should be carried out in clean containers in a hygienic and sanitary manner.

Reason

Mixing should be carried out hygienically in clean containers to prevent contamination and help control the growth of microorganisms.

Compliance

1. All workers must observe good personal hygiene practices.
2. Utensils and containers used for mixing must be properly sanitized before and after use.
3. Utensils and containers used must be constructed from food grade materials and free from corrosion.



Section 6 Forming/Shaping

GMP 6.1 Forming/Shaping

Forming/shaping should be carried out in clean containers in a hygienic and sanitary manner.

Reason

Forming/shaping should be carried out hygienically in clean containers to prevent contamination and help control the growth of microorganisms.

Compliance

1. All workers must observe good personal hygiene practices.
2. Utensils and containers used for mixing must be properly sanitized before and after use.
3. Utensils and containers used must be constructed from food grade materials and free from corrosion.

Section 7 Packing and Labeling

GMP 7.1 Packing with *Taung-son* leaves and plastic sheets

Packing should be carried out with clean *Taung-son* leaves and plastic sheets in a hygienic and sanitary manner.

Reason

Dirty and unclean packaging materials may contaminate the product. Damaged and dirty packaging materials are unable to protect the

food against contamination and may be a source of contamination to the product.

Compliance

1. Only clean and undamaged packaging materials should be used.
2. *Taung-son* leaves should be washed and sanitized before use.
3. All workers must observe good personal hygiene practices.

Section 8 Fermentation

GMP 8.1 Fermentation

The packaged product should be allowed to ferment in a clean environment and protected from contamination. It should not be placed directly on the floor.

Reason

The careful control of the environment is necessary to prevent contamination of the product and deterioration in product quality.

Compliance

1. The processing area should be free from pest such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. All utensils and containers used must be clean and of food grade.

Product Name

Fish sauce – *Ngan pya ye*

Product Description

Fish sauce is one of the traditional fish products of Myanmar. Its local name is *Ngan pya ye*. It is made from a mixture of fish and salt that has been allowed to ferment over a period of six months to a year and the final product has a rich translucent reddish-golden brown color. The shelf life of *Ngan pya ye* at room temperature is about six weeks. It is consumed as a condiment mixed with fresh-cut or dried chilli and is one of the basic ingredients in Myanmar cooking. It is used liberally in nearly all Myanmar dishes such as in fish/poultry curries and salads.

Process Flow Diagram



Outline of Processing Steps

1. Mixing of Fish and Salt

Small marine fishes of 2 to 5 inches in length are commonly used as the raw materials in fish sauce production. If fishes of larger sizes are used, they are usually cut into smaller pieces. Three to four parts of fish are mixed with one part of salt by weight and left for one to two days before they are filled into a concrete tank lined on the bottom with a layer of salt, and topped with a layer of salt. Bags of salt are placed over the fish pile to weigh down the fishes and to keep the fishes from floating to the surface as the fluids within them are extracted and the fermentation process occurs.



Figure 1
Mixing of fish and salt



Figure 2
Mixture of fish and salt placed in concrete tank with bags of salt on top

2. Fermentation

Natural fermentation is allowed to occur for about six months to a year. After three months, the mixture starts to develop the pleasant aroma of fish sauce, the liquid from the bottom of the tank are siphoned to the upper layer and mixed well.



Figure 3
Fermentation process from 6 – 12 months

3. Sun-drying

After a further six months, the liquid (fish sauce) is removed from the concrete tank preferably by draining through a spigot on the bottom of the tank. This is to allow for the fish sauce to pass through layers of fish remains before being siphoned out. The filtered fish sauce is then filled into clean earthen jars, covered and left in a sunny location for one to two weeks.



Figure 4
Sun-drying in earthen jars

From time to time, they are uncovered to allow for the fish sauce to be exposed to direct sunlight. This process allows the fish sauce to air out in the sun for a couple of weeks in order to dissipate the strong fish odors. This also allows for the fish sauce to ripen.



Figure 5
Fish sauce - Ngan pya ye

4. Bottling, Capping and Labeling

Bottling, capping and labeling is usually carried out manually.



Figure 6
Bottling of fish sauce



Figure 7
Labeling of fish sauce

GMP for Fish sauce (ngan pya ye)

Section 1 Mixing of Fish and Salt

GMP 1.1 Raw materials – Fish and Salt

The quality and safety parameters of each incoming lot of raw materials – fish and salt - should be checked and documented.

Reason

To ensure the quality and safety of the product, it is important to ensure that only

good quality and safe raw materials are used. Fish should be fresh in order to prevent high histamine content due to poor handling and temperature abuse.

Compliance

1. Fish should be evaluated for freshness and histamine content. Fish should not be stale or decomposed.

2. Fish should be adequately iced or salted upon arrival.
3. Fish containers and all utensils should be made of non-corrodible materials, clean and not rusty.
4. Salt used should be clean and certified as food grade. It should be in clean, intact and undamaged packaging.

GMP 1.2 Mixing

The mixing of fish and salt should be done in a clean, hygienic manner and adequate amount of salt should be used.

Reason

Mixing should be carried out hygienically to prevent microbial contamination. The amount

of salt used must be sufficient to control growth of pathogenic and spoilage bacteria during the fermentation process.

Compliance

1. Not more than four parts of fish to one part of salt should be used.
2. Mixing should be carried out in a clean and hygienic environment free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
3. Utensils and containers used for mixing must be properly washed and sanitized before and after use.
4. Utensils and containers used must be constructed from food grade materials and free from corrosion.

Section 2 Fermentation

GMP 2.1 Fermentation

Fermentation should be carried out in a clean, hygienic manner and environment.

Reason

As the fermentation process is reasonably long (from 6 months to a year), the careful control of hygiene and environment is necessary to prevent contamination and spoilage of the fish sauce.

Compliance

1. The processing area should be protected and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The fermentation containers/tanks should be washed and sanitized properly before and after use.
3. All utensils, containers and equipment used must be clean, made of non-corrodible materials capable of tolerating a high degree of salt and well maintained without any rust, cracks or crevices or any other damage.

Section 3 Sun-drying

GMP 3.1 Sun-drying

Sun-drying should be carried out in a clean, hygienic manner and environment.

Reason

As this process occurs out in the open, the careful control of hygiene and environment is necessary to prevent contamination of the fish sauce.

Compliance

1. The processing area should be protected and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The earthen jars must have proper, tight-fitting lids to protect the fish sauce from pests, rain, dirt, dust and other extraneous materials

Section 4 Bottling, Capping and Labeling

GMP 4.1 Bottling, Capping and Labeling

Bottling, capping and labeling should be carried out in a clean, hygienic manner and environment.

Reason

As these processes are carried out manually, the careful control of hygiene and sanitation is necessary to prevent contamination of the fish sauce. The use of unclean bottles and caps will also result in product contamination

Compliance

1. All bottles and caps must be washed and sanitized properly just before use.
2. All workers must observe good personal hygiene practices and properly attired with disposable gloves, face masks and hair covers.
3. The processing area should be protected and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.



Philippines

Product Name

Shrimp sauce – *Alamang*

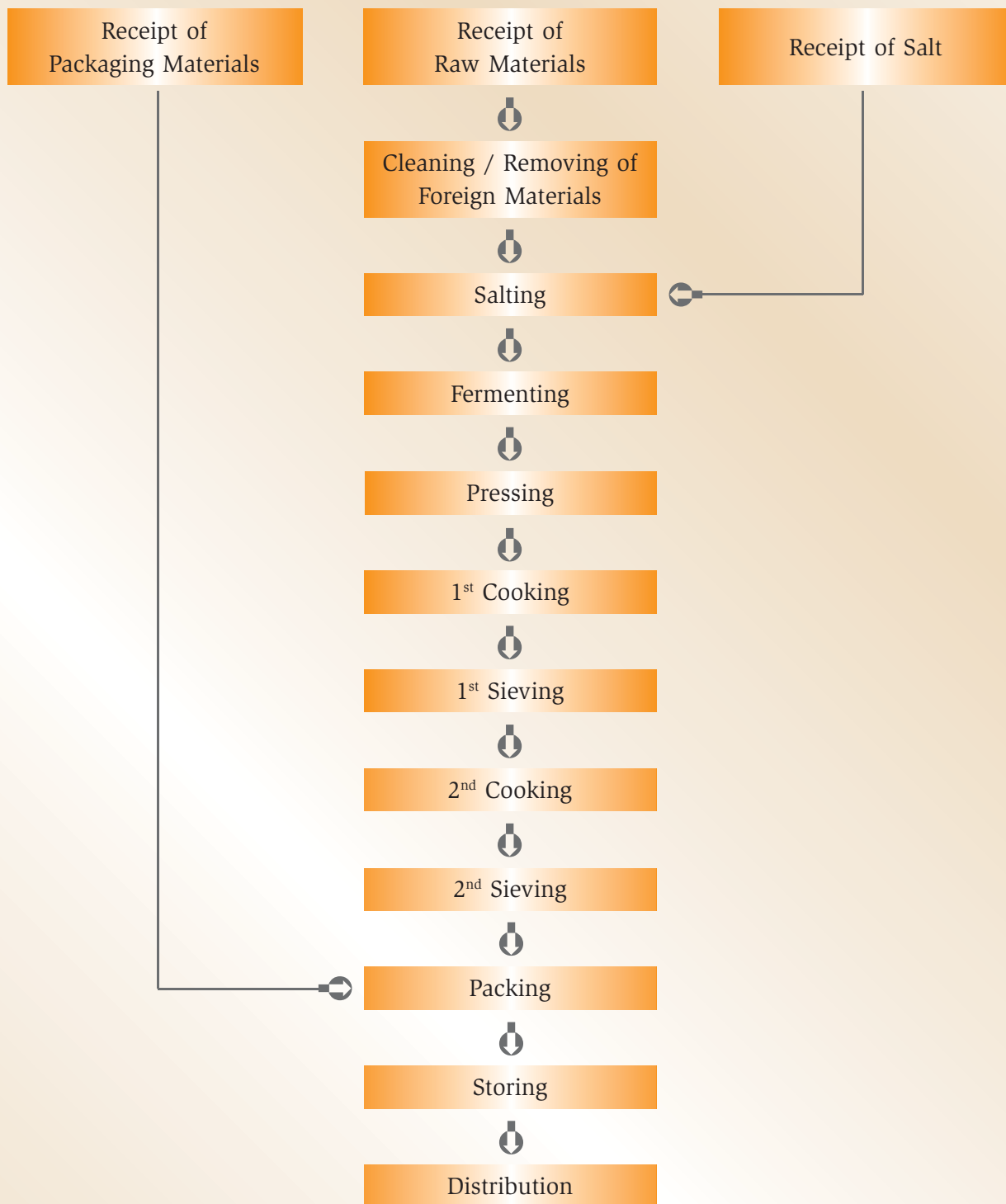
Product Description

Shrimp sauce or *Alamang*, as it is locally called, is a condiment that is widely used in Filipino cuisine. It gives Filipino food its own unique character and rich taste. *Alamang* is made from the tiny shrimp *Acetes* spp. and is the salty flavouring that has become one of the most popular traditional products of the Philippines. During the months of abundance in catch (May and September), fresh tiny shrimps are salted and allowed to ferment for a period of one and a half months to a year. After fermentation, the fishes are pressed to extract the sauce. They are then cooked and sieved to produce a clear and richly aromatic shrimp sauce.

Currently, *Alamang* is still prepared in its traditional way that is predominantly manual with the use of some equipment/utensils. Most of the shrimp sauce are consumed locally though some are exported heavily to overseas Filipino communities.



Process Flow Diagram



Outline Of Processing Steps

1. Receipt of Raw Materials and Packaging Materials

a. Receipt of packaging materials

The packaging materials used in the packing of shrimp sauce include clean bottles where the shrimp sauce are poured into and cardboard cartons that are used to contain the bottles of shrimp sauce. These bottles of shrimp sauce are stored in the cardboard cartons until they are ready for distribution.

b. Receipt of *Acetes* shrimps

Only fresh *Acetes* are used in the processing of *Alamang*. This is to ensure good quality and safety in the finished product.

c. Receipt of salt

Only food grade salts are used for the fermentation of *Acetes* in the production of *Alamang*.

2. Cleaning

Fresh *Acetes* are sorted to remove all foreign materials such as stones, leaves and wood. To reduce chances of contamination and spoilage, cleaning is done without delay.

3. Mixing *Acetes* and Salt



Figure 1
Mixing Acetes with salt

The mixing of salt with *Acetes* is done prior to fermentation to help preserve the *Acetes* and prepare them for the fermentation stage. As the amount of salt added varies with different processors, household producers and commercial establishments, the quantity parameters are listed below on Table 1.

Table 1

Quantity of <i>Acetes</i> (kilos)	Amount of salt (gallon)	Duration of Fermentation (month)
50	2 ½	1 ½
8	½	2 - 3
50	3	12
50	3	1 - 3

4. Fermentation

The fermentation of *Acetes* is carried out in earthen jars or plastic containers. The *Acetes* is stored at room temperature until it develops a characteristic flavour and aroma. The fermentation duration can stretch from one and a half months to a year, depending on different processors and fermentation procedures.



Figure 2
Fermentation in plastic containers

5. Extraction

After fermentation is completed, the fermented mixture is pressed to extract the shrimp sauce. The pressing can be done by hand or with the use of improvised equipment. After the extraction is done, the solid residue is incorporated into another traditional product - shrimp paste.



Figure 3
Pressing by hand



Figure 4
Pressing with improvised equipment

6. 1st Cooking

The extracted shrimp sauce is cooked under moderate fire for two to three hours. The cooking is done in earthen cooking vats.



Figure 5
Earthen cooking vat

7. 1st Sieving

The cooked shrimp sauce is then sieved using a very fine white cloth, to separate the clear sauce from *hecko*. *Hecko*, a fine solid particle, is not a waste product. It is used by many as another traditional flavouring or condiment.



Figure 6
Alamang sauce



Figure 7
Hecko

8. 2nd Cooking

The sieved sauce is cooked again under slow fire for several hours until white salt crystals appear at the surface.

9. 2nd Sieving

The shrimp sauce is then sieved again to produce a very clear shrimp sauce ready for packing.



Figure 8
Sieving with fine white cloth

10. Packing/Bottling

Shrimp sauce is packed into clean bottles by hand.



Figure 9
Bottling of shrimp sauce



Figure 10
Finished product – Alamang

11. Storage

Finished goods are stored at room temperature in capped bottles before distribution. Goods are kept away from direct exposure to sun and intense heat.



12. Distribution

The bottles of shrimp sauce are then packed into cartons. Each carton contains twenty-four bottles of fish sauce. A

bottle of shrimp sauce typically contains approximately 360ml of shrimp sauce. It is sold at 35 Philippines peso in the local market.

GMP for Shrimp Sauce (Alamang)

Section 1 Receipt of Raw Materials and Packaging Materials

GMP 1A.1 Receipt of Packaging Materials

Damaged and dirty packaging materials such as bottles and caps as well as other packaging materials that do not meet the stated specifications should be rejected. Packaging materials should not pass on any odour, taste and other unwanted characteristics to the final product.

Reason

Damaged and dirty packaging materials can be a source of contamination while packaging materials that do not meet the stated specifications may not serve their purpose in properly containing and protecting the product from any source of contamination.

Compliance

1. Only clean and undamaged packaging materials should be allowed to enter the processing establishment.
2. Packaging materials that do not meet the required specifications should be rejected.
3. Records of every batch of packaging materials received should be filed and kept for reference.

GMP 1A.2 Storage of Packaging Materials

Upon reception, packaging materials should be stored immediately in a clean designated storage room. Dirty outer covering should be removed before storing the packaging materials.

Reason

To prevent any possibility of introducing contaminants to the packaging materials which in turn may contaminate the finished product.

Compliance

1. Packaging materials should be immediately stored in a clean designated room.
2. A storage room should be provided with shelves to store the different types of packaging. Proper labelling should be observed and the date of receipt should be indicated so that packaging materials will be use in a first-in-first-out basis.
3. Storage rooms should be designed to allow easy cleaning and monitoring. They should be cleaned regularly and monitored for possible pest infestation and other sources of contamination.

GMP 1B.1 Receipt of Salt

Every batch of salt that is received in the processing establishment should be certified to meet the safety requirements for salt in terms of microbial load, being free of foreign matter and purity.

Salt should be contained in clean and food grade packaging materials.

Reason

Salt is a major ingredient in the production of shrimp sauce. Therefore, any contamination of salt will affect the quality and safety of the finished product.

Compliance

1. Every batch of salt received in the processing establishment should comply with the set specifications for salt and should be accompanied by necessary certification.
2. Salt should be contained in clean and food grade packaging materials.
3. Records for every batch of salt received should be filed and kept for traceability in case safety concerns arise.

GMP 1B.2 Storage of Salt

Immediately after receipt, the salt is stored in a designated clean storage room. The storage room should be protected from all sources of contamination that may be present in the plant. These sources of contamination include cleaning agents, pesticides and insecticides.

Reason

Any contamination to the salt can affect the safety and quality of the finished product.

Compliance

1. Salt should be stored in a clean designated storage room.
2. The storage room should be designed to allow for easy cleaning and monitoring. It should be cleaned regularly and monitored for possible pest infestations and any other possible contamination.
3. Salt should be properly labelled and the date of receipt should be properly indicated to adhere to the first-in-first-out principle in the using of the salt.

GMP 1C.1 Receipt of Acetes Shrimps

Only very fresh shrimps should be received and used for processing. They should be contained in clean and appropriate containers upon receipt. Shrimps should also pass the quality criteria set by the management before they are accepted into the processing establishment.

Reason

Shrimps that are not fresh will produce an inferior quality finished product that may be unsafe for human consumption.

Compliance

1. Only very fresh shrimps should be used in production of shrimp sauce.
2. Shrimps should be contained in clean, food grade containers.
3. Very minimal delays should be permitted to ensure a quick and smooth transition from time of receipt to start of processing.



Section 2 Cleaning

GMP 2.1 Cleaning

Cleaning/removing of foreign materials should be done as soon as possible, avoiding unnecessary delays. It should be done in a clean designated area using clean and appropriate materials.

Reason

Any delays can cause irreversible deterioration

to the quality of the raw materials. Unclean and non-compliant cleaning materials can be a major source of contamination.

Compliance

1. Cleaning/removing of foreign material should be accomplished immediately.
2. Only clean, food grade and inert cleaning materials should be use.

Section 3 Mixing Acetes and Salt

GMP 3.1 Mixing Acetes and Salt

Only salt with proper certification should be used. The salting procedure should be done using a food grade and non-corrodible container.

Reason

Contaminated salt can affect the quality and safety of the finished product. Similarly, any corroded parts of the container may be

incorporated into the finished product. This may pose as a serious health threat to the consumers.

Compliance

1. Only salt with proper certification should be used in processing.
2. Containers and utensils used for salting should be food grade and non-corrodible.

Section 4 Fermentation

GMP 4.1 Fermentation

Fermentation containers should be food grade and non-corrodible and fermentation should be carried out in a clean and well-ventilated room.

Reason

Fermentation containers are in direct contact with the product for long periods of time hence it is a must that they should be food grade and non-corrodible to avoid possible reactions and contamination of the product.

Fermentation should be done in a clean and well-ventilated room to avoid any

forms of contamination that may occur. The contamination may cause product spoilage.

Compliance

1. Fermentation containers should be made from food-grade materials and be non-corrodible. They should also be made of materials that can tolerate exposure to high salt concentrations.
2. Fermentation should be carried out in a clean and well-ventilated room.
3. Fermentation rooms should be checked regularly for any possible contaminants.

Section 5 Extraction

GMP 5.1 Extraction

Improvised pressing equipment should be clean and fit for their intended use. In the absence of pressing equipment, manual hand pressing is employed. In such cases, proper personnel hygiene practices should be observed.

Reason

To prevent any possible contamination of the product that can affect the quality and safety of the final product.

Compliance

1. Pressing equipment used should be clean and made of non-corrodible materials
2. Proper personnel hygiene practices should be observed by the workers

Section 6 1st Cooking

GMP 6.1 1st Cooking

Cooking should be carried out with proper monitoring of time and temperature. It should be done using clean, well maintained cooking vats.

Reason

Time and temperature should be properly controlled in order to ensure that the sauce is properly cooked to prevent spoilage.

Cooking vats should be clean and well maintained to avoid any possible contamination.

Compliance

1. Cooking time and temperature should be properly observed.
2. Cooking vats should be clean and made of non-corrodible materials that can be easily cleaned.

Section 7 1st Sieving

GMP 7.1 1st Sieving

Sieving should be done without any unnecessary delays. Only clean cloths should be used in this process. The cloths should not be used for any other purposes besides sieving. Clean and food grade containers should be available to contain the filtrate.

Reason

Unclean and non-food grade cloths and containers may affect the quality and safety of the finished product.

Compliance

1. Only clean and food grade cloths and containers should be used in sieving.
2. No delays should be allowed.



Section 8 2nd Cooking

GMP 8.1 2nd cooking

Cooking should be carried out with proper monitoring of time and temperature. It should be done using clean, well-maintained and food grade cooking vats. If the same cooking vat is used in the 1st and 2nd cooking, it should be ensured that it is properly washed before being used for the 2nd cooking.

Reason

To prevent any cross contamination.

Compliance

1. Cooking vats should be properly washed before use for the 2nd cooking.

Section 9 2nd Sieving

GMP 9.1 2nd Sieving

Sieving should be carried out without any unnecessary delays. Only clean cloths should be used. The cloths should not be used for any other purpose other than sieving. Clean and food grade containers should be available to contain the product.

Cloths and containers used should be different from the one used in the 1st sieving.

Reason

To prevent any cross-contamination, utmost observance of hygiene is very important. This is because the product is ready for packaging at this phase and will go through no further heat processing.

Compliance

1. Only clean and food grade cloths and containers should be used.
2. The cloths and containers used in the 2nd sieving should be different from the ones used in the 1st sieving.

Section 10 Packing/Bottling

GMP 10.1 Packing/bottling

Packing/bottling should be done in a clean area intended and stipulated for this purpose. Only clean and undamaged packaging materials (bottles, caps and cartons) should be used.

Reason

This is done to prevent any contamination to the finished product and also to optimize

the packaging material's ability to keep the *Alamang* safe from contamination.

Compliance

1. Only clean and undamaged packaging materials should be use.
2. Packing should be done in a clean designated area.



Section 11 Storage

GMP 11.1 Storage

Finished product should be stored away from direct sunlight and intense heat.

Reason

This is to prevent the product from deterioration and to lengthen its shelf life.

Compliance

1. Products should be stored away from direct exposure to sunlight and intense heat.
2. Regular monitoring of the finished product storage area should be conducted.

Section 12 Distribution

GMP 12.1 Distribution

Distribution condition should be appropriate to the product. The product must be well protected to avoid any possible damage.

Reason

To ensure that the final product reaches the consumers safely, retaining its high quality.

Compliance

1. The finished products should be delivered packed in cartons to ensure no breakages of the bottled shrimp sauce occur.
2. The finished products should be delivered using a delivery van or any available appropriate vehicle straight to the buyer avoiding any delays.



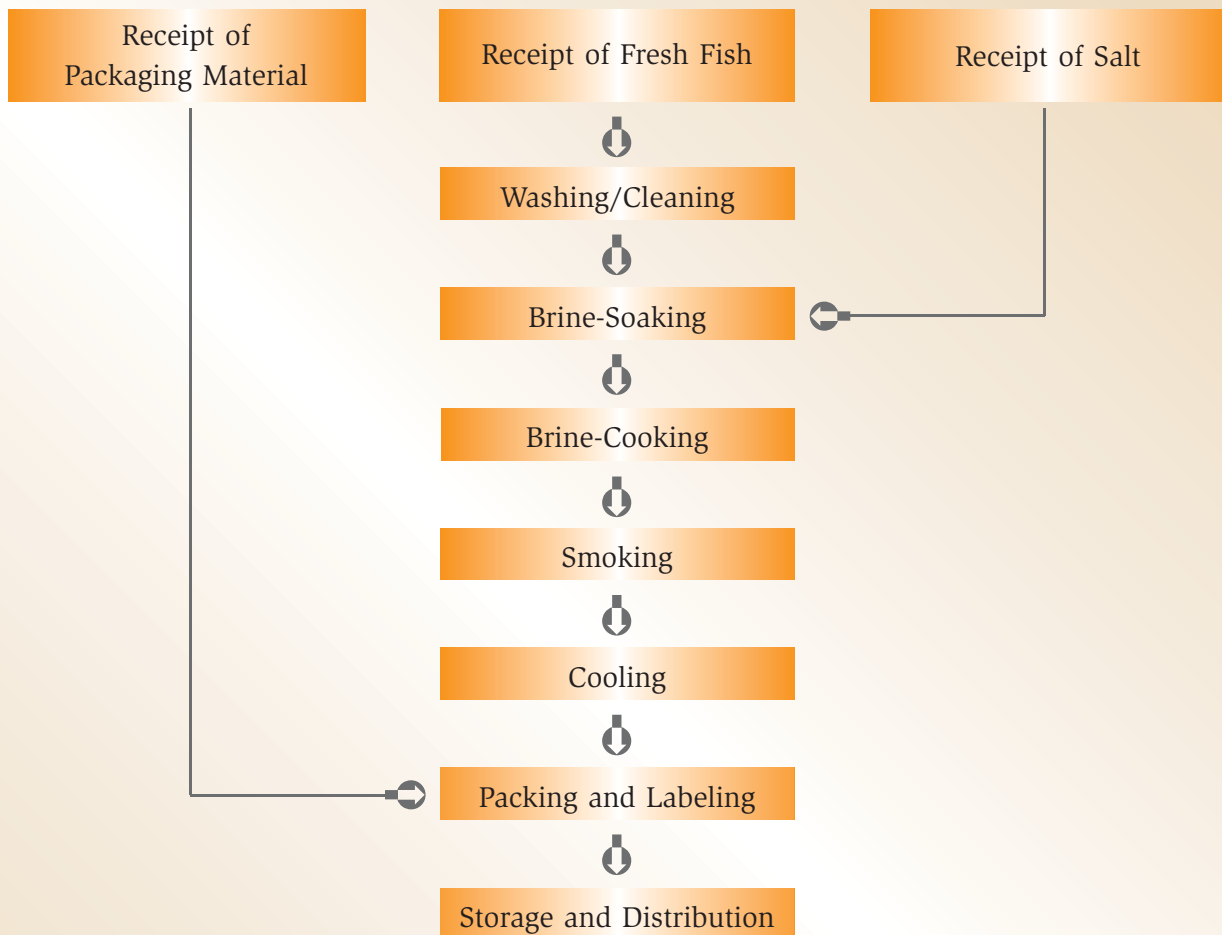
Product Name

Smoked Fish – *Tinapa*

Product Description

Smoked fish or *Tinapa*, as it is locally called, has a lucrative market in towns bordering Manila Bay. Species of fishes used for *Tinapa* include *sardines*, *milkfish*, *anchovies*, *herrings* and *round scad*. The fishes are washed, soaked and cooked in brined before being smoked. The smoked fishes are packed into polyethylene bags. They are then packed into styrofoam boxes or other suitable boxes before being stored at room temperature or for longer storage periods in a chiller or freezer. During the season of abundance, the fishes are cooked in bulk, smoked and stored in the chiller or freezer for consumption during the lean months.

Process Flow Diagram



Outline of Processing Steps

1. Receipt of Raw Materials

a. Receipt of packaging materials

Packaging materials such as food-grade polyethylene bags, styrofoam boxes and cartons, are used to pack the smoked fish prior to distribution.

b. Receipt of fish

Every shipment of fish should be recorded and evaluated to ensure that they are safe and suitable for processing. Fishes are iced to keep them at low temperatures not exceeding 5°C.

c. Receipt of salt

Food-grade salt (sodium chloride) is used for the brining and cooking of the fishes prior to smoking.

2. Washing/Cleaning

The fishes are washed in water to remove blood, slime, and dirt before they are further processed. Low temperatures should be maintained throughout the process; hence, iced water is used.

3. Brine-Soaking

Soaking the fish in brine can retard spoilage of fish while it is waiting to be cooked in brine. *Herring* and *sardines* are brined in the round i.e. their heads and viscera are not removed in the process of soaking in brine. The brine solution is made up of salt and water in a 1:3 ratio.

The soaking times are as shown below:

Size of fish	Time of soaking
10 cm – 14 cm	20 min
4.5 cm – 8 cm	5 min

Milkfish on the other hand are gutted before they are soaked in concentrated solutions of brine for one to two hours depending on the size of the fishes.

4. Brine-Cooking

The brine used in the brine-cooking is three times less concentrated than the brine used in brine soaking. The salt to water ratio is 1:9. After the brine is prepared, it is placed inside a cooking vat (*carajay*, local name) and brought up to a boil. The fishes are then placed in an immersion basket and immersed in the boiling brine. The number of baskets that can be immersed at any given time depends greatly on the size of the *carajay*. Table 1 shows the duration of brine-cooking for different species of fishes.



Figure 1
Boiling brine in cooking vat

Table 1: Duration of Brine-Cooking

Species of fish	Duration of brine-cooking (minutes)
Silinyasi, all sizes (young <i>Sardinella</i>)	1.3 to 1.5
Tunso (<i>Sardinella fimbriata</i>)	2.5 to 3
Lapad (<i>Sardinella perforate</i>)	2.5 to 3
Tamban (<i>Sardinella longiceps</i>)	3 to 4.5
Bangus (<i>Chanos chanos</i>)	4 to 10

Table 2: Duration of Smoking

Species of fish	Duration of smoking (minutes)
Silinyasi, all sizes (young <i>Sardinella</i>)	135 – 140
Tunso (<i>Sardinella fimbriata</i>)	45 – 60
Lapad (<i>Sardinella perforate</i>)	60 – 105
Tamban (<i>Sardinella longiceps</i>)	100 – 120
Bangus (<i>Chanos chanos</i>)	60 – 360

5. Smoking

After brine-cooking, the fishes are laid out in the draining trays and cooled. After cooling, fishes are arranged in smoking trays. The time taken to smoke the fishes varies according to the size of fishes and the type of product desired. Table 2 shows the duration of smoking time used with different kinds of fishes.



Figure 2
Cooked fish on draining trays for cooling



Figure 3
Smoking of fish

6. Cooling

The fishes are laid in trays and cooled before packing.



Figure 4
Smoked fish on trays for cooling

7. Packing and Labeling

Smoked products are packed in different kinds of packaging materials depending on the processor's preference. Some of the more common packaging materials are styrofoam boxes/trays wrapped over with plastic film, bamboo baskets lined



Figure 5
Smoked fish packed on styrofoam trays with plastic film

with banana leaves, wooden boxes/ plastic containers, cardboard cartons lined with old newspaper. Smoked fish may also be shipped to market in the original smoking trays.

Smoked fish is usually stored and distributed at room temperatures. For longer storage, smoked fish should be put in a refrigerator or freezer. Distribution condition should be appropriate for the product.

8. Storage and Distribution



Figure 6
Storage in refrigerator



Figure 7
Storage in freezer

GMP for Smoked Fish (*Tinapa*)

Section 1 Receipt of Raw Materials and Packaging Materials

GMP 1A.1 Receipt of Packaging Materials

Packaging materials (e.g. styrofoam, P.E. bags, plastic containers) should meet the specifications set by the management on the processing establishment to ensure that the packaging materials are of food-grade and fit for their intended use.

Damaged, dirty and unsuitable packaging materials should be rejected immediately.

Reason

Damaged, dirty and inappropriate packaging materials may contaminate the finished product resulting spoilage and microbial contamination.

Compliance

1. Only clean packaging materials that meet the specifications set are allowed entry into the establishment.
2. Packaging materials should be enclosed in a clean covering upon receipt.

3. Newspapers are no longer allowed for use as packaging material.

GMP 1A.2 Storage of Packaging Materials

Packaging materials should be stored in a clean room protected from any possible contamination.

Reason

Contaminated and damaged packaging materials will not provide the necessary protection to the finished product.

Compliance

1. The storage area for the packaging materials is always clean and regularly monitored for possible pest infestation and presence of any other possible contaminants.
2. The packaging materials are used following the First-In-First-Out (FIFO) principle.
3. Storage room for packaging materials should be provided with shelves for easy identification and proper labeling (date received, supplier, intended use, etc.).

GMP 1B.1 Receipt of Salt

Every batch of salt received in the processing establishment should have a certification that proves that the salt has met the safety requirements for salt (microbial load, free of foreign matter, purity). Salt should be contained in a clean and food-grade packaging material upon receipt.

Every batch of salt received should have the following information properly documented:

- Date received:
- Supplier/Source
- Condition of packaging
- Presence of proper certification

Reason

Salt is a major ingredient for production of smoked fish. Therefore, any contamination to it will affect the quality and safety of the finished product.

Compliance

1. Every batch of salt received in the processing establishment must comply with the set specifications for salt and must be accompanied with necessary certifications.
2. Salt is contained in clean and food-grade packaging materials.
3. Proper documentation is properly filed for easy traceability.

GMP 1B.2 Storage of Salt

Immediately after receipt, salt should be transferred to a clean, dry and specific area intended for salt storage. Dirty outer packaging materials should be removed before bringing the salt into the storage room. Salt removed from its original packaging is transferred to other clean containers. Containers should be food-grade and inert to salt to avoid any unwanted chemical reactions that might cause health hazards to the consumers.

Reason

Any contamination to the salt may affect the safety and quality of the finished product.

Compliance

1. Salt is properly stored in a clean, dry, and designated storage room.
2. The storage room is regularly cleaned and monitored for possible pest infestation and other possible contaminations.
3. Every batch of salt should be properly labelled and should follow the first-in-first-out principle.

GMP 1C.1 Receipt of Fish

Only fresh fish, properly iced and packed in clean container should be received and used for processing. The core temperature of the fish upon receipt should not exceed 5°C and it should meet the requirements for sensory attributes set by the management.

Reason

Nothing can reverse the deterioration of fish; therefore it is a must that the fish does not experience any temperature abuse. Contamination from dirty ice and containers may affect the quality, safety and shelf life of the product.

Compliance

1. Fishes should be contained in clean and appropriate fish boxes/containers. They should be properly iced to avoid any rise in temperatures to above 5°C. This is to

ensure that any microbial and enzymatic reactions that may occur are slowed down. This will in turn ensure that the fishes are maintained at good quality for as long a period of time as possible.

2. Sensory evaluation of the fish should be conducted upon receipt to determine its and suitability for processing.
3. Proper documentation should be done and filed properly for traceability. The information that should be documented should include:
 - Date received
 - Supplier
 - Date caught
 - Fishing Ground
 - Species
 - Temperature upon receipt
 - Condition of fish container
 - Sensory evaluation results

Section 2 Washing/Cleaning

GMP 2.1 Washing/Cleaning

Potable water should be used for washing and cleaning of raw materials. Any unnecessary delays should be avoided and it must be ensured that containers used are clean and suitable for their intended use.

Reason

Contaminated water and containers used can affect the quality and safety of the finished product. Any delays can cause irreversible quality deterioration of the raw material, which cannot be improved by succeeding processing steps.

Compliance

1. Potable water from approved sources should be used for washing. Records of water testing should be properly kept for future reference.
2. Containers should be clean and made from food-grade materials.
3. Unnecessary delays should be avoided to ensure that the raw materials would maintain its freshness.



Section 3 Brine-Soaking

GMP 3.1 Brine-soaking

Brine used should be regularly changed for every batch of fish being soaked. Soaking time and ratio of salt and water in brine should be properly observed.

Reason

Proper observance of soaking time and amount of salt used in brine is important to achieve the desired quality of the product. Brine solution should always be changed to prevent cross contamination.

Compliance

1. Brine solution should be properly prepared, observing the proper ratio of salt and water. Brine should be protected from contaminants like pest, insects and dust.
2. Brining containers should be made from food grade materials, non corrodible and able to tolerate high salt concentrations.
3. Brining containers should be clean and well maintained.

Section 4 Brine-Cooking

GMP 4.1 Brine-cooking

Brine used should be regularly changed for every batch of fish being cooked. Cooking time and ratio of salt and water in brine should be properly observed.

Reason

It is important to keep the brine solution always fresh to prevent any possible microbial contamination to the product. Proper observance of cooking time and amount of salt used in brine is important to achieve the desired quality of the product.

Compliance

1. Brine solutions should be prepared with proper observation of salt and water ratio. It should be regularly changed to prevent any cross contamination.
2. Cooking vats used should be made from food grade materials, non corrodible and able to tolerate high salt concentrations.
3. Cooking vats should be washed and sanitized before and after every operation and stored in a clean and dry area.

Section 5 Smoking

GMP 5.1 Smoking

Smoking chambers should be regularly cleaned and maintained. Wood used for smoking should be safe for its intended use.

Smoking time and temperature should be monitored diligently to achieve the desired quality.

Reason

The smoking chambers should be regularly cleaned to eliminate any form of contaminants. It should be regularly maintained ensure it is working properly in maintaining the proper temperature and in regulating the smoke.

It is necessary to pay attention to the type of wood used in smoking. Some type of wood may impart substances to the finished product, which can be detrimental to human health.



Compliance

1. Hardwood should be preferred for use in smoking. Hardwood produces mild flavour and it contains less amounts of resin than softwood.
2. Regular cleaning and maintenance of the smoking chambers should be conducted.

Section 6 Cooling

GMP 6.1 Cooling

Cooling should be carried out hygienically in a clean and protected environment.

Reason

The careful control of hygiene and the environment is necessary to prevent contamination of the product and deterioration in product quality.

Compliance

1. Cooling area should be free from any flies, insects and other pests. Regular pest control programme should be conducted.
2. Cooling trays are kept clean and in good condition. They are stored in a clean and dry area when not in used.
3. All workers must observe good personal hygiene practices.

Section 7 Packing

GMP 7.1 Packing

Packing should be done hygienically in a clean designated area. Packaging materials should be food grade, clean and undamaged.

Reason

Any contamination from the packaging material can affect the quality and safety of the finished product. Packaging material is intended for enclosing and protecting the product from any form of contamination, therefore it is necessary to keep it in good condition.

Compliance

1. The packing area should be clean and free from from any flies, insects and other pests
2. Only clean and undamaged packaging materials are used.
3. All workers must observe good personal hygiene practices.

Section 8 Storage and Distribution

GMP 8.1 Storage and Distribution

Finished products shall be handled properly and under conditions appropriate to the product during storage and distribution.

Reason

Proper handling will prevent cross contamination and product deterioration by temperature abuse or improper handling practices.



Compliance

1. Finished products should be stored in rooms which are clean and free from pests and under appropriate temperatures - not exceeding 5°C if stored chilled/refrigerated and not exceeding -18°C if stored frozen.
2. The finished products should be delivered using a delivery van or any appropriate vehicle straight to the buyer avoiding any delays.
3. Chilled products should be transported in refrigerated vehicles at temperatures not exceeding 5°C during distribution.
4. Frozen products should be transported in freezer vehicles at temperatures not exceeding -18°C during distribution.
5. Temperature recorders should be available on all delivery vehicles.

Singapore

Product Name

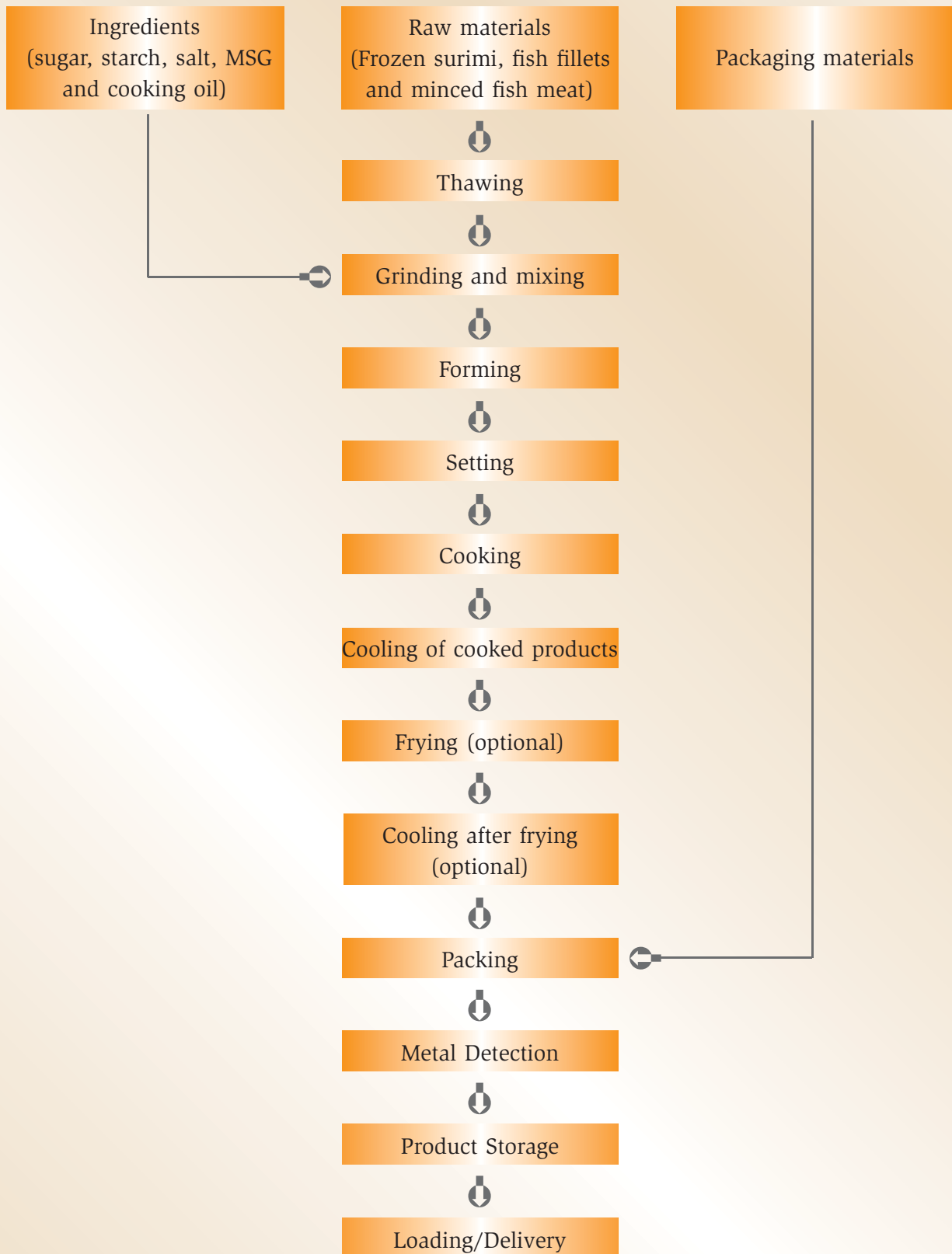
Fish balls/fish cakes

Product Description

Fish balls and fish cakes are widely consumed in Singapore as ready to eat snacks as well as ingredients in many local dishes especially that of noodles and vegetable dishes. Fish balls and fish cakes come in a variety of shapes and sizes. Traditionally, fish balls and fish cakes are made from fresh fish but inconsistent and insufficient supplies of fresh fish has led processors in Singapore to favor the use of *surimi* as the chief raw material. *Surimi* is fish meat that has been minced, leached by washing with water, thoroughly mixed with sugar and polyphosphate and then frozen. The main ingredients in fish balls and fish cakes are sugar, starch, salt, MSG and cooking oil.



Process Flow Diagram



Outline of Processing Steps

1. Receipt and storage of Ingredients

Typical ingredients used in the manufacture of fish balls and fish cakes are salt (3-5%), sugar (3%), starch (3%), monosodium glutamate (MSG) (1%), and water (40%) (based on the weight of surimi). These ingredients are usually stored at room temperature. The ingredients are used during the mixing step to enhance the texture, taste and flavour of the finished product.

2. Receipt and storage of Raw Materials

The raw materials used for making fish balls and fish cakes are surimi and fish fillets or minced fish meat. The tropical fish species commonly used for surimi production are Threadfin bream (*Nemipterus* spp.), big-eye snapper (*Priacanthus* spp.), croaker (*Pennahia*, *Johnius* spp.), lizardfish (*Saurida* spp.) and goatfish (*Upeneus* spp.). Fish fillets or minced fish meat (Yellow tail fusilier, *Caesio erythrogaster*) are sometimes used together with surimi to enhance taste and flavor of the finished products. Various grades of frozen surimi are now marketed (AA, SA, A, B, C and D) but the grades vary between different manufacturers.

3. Receipt and storage of Packaging materials

Packaging materials such as polystyrene (PS) trays, polypropylene (PP) trays, low-density polyethylene (LDPE) films, PP films, PE and PP bags are commonly used to pack the fish balls and fish cakes.

4. Thawing

Before use, the frozen surimi should be thawed under controlled conditions and should not be subjected to sudden increases in temperatures (e.g. thawing under hot weather, immersing in water etc).

Thawing in chiller room (0-5°C)

The frozen surimi can be left overnight in the chiller room so that it will be semi-thawed when required. This method of slow thawing allows the frozen surimi to thaw out evenly and the processors need not worry about denaturation of fish proteins caused by heat.



Figure 1

Thawing of surimi in chiller room

Thawing in air (air-conditioned room)

The blocks of frozen surimi can be placed on shelves and thawed by directing a current of air (e.g. electric fan) evenly over the surface of the blocks. The shelves



Figure 2

Thawing of surimi in air assisted by electric fan

should be kept away from direct sunlight and heat. When sufficiently softened, the blocks can be cut into pieces manually or using a surimi cutter. The frozen surimi is thawed for a certain time (about 2-3 hrs) before processing.

5. Grinding & Mixing

A silent bowl cutter machine is used to grind and mix raw materials and ingredients into a homogenous sticky paste. The process breaks down and loosens the muscle fibres. Next, salt is added to enhance the extraction of salt-soluble proteins and provide taste to the final product. The amount of salt added is usually about 3-5% by weight depending on consumer preferences. After adding salt, the other ingredients and ice water can be added to enhance taste and flavour of the finished products.



*Figure 3
Grinding and mixing using
Silent Bowl Cutter*

6. Forming

After grinding and mixing, the fish paste is shaped quickly in a forming machine to produce the fish balls or fish cakes. The products are formed directly into a container with water. Under tropical conditions, the fish paste after grinding and mixing begins to “set” quickly at room temperature. The process of “setting” results in a firm translucent product whose shape will thereafter resist change. It is therefore important to keep the paste chilled and to form the paste into the required shapes as quickly as possible.



*Figure 4
Forming of fish cakes*



*Figure 5
Forming of fish balls*

7. Setting

After the final shape of the product is attained, the setting process begins. Fish balls and fish cakes are usually set in water before cooking since they are buoyant in water and the shape are retained. The sticky fish paste will gel to give the product a springy texture.



Figure 6
Setting of fish cakes in stainless steel tank

8. Cooking

One of the main purposes of cooking fish balls and fish cakes is to sterilise the products. However, special care must be taken to ensure that the products are cooked in hot water at 90°C. If the products are cooked in boiling water, the boiling water is likely to cause the moisture within the products to vaporise. This will result in the undesirable roughening of the surface of the products.



Figure 7
Continuous conveyor cooker (hot water) machine

9. Cooling of cooked products

After cooking in hot water, the fish balls and fish cakes are usually cooled in an air-conditioned room before storage in a chiller room.



Figure 8
Cooling in air-conditioned room

10. Frying (For product color)

The fish ball and fish cakes may be fried to give the product surface a golden brown color. The usual process gives a partly fried or par fried product, rather than a completely fried one. Frying could be carried out either by batch or continuous operation.



Figure 9
Frying of fish cakes



Figure 10
Frying Machine

11. Cooling after frying

After frying, the fish balls and fish cakes are usually cooled in an air-conditioned room before being stored in a chiller room.

12. Packing and Labeling

Fish balls and fish cake are usually packed manually in suitable packaging materials. Good packaging enhances efficient mechanized handling, distribution and marketing. The packaging materials prevent dehydration during storage and ensure product quality until time of consumption. Fish balls and fish cakes may also be vacuum packed to extend shelf life.



Figure 11
Packing of raw fish balls in chilled water.

13. Metal Detection

Metal fragments from damaged (broken or chipped) blades of the cutting equipment such as silent cutter and mincer is a food safety hazard. A metal detector will ensure such a hazard is eliminated from the finished product. Metal detection is usually carried out after the packing step.

14. Product storage

Properly packaged finished fish balls and fish cakes are stored in the chiller room before delivery. The finished products are contained in plastic trays, which are stacked on racks with wheels. As local consumers desire the products fresh, the finished products are usually stored in the chiller room for 12-24 hours only.

15. Loading/Delivery

The fish balls and fish cakes are usually distributed within 12-24 hours after production. The delivery of the fish balls/cakes to supermarkets, market stalls, food stalls and restaurants are carried out in refrigerated vehicles or in insulated boxes or containers with or without ice.



Figure 12
Refrigerated vehicles used for delivery of finished products

GMP for Fish Balls and Fish Cakes

Section 1 Receipt and Storage of Ingredients

GMP 1.1 Receipt

Ingredients (e.g. sugar, starch, salt, monosodium glutamate (MSG) and cooking oil) shall have their packaging intact and undamaged upon receipt and with proper labels.

Reason

Damaged packaging will not provide the desired protection to the stored ingredient and may lead to contamination of the ingredient by extraneous materials such as microorganisms, insects, chemicals and foreign materials (dust, dirt, sand etc). Clear labelling of ingredients would help in their identification thus ensuring that the correct ingredients are used.

Compliance

1. Ingredients in badly damaged packaging without proper labeling should not be accepted for use in processing.
2. Ingredient packaging labels should contain the following information:
 - Name of ingredient
 - Name of manufacturer or importer
 - Country of origin
 - Expiry date/ Use-by date

GMP 1.2 Storage

Ingredients shall be stored above the floor in a neat and tidy manner in a specifically assigned clean and dry room.

Reason

Storage of ingredients in an open area in a haphazard manner will result in contamination by extraneous materials such as microorganisms, insects, chemicals and foreign materials (dust, dirt, sand etc) as well as deterioration in the quality of the ingredients.

Compliance

1. A clean and dry room that is insect-free must be provided for the storage of ingredients, which should be designed and constructed to a) permit adequate maintenance and cleaning, b) avoid pest access and harbourage; and c) enable minimal likelihood from contamination.
2. Proper non-wooden shelving racks should be in place for storing of the ingredients away from the floor.
3. Ingredients that have been removed from their packaging should be stored in clean, dry containers with proper covers and labels.
4. Ingredients must be used on a First-In-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule. Ingredients should not be used beyond their expiry/used-by date.

GMP 1.3 Water

Water used as an ingredient shall be of potable quality from approved source. Ice and steam shall also be made using potable water. Ice and water used shall be handled and stored so as to protect them from possible contamination.

Reason

The use of unapproved non-potable water in processing or ice and steam made from unapproved non-potable water may lead to contamination of the products by biological and chemical hazards.

Compliance

1. The water source used in processing and in the manufacture of ice and steam must be obtained from an approved potable water

source such as the public water supply system.

2. Regular checks of the water lines should be carried out to ensure that the pipes that
3. Non-potable water lines shall be clearly identified and separated from potable water to avoid cross contamination.

Section 2 Receipt and Storage of Raw Materials (Surimi, fish fillets, minced fish meat)

GMP 2.1 Receipt and storage of raw materials

Raw materials shall be stored at the proper frozen or chilled temperatures upon receipt with intact packaging and proper labels.

Reason

Raw materials must be kept at proper frozen or chilled temperatures to prevent microbial growth and quality deterioration. Packaging must be kept intact to provide the desired protection to the raw materials and prevent contamination. Proper labeling will ensure that the raw materials are correctly identified and stored at the appropriate temperatures.

Compliance

1. Frozen raw materials must be stored or transported at temperatures of -18°C or below and have a core temperature not exceeding -12°C .
2. Chilled raw materials must be stored or transported at temperatures of 4°C or below and have a core temperature not exceeding 7°C .
3. The freezer and chiller rooms and transporting vehicles should be equipped with temperature recorders.
4. Frozen/chilled raw materials must be kept frozen/chilled in the freezer/chiller immediately upon receipt unless they are scheduled to be used upon receipt.
5. Freezer/chiller rooms should not be overloaded beyond their designated capacity.
6. Frozen/chilled raw materials should not be stored directly on the floor of the freezer/chiller rooms. Proper non-wooden shelving racks should be available to allow proper circulation of cold air around the products.
7. Raw materials must be stored separately from the finished products in the freezer/chiller.
8. Freezer/chiller must be kept in a well-maintained sanitary condition with no accumulation of ice formation inside the freezer chamber.
9. Raw materials must be used on a First-In-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule and should not be used beyond their expiry or use-by dates.

Section 3 Receipt and Storage of Packaging Materials

GMP 3.1 Receipt and storage of packaging materials

Packaging materials (e.g. cardboardes, polyethylene (PE) and polypropylene (PP) bags and polystyrene (PS) trays) that are used to contain the finished products shall be safe for their intended use and be stored under proper conditions.

Reason

Packaging has an important function in protecting the finished products from contamination. Damaged packaging materials will not provide the desired protection and dirty packaging materials may contaminate the product.

Compliance

1. Packaging materials used shall be non-toxic and of food grade quality to ensure that they are safe for containing the finished products.
2. Packaging materials used shall be in clean and hygienic conditions.
3. A clean and dry room that is insect-free shall be provided for the storage of packaging materials. The storage room should be designed and constructed to a) permit adequate maintenance and cleaning, b) avoid pest access and harbourage; and c) enable minimal likelihood from contamination by locating the storage room for packaging materials away from areas where raw or food products are handled.
4. Proper shelving racks shall be in place for storing of the packaging materials, away from the ground.
5. Packaging materials shall be used on a First-In-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule and should not be used beyond their recommended shelf life period.

Section 4 Thawing

GMP 4.1 Thawing

Thawing of frozen raw materials shall be carried out in a clean environment under proper temperature conditions.

Reason

A proper thawing process will allow the frozen raw materials to thaw out evenly and prevent contamination, microbial growth and quality deterioration due to high temperature exposure.

Compliance

1. Frozen raw materials shall be left to thaw overnight in the chiller room (0-5°C) for semi-thawed usage the next day.
2. Thawing shall be conducted by placing the frozen raw material on proper thawing racks and assisted by directing a current of air (e.g. electric fan) evenly on the surfaces of the frozen raw materials.
3. Non-wooden racks shall be used to hold the frozen raw materials during thawing. The thawing racks shall be made of stainless steel or some suitable plastics, the surfaces of which should be free from pits, crevices or cracks.
4. Frozen goods can also be thawed by soaking them in water of potable quality in thaw tanks made of non-corrodible materials e.g. stainless steel or fibre glass at a temperature not exceeding 20°C by addition of ice. The core temperature of the thawed raw materials should not exceed 5°C.

5. External packaging materials of the frozen raw materials shall be removed and discarded. They should not remain in contact with the raw materials during the thawing process. This is to prevent contamination.
6. Upon completion of the thawing process, the raw materials shall be examined for signs of spoilage or contamination, which would make them unfit for use.
7. Thawed raw materials shall be used immediately or kept in the chiller room until use.

Section 5 Grinding and Mixing

GMP 5.1 Grinding and mixing process

Grinding and mixing of the raw materials and ingredients into a paste shall be carried out under low temperature conditions.

Reason

The grinding and mixing process generates heat, which will result in protein denaturation, affecting the quality of the product. High temperature also poses a biological risk as it may promote microbial growth.

Compliance

1. Grinding and mixing process shall be carried out in an air-conditioned room.
2. The temperature of the mixture/paste during the grinding and mixing process should be kept at 10°C or lower by the use of ice water as an ingredient.

GMP 5.2 Grinding and mixing equipment

The equipment used in the grinding and mixing process such as the silent or vacuum bowl cutter shall be kept clean and well maintained.

Reason

Dirty and/or poorly maintained equipment may become a source of contamination of the products.

Compliance

1. The equipment must be thoroughly washed and sanitized at the end of each processing day and as appropriate such as before and after production of each type of product.
2. The food-contact surfaces of the equipment must be made of non-toxic materials and should not be corroded or damaged in any way. The food contact surfaces must be smooth and free from crevices.

Section 6 Forming

GMP 6.1 Forming process

Forming of the fish ball/cake shall be carried out as soon as the grinding and mixing process is completed. In the event of any delay, the paste shall be stored in the chiller room (0-5°C).

Reason

The paste shall be kept chilled at all times to prevent microbial growth and quality deterioration.

Compliance

1. Forming shall be carried out immediately after the grinding and mixing process.
2. The paste shall be stored in a chiller room (0-5°C) if it is not scheduled to be used immediately.

GMP 6.2 Forming equipment

The equipment used in the forming process shall be kept clean and well maintained.

Reason

Dirty and/or poorly maintained equipment may become a source of contamination to the products.

Compliance

1. The equipment must be thoroughly washed and sanitized at the end of each processing day and at appropriate instances such as before and after production of each type of product.
2. The food-contact surfaces of the equipment must be made of non-toxic material and should not be corroded or damaged in any way. The food contact surfaces must be smooth and free from crevices.

Section 7 Setting

GMP 7.1 Setting process

Setting of the fish balls/cakes shall be carried out in warm potable water.

Reason

Cross-linking of fish protein molecules to obtain maximum gel strength of the formed product is achieved during the setting process. Disintegration of gel structure occurs at the temperature range of 60-75°C, resulting in a mushy-like texture of the finished product. Water used should be of potable quality to prevent it from becoming a source of microbial or chemical contamination.

Compliance

1. Setting should be carried out in warm potable water at 40°C (for tropical species surimi) for 20-30 minutes.
2. The temperature of the setting water should not be in the range of 60-75°C.

GMP 7.2 Setting tanks

The setting tanks shall be set constructed of non-corrodible materials, which are durable and cleanable.

Reason

The preferred material for the setting tanks is stainless steel, because of its impermeable nature and the ease with which it can be cleaned and disinfected. The surfaces should be smooth and free from pits and crevices. Built-up of tiny particles of food and bacteria in crevices will become a source of contamination. Wood fibers are porous and will absorb moisture. This permits the migration of microbes and soluble food materials into the wood where they may be protected from normal cleaning processes. With time, microbial populations increase and established in the wood. Plastics may be used but some are susceptible to cracking, scoring and abrasion which make them difficult to clean and disinfect. Plastics also become brittle with age and tend to shatter. Galvanized iron (iron coated with zinc) is toxic and should not be used.

Compliance

The setting tanks must be made of stainless steel or suitable plastics. The surfaces and

joints of the containers must be free from pits, crevices or cracks. The welded joints should have a smooth finish.

Section 8 Cooking

GMP 8.1 Cooking time and temperature

Cooking of the fish balls/cakes shall be carried out in hot water at an adequate temperature and for an appropriate time. The temperature and time required will depend on the size and shape of the product.

Reason

Cooking at an adequate temperature and time will serve to eliminate pathogens and reduce the total population of bacteria in the finished product.

Compliance

1. The temperature of the hot water should be at least 90°C (but not boiling).
2. The cooking time should be adequate to achieve a core temperature of more than 80°C in the finished product.

GMP 8.2 Cooking machine

The cooking machine shall be kept clean and well maintained.

Reason

Dirty and/or poorly maintained cooking machines may become a source of contamination to the products.

Compliance

1. The cooking machine must be thoroughly washed and sanitized at the end of each processing day and as appropriate.
2. The food-contact surfaces of the cooking machine must be made of non-toxic material and should not be corroded or damaged in any way. The food contact surfaces must be smooth and free from crevices.

Section 9 Cooling of cooked products

GMP 9.1 Cooling time

Cooling of the cooked product shall be carried out as quickly as possible.

Reason

Rapid cooling of cooked products will prevent the germination of bacterial spores and the growth of spore-forming bacteria such as *Bacillus* and *Clostridium* species. Heat-injured bacteria are also prevented from recovering and regaining ability to grow at chilled temperatures.

Compliance

1. Cooling of the cooked products should be carried out quickly in an air-conditioned room (12-15°C) for less than 2 hrs followed by storage in a chiller room (0-5°C).
2. Cooked products should be cooled from 60°C to 21°C within 2 hrs and to less than 4°C within another 4 hrs to prevent spore germination as well as to retard the growth of spoilage bacteria.

GMP 9.2 Cooling area

Cooling of cooked products should be carried out in a separate room or area from raw materials and semi-processed products.

Reason

Separation of cooked products from raw materials and semi-processed products during cooling prevents cross-contamination from occurring.

Compliance

1. A separate clean and dry room or area should be designated for product cooling.
2. Raw materials and or semi-processed products should not be kept in the same room or area as the cooked product.

Section 10 Frying (For product colour)

GMP 10.1 Frying oil

Frying oil has to be changed frequently.

Reason

Frying oil will become oxidized oil and rancid after multiple use. In addition, burnt product residues in the oil may cause product discoloration.

Compliance

1. Frying oil should be changed frequently when colour becomes too dark and cloudy.
2. Burnt product residues should be removed from the frying oil.

GMP 10.2 Frying machine

The frying machine shall be kept clean and well maintained.

Reason

Dirty and/or poorly maintained frying machine may become a source of contamination of the products.

Compliance

1. The frying machine must be thoroughly washed and sanitized at the end of each processing day and as appropriate such as before and after production of each type of product.
2. The food-contact surfaces of the frying machine must be made of non-toxic material and should not be corroded or damaged in any way. The food contact surfaces must be smooth and free from crevices.

Section 11 Cooling (After frying)

GMP 11.1 Cooling time

Cooling of the fried product shall be carried out as quickly as possible.

Reason

Rapid cooling of fried product will prevent the germination of bacterial spores and the growth of spore-forming bacteria such as *Bacillus* and *Clostridium* species. Heat-injured bacteria are also prevented from recovering and regaining ability to grow at chilled temperatures.

Compliance

1. Cooling of the fried product should be carried out quickly in air-conditioned room (12-15°C) for less than 2 hrs followed by storage in a chiller room (0-5°C).
2. Fried product should be cooled from 60°C to 21°C within 2 hrs and to less than 4°C within another 4 hrs to prevent spore germination as well as to retard the growth of spoilage bacteria.

GMP 11.2 Cooling area

Cooling of fried products shall be carried out in a separate room or area from raw materials and semi-processed products.

Reason

Separation of fried product from raw materials and semi-processed products during cooling prevents cross-contamination from occurring.

Compliance

1. A separate clean and dry room or area should be designated for fried product's cooling.
2. Raw materials and or semi-processed products should not be kept in the same room or area as the fried product.

Section 12 Packing and Labeling

GMP 12.1 Packing area

Packing of finished products shall be carried out hygienically in a separate, clean and dry air-conditioned packing room.

Reason

Packing should be carried out in a separate room from raw materials and semi-processed products to prevent cross contamination. Low temperatures are maintained in the packing room to reduce microbial growth and quality deterioration.

Compliance

1. Packing of finished products should be carried out quickly and with minimal delay to minimize any possibility of cross-contamination and microbial growth.
2. Products should be packed on stainless steel tables.
3. Staff should be properly attired with clean uniforms, disposable head covers, facial masks and hand gloves to pack the finished products.
4. New, clean packaging materials should always be used.
5. Temperature of the room should be controlled between 12-15°C.

GMP 12.2 Labeling

Packed products shall be properly labelled.

Reason

Adequate labelling of finished product would ensure product identity and traceability.

Compliance

1. Every pack should be clearly identified and marked to show lot number and date labeled to ensure traceability.
2. A proper recall system or program should be in place to remove or correct marketed products that violate the law.

Section 13 Metal Detection

GMP 13.1 Metal detection

Every pack of finished product shall pass through a metal detector.

Reason

Metal fragments are food safety hazards as they can cause injury to consumers. Metal fragments are normally produced through metal-to-metal contact during the cutting and blending process during production. Thus, the possible inclusion of metal fragments can be

greatly reduced by frequent examination of cutting and blending equipment for damage or missing parts or be eliminated by passing through a metal detector.

Compliance

1. A suitable metal detector should be installed to eliminate the metal fragment hazards.
2. The metal detector must be periodically calibrated to ensure proper operation

Section 14 Product Storage

GMP 14.1 Storage

The finished products shall be stored properly at adequate chilled temperatures.

Reason

Proper storage of finished products at adequate temperatures will prevent microbial growth, maintain quality and extend shelf life.

Compliance

1. Chilled products must be stored at temperatures of 4°C or below and have a core temperature not exceeding 7°C.
2. The chiller rooms should be equipped with temperature recorders.
3. Chiller rooms should not be overloaded beyond their designated capacity.

4. Chilled products should not be stored directly on the floor of the chiller rooms. Proper non-wooden shelving racks should be available to allow proper circulation of cold air around the products.
5. Finished products must be stored separately from the raw materials and/or semi-processed products in the chiller.
6. Chiller must be kept in a well-maintained sanitary condition.
7. Finished products must be used on a First-In-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule and should not be used beyond their expiry or use-by dates.



Section 15 Loading/Delivery

GMP 15.1 Loading and delivery

Finished products shall be handled properly during loading and delivery.

Reason

Proper handling during loading and delivery will prevent cross contamination and product deterioration by temperature abuse or improper handling practices.

Compliance

1. Products should not be left in the open at ambient temperatures for overly long periods during loading/delivery. They should be left in the cold ante-room.
2. All chilled products should be transported in refrigerated vehicles.
3. Temperature recorders should be available on all refrigerated vehicles.

Thailand

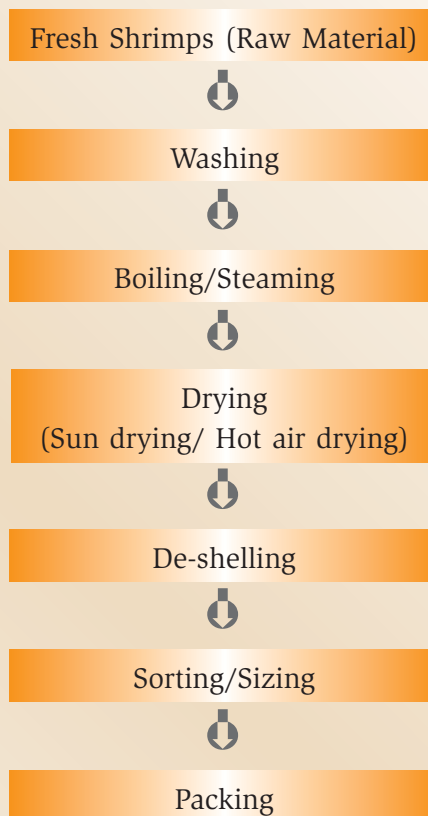
Product Name

Dried Shrimp

Product Description

Dried shrimp is a Thai traditional product that is well known in Thailand and other South East Asian countries as well as more distant countries such as China, India and the United States of America. The preferred raw material for the production of dried shrimp is the marine shrimps belonging to the Penaeidae and Palaemonidae families. Nonetheless, aquaculture shrimps are also being used in the production of dried shrimp due to the shortage of marine shrimp. Many processes are involved in the production of dried shrimp but these processes may vary slightly for each processing establishment. For example, some establishments cook the shrimps before drying them, while some others do not. In cases where the shrimps are cooked before drying, they are first boiled in hot water, or steamed before they are sun dried or dried using a mechanical dryer till their moisture content complies with the requirements of the customer.

Process Flow Diagram



Outline of Processing Steps

1. Receipt of Fresh Shrimps

The fresh shrimps are transported to the traditional processing establishment in a clean and cool condition. Ice is added to keep the shrimps at low temperatures in order to control the quality of the shrimps. The receiving area should be maintained in a clean and sanitary condition. The floors should have an impervious finish with proper flooring and sloping.



Figure 1
Receiving of fresh shrimp



Figure 2
Inspection of shrimp



Figure 3
Additional of ice to preserve fresh shrimp

2. Washing

Shrimps are washed manually or with the use of machines in clean and potable water from approved sources before they are further processed.



Figure 4
Manual washing of shrimps



Figure 5
Machine washing of shrimps

3. Boiling/Steaming

Shrimps are cooked for varying periods of time based on their sizes. They may be boiled in water or steamed. Salt may be added into the boiling water depending on the requirements of the customers.



Figure 6
Boiling of shrimps in baskets

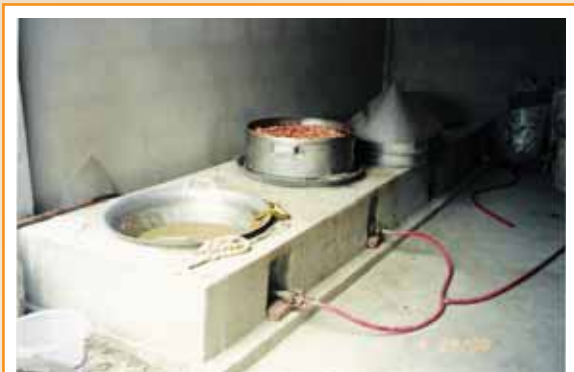


Figure 7
Boiling of shrimps in stove

4. Drying

The preferred method of drying is traditional sun drying. However, in the event of rainy weather, the hot air dryer or oven may be used to dry the shrimps. The cooked shrimps are dried until their shells are separated from the meat. This is to facilitate easy removal of the shell.



Figure 8
Sun drying



Figure 9
Drying of shrimps over hot air

5. De-shelling

The shrimps may be de-shelled manually or with the aid of equipment. There are various kinds of dried shrimps namely dried shrimps with shells, dried shrimp meat (without shells) and dried shrimps with some small amount of remnant shells.



Figure 10
Manual de-shelling



Figure 11
Machine de-shelling

6. Sorting/Sizing

After the shells are removed, the dried shrimps are sorted according to their sizes by hand or with the aid of a machine. Sorting is a necessary step for both small and larger scale traditional processing establishments.



Figure 12
Manual sorting/sizing



Figure 13
Machine sorting/sizing

7. Packing

The dried shrimps are packed into clean food grade polyethylene (PE) bags in bulk or in smaller retail packs before

being stored in a chiller or freezer. The dried shrimps are packed in PE bags or laminated plastic bags in order to maintain their quality.



Figure 14
Packing in Polyethylene (PE) bag



Figure 15
Retail PE packs

GMP for Dried Shrimp

Good Manufacturing Practice (GMP) is the combination of manufacturing and quality control procedures targeted at ensuring that

products are consistently manufactured to their specifications and safe for consumption.

Principle	Requirement
1. Location of plant and establishment as well as the hygiene of the surrounding area and design of facilities.	Should be free from objectionable odour, smoke, dust or other forms of contamination. The establishment should be well constructed and kept in good repair to prevent contamination. It should be free from dogs, cats, birds, insect and other vermin.
2. Food equipment	The equipment used should be made from stainless steel or hardened wood. All utensils should be clean and non-absorbent.
3. Production and process controls	Only fresh and wholesome raw materials should be used. The quality and quantity of the ingredients should be well controlled. Packing should be performed in a clean and dry area in order to prevent contamination.
4. Sanitary and cleaning facilities	Ice and water supply should be potable. Clean toilets should be provided and present in sufficient numbers.

Principle	Requirement
5. Sanitation program and maintenance	Sanitation programs should be adequate. Building, equipment, utensils and other physical facilities of the plant should be kept clean and should be maintained in good and hygienic condition.
6. Hygiene of workers	Food handlers should maintain a high degree of personal cleanliness and, when necessary, wear suitable protective clothing, head covering and footwear.

Section 1 Receipt of fresh shrimps

GMP 1.1 Receipt

Shrimp are packed in sufficient ice in proper containers after harvesting and while transported to the processing establishment.

Reason

Icing shrimps reduces bacterial growth and also slows down the enzymatic reactions involved in spoilage.

Compliance

1. Shrimps are iced to keep them at low temperatures not exceeding 5°C.
2. Ice should be made from potable water to prevent contamination.

Section 2 Washing

GMP 2.1 Washing

Shrimp should be washed with clean water from approved potable sources.

Reason

The purpose of washing is to minimize the possibility of contamination by removing any extraneous foreign materials. The use of clean potable water will prevent contamination of the product.

Compliance

1. Potable water from approved sources should be used for washing. Records of water testing should be properly kept for future reference.
2. Containers should be clean and made from food-grade materials.
3. Unnecessary delays should be avoided to ensure that the raw materials retain their freshness.

Section 3 Boiling/Steaming

GMP 3.1 Boiling/Steaming

Washed shrimps are cooked by boiling in water or steaming for sufficiently long periods of time. The properly designed equipment and utensils shall be used and made from non corrodible materials that can be easily cleaned.

Reason

Shrimps should be cooked in order to reduce the water content and to control spoilage. The cooked shrimps will also require a shorter drying time as compared to fresh shrimps.

Compliance

1. Cooking equipment and utensils used should be made from food grade materials and be non corrodible.
2. Cooking equipment and utensils should be washed and sanitized before and after every operation and stored in a clean and dry area.
3. Water used is from an approved potable source.

Section 4 Drying

GMP 4.1 Drying

Drying should be carried out hygienically in a clean and protected environment. Shrimps should not be placed directly on the floor.

Reason

The careful control of hygiene and the environment during the drying process is necessary to prevent contamination of the product and deterioration in product quality.

Compliance

1. The drying area should be free from any flies, insects and other pests. Regular pest control programmes should be conducted.
2. Drying equipment and utensils are kept clean and in good condition.
3. All workers must observe good personal hygiene practices.

Section 5 De-shelling

GMP 5.1 De-shelling

De-shelling should be carried out in a clean and hygienic manner.

Shrimp shelling shall be done in an area where contamination can be prevented. Other parts of the equipment may be made of corrodible materials if they are well protected by a suitable coating. All materials used should be clean and safe.

Reason

The careful control of hygiene and the environment during the de-shelling process is necessary to prevent contamination of the product and deterioration in product quality.

Compliance

1. The de-shelling area should be free from pest such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.

2. All equipment, utensils, containers and materials used must be easy to clean and well maintained.
3. All workers must observe good personal hygiene practices.

Section 6 **Sorting/Sizing**

GMP 6.1 **Sorting/Sizing**

Sorting/sizing should be carried out in a clean and hygienic manner.

Shrimp shelling shall be done in an area where contamination can be prevented. Other parts of the equipment may be made of corrodible materials if they are well protected by suitable coating. All materials used should be clean and safe.

Reason

The careful control of hygiene and the environment during the sorting/sizing process is necessary to prevent contamination of the product and deterioration in product quality.

Compliance

1. The sorting/sizing area should be free from pest such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. All equipment, utensils, containers and materials used must be easy to clean and well maintained.
3. All workers must observe good personal hygiene practices such as wearing proper and suitable attire, footwear, hair net or hat, washing hands prior to commencing work, after each absence from duty and after using the toilet facilities, with a suitable hand cleaning soap and clean water.

Section 7 **Packing**

GMP 7.1 **Packing**

The dried shrimps should be packed as quickly as possible into clean food grade plastic (PE) bags or suitable plastic containers in a hygienic manner.

Reason

Packaging materials are designed to preserve the quality of the product and to protect the product against mechanical damage, dust, dirt, other extraneous foreign materials, insects and microbial contamination. The careful control of hygiene and the environment in the packing area is necessary to prevent contamination of the product and deterioration in product quality.

Compliance

1. Plastic (PE) bags or plastic containers used in packing should be clean and of food grade.
2. The packing area should be free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
3. All equipment, utensils, containers and materials used must be clean and in good condition.
4. All workers must observe good personal hygiene practices.

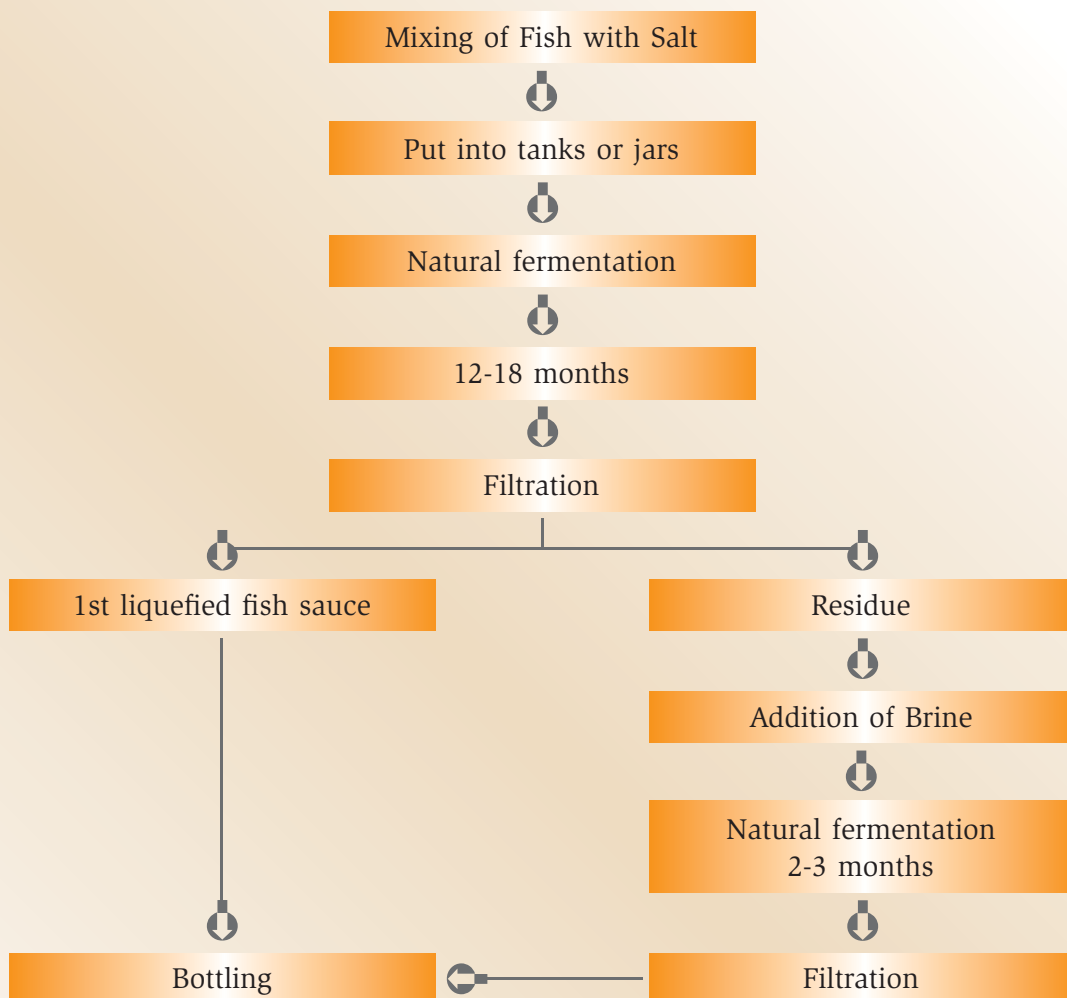
Product Name

Fish sauce – *Nam-pla*

Product Description

Fish sauce or *Nam-pla*, as it is known in Thailand, is a traditional fishery product that is well known not only in Asia but also in many parts of the world. Though *Nam-pla* can be made from many species of fishes, freshwater and marine, anchovies are the best raw materials for the production of fish sauce. The fish is usually mixed with salt at a ratio of 2:1 or 3:1 and left to ferment in fermentation tanks or jars for at least 12 months. The fermentation involves the hydrolysis or breaking down of proteins into their constituent peptides and amino acids. During the fermentation, the liquefied fish sauce rises to the top of the tanks or jars. After a sufficiently long period of fermentation, the fish sauce is examined. If it complies with certain quality specifications, it is filtered and prepared for retail. Fish sauce derived from the first batch of fermentation is considered top grade or “Grade A or 1” fish sauce. According to the Thai Food and Drug Administration (FDA) Act, fish sauce is graded according to their total nitrogen content, salt content, amino nitrogen, glutamic acid/nitrogen ratio, aroma, and color. After the first batch of fish sauce is taken off, the residue is fermented in brine for several more months. Subsequent batches are considered as lower grades of fish sauce.

Process Flow Diagram



Outline of Processing Steps

1. Mixing of fish with salt

The raw material (fish) is transported to the processing area in a fresh condition. Fish is mixed with salt in a fish to salt ratio of 2:1 or 3:1. Next, the fish and salt mixture is placed into appropriate containers such as jars, vats or concrete tanks and covered. This is to prevent contamination by water



Figure 1
Receipt of Raw Fish



Figure 2
Receipt of salt



Figure 3
Mixing of fish and salt

and insects. The containers may be left outside or inside a building.

2. Natural fermentation

The fermentation of the fish to form *Nampla* involves the hydrolysis or breakdown of proteins into peptides and amino acid by autolysis. For products with high concentrations of salt (> 20% salt by weight), the early stage of fermentation is facilitated by a group of non-specific bacteria. In the later stages of fermentation however, the fermentation is taken over by halophilic bacteria that can tolerate the higher concentrations of salt remaining in the fermentation containers. The growth and activity of microorganisms depend largely on their salt tolerance. The most



Figure 4
*Fermentation in earthen jars
(12-18 months)*



Figure 5
Fish sauce

common spoilage organisms found in fishes can be inhibited with the addition of large amounts of salts. The salt also serves to inhibit pathogenic bacteria that may enter the fermentation mixture. The fermentation usually lasts between 8 to 12 months. After which the fish sauce is checked and if it meets the quality specification, it is ready for bottling.

3. Filtration and Bottling

After 12-18 months of fermentation, a reddish-brown liquid is obtained. This liquid will have a specific aroma. As the Thai fish sauce standard states that fish sauce must be a clear liquid with no precipitate, the fish sauce has to be filtered

before being bottled. The processing room should be a specially designated area which is clean to prevent contamination by insects or flies.



Figure 6
Finished product – Fish sauce in bottles

GMP for Fish Sauce (*Nam-pla*)

The production of fish sauce must be carried out according to Good Manufacturing Practice (GMP) that comply with the Thai Food Act which states the minimum requirements for the following:

1. Location and establishment
 2. Equipment
 3. Production and process controls
 4. Sanitary and cleaning facilities
 5. Sanitation program and maintenance
 6. Personnel hygiene
- 1. Location and establishment:**
1. The surroundings of the establishment must be kept clean and free from objectionable odours, smoke, dust or other contamination.
 2. The floors in wet working areas where fish is received or processed are constructed of durable, waterproof, non-absorbent materials, which are easy to clean and disinfect. They are maintained in good repair and must be kept clean.

3. The hygiene and design of facilities should help prevent contamination from dogs, cats, birds, insects and other vermin.

2. Equipment

1. These should be made from stainless steel or hardened wood, which is non-absorbent and kept in a hygienic condition.

3. Production and process controls

1. Attention should be given to maintain the freshness of the raw materials in order to attain a final product of good quality.
2. The ratio of fish to salt has to be varied according to the size of the fish used as raw material.
3. The finished product should comply with the quality standard.

4. Sanitation and cleaning facilities

1. The water supply should be potable
2. Clean toilets are provided and in sufficient numbers.

5. Sanitation program and maintenance

1. The sanitation program should be adequate.
2. The building equipment, utensils and other physical facilities of the plant should be kept clean and maintained in an orderly and hygienic condition.

6. Personnel hygiene

Every person engaged in the handling or processing procedure should maintain a high degree of personal cleanliness

particularly in the packing areas. They should observe the following protocol:

1. Washing hands before and after work.
2. Caps or hats should cover hair properly.
3. Wearing suitable protective clothing.
4. No food or drinks are to be brought into the working area
5. No smoking and spitting
6. No jewelry and fingernail polish

Section 1 Mixing of fish with salt

GMP 1.1 Receipt of fish

Fish must be received in a fresh condition and free from decomposition.

Reason

If fish is not fresh or in a state of decomposition, there is the danger of high histamine content in the fish formed due to bacterial activity. A high histamine content is potentially harmful to humans who are allergic to this substance.

Compliance

1. The freshness of the fish can be maintained by reducing the transport time from the landing place to the processing establishment or by adding salt to the fish at the landing place before transporting the fish to the processing establishment.

GMP 1.2 Mixing of fish and salt

Mixing should be carried out hygienically in a clean area. The amount of salt used should be in the correct ratio and well mixed with the fish.

Reason

Mixing with salt should be carried out hygienically to prevent contamination and help control the growth of microorganisms such as halophilic bacteria and moulds. Salt must be sufficient and well mixed to ensure that no spoilage occurs during the fermentation process.

Compliance

1. Mixing should be carried out in a clean and properly sanitized area which is free from all pests.
2. All workers must observe good personal hygiene practices.
3. Utensils and containers used for mixing must be properly sanitized before and after use.
4. Utensils and containers used must be constructed from food grade materials which can tolerate high degrees of salt and free from corrosion.
5. It may also be carried out on a clean floor which is covered with a clean plastic sheet. However, it should never be carried out directly on the floor.

Section 2 Natural fermentation

GMP 2.1 Fermentation

Fermentation should be carried out hygienically in a clean area.

Reason

As the fermentation period is long (12 to 18 months), the careful control of hygiene and environment is necessary to prevent contamination and spoilage of the fish sauce.

Compliance

1. The fermentation area should be clean and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The fermentation containers should be washed and sanitized properly before and after use.
3. All utensils, containers and equipment used must be clean, made of non-corrodible materials capable of tolerating a high degree of salt and well maintained without any rust, cracks or crevices or any other damage.
4. The containers must have tight-fitting covers to prevent contamination from insects, rain and water seepage.
5. The date of fermentation and the number of the fermentation container must be recorded and labeled for each lot of fermentation.

Section 3 Filtration and Bottling

GMP 3.1 Filtration and Bottling

Filtration and bottling of the fish sauce should be carried out hygienically in a clean and dry area with good ventilation. The filter, equipment and bottles should be clean and stored in a sanitary manner before and after used. There should be awareness of personal hygiene amongst working personnel.

Reason

Filtration is necessary in order to produce a fish sauce of good quality as the Thai fish sauce standard states that fish sauce must be a clear liquid with no precipitate. The careful control of hygiene and sanitation is necessary to minimize the possibility of contamination of the fish sauce. The use of unclean bottles and caps will also result in product contamination

Compliance

1. The filtration and bottling area should be clean and free from pests such as cockroaches, flies and other insects as well as vermins and other animal pests such as dogs and cats.
2. All filtration and bottling utensils, containers and equipment used must be clean, made of non-corrodible materials capable of tolerating a high degree of salt and well maintained without any rust, cracks or crevices or any other damage.
3. All personnel must comply with good personal hygiene practices.

Vietnam

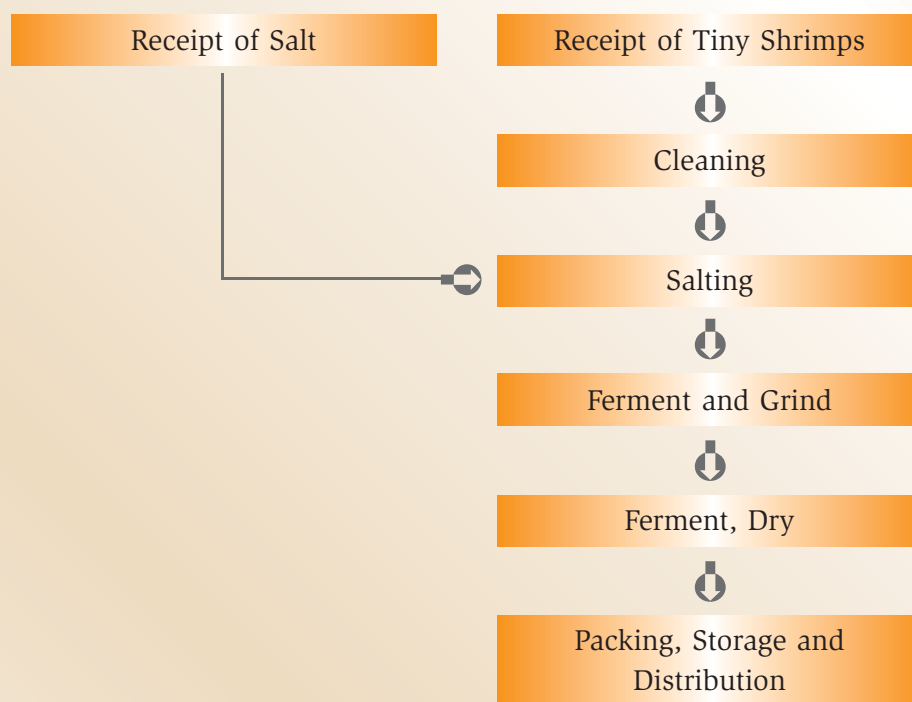
Product Name

Fermented tiny shrimp paste – *Mam tom*

Product Description

Fermented tiny shrimp paste or *Mam tom* in Vietnamese language is largely produced in the coastal provinces of Vietnam. Its ingredients include tiny shrimps and salt (10-13% by weight). The time required for fermentation may vary between two to six months. Depending on the technology used, the texture of the shrimp-salt mixture may be smooth or very smooth. The mixture will also possess a light and distinct fragrance.

Process Flow Diagram



Outline of Processing Steps

1. Receipt of Raw Materials

a. Receipt of tiny shrimps

To ensure that high quality shrimp paste is produced, the producers should only use tiny shrimps that are captured from the floating layer. Cast or drift nets that do not contain lead should be used. The tiny shrimps have to be despatched to the Traditional Processing Establishments (TPE) within three hours of their capture. In cases where the TPE is located far away from the location of capture, the shrimps have to be salted at a Pre-Processing Establishment (PPE) at or near the landing site before being sent to the TPE.



Figure 1
Tiny shrimps for Mam tom production

b. Receipt of Salt

The salt used for the production of *Mam tom* must comply with the national standard for salt and be fit for human consumption. The salt is received and stored in a separate storage place to ensure that it is hygienic for use in processing

2. Washing

At the TPE, the tiny shrimps are scattered on the clean cement floor or on plastic sheet. This is to allow all foreign materials such as sand, grit, seaweed and other small fishes to be removed. This is done manually

with or without the help of basket sieves. The shrimps are then washed two times with water in a tank to ensure thorough removal of foreign materials. The shrimps are washed in 50kg- batches. After the tiny shrimps are put into the tank of water, the mixture is stirred carefully to allow the lighter materials to float to the surface. The heavier materials like sand, grit and shells will sink to the bottom of the tank. After removing the floating foreign materials, the tiny shrimps are removed from the water taking care not to remove any shrimps at the bottom of the tank as they may be mixed with the heavier foreign materials such as sand and grit. The shrimps are then transferred to the second tank containing clean water and washed again.

3. Salting and Grinding

For the shrimps that are not salted at a PPE before delivery, salt is then added in the required proportions after the shrimps have been cleaned. The salted shrimps are then ground by a grinding machine.



Figure 2
Salting of tiny shrimps

4. Fermentation

The ground tiny shrimps are fermented in cement tanks, glazed terra-cotta jars or plastic bins for two to six months. The fermentation can occur outdoors in the presence of proper covers and lids, or

indoors depending on the methods used at the TPE. The time required for the grinding and the fermentation period may vary depending on the local practice. This will result in Mam tom of different degree of smoothness, colour and taste.

During fermentation, the shrimp paste is stirred daily. The worker must open the cover of the containing vessel and stir the mixture with a wooden/plastic stirrer every morning. It is then allowed to sun and the cover is then closed in the afternoon. In the event where there is rain, the covers are not opened. When the tiny shrimps cease bloating, the frequency of stirring is reduced to once every ten days. This is done to increase the temperature so that the hydrolysis reaction is speeded up leading to a shorter fermentation time



Figure 3
Outdoor fermentation in cement tanks with covers



Figure 4
Indoor fermentation in plastic bins with lids

and the specific taste and color of the final product.



Figure 5
Stirring the shrimp paste

5. Packing and Storage

The finished product may be packed in a number of ways after fermentation – in glass bottles, plastic bottles, cans and plastic (polyethylene) bags. Storage is at room temperature.



Figure 6
Shrimp paste packed in plastic bottle

GMP for fermented tiny shrimp paste (*Mam tom*)

Section 1 Receipt of Raw Materials

GMP 1.1 Receipt of tiny shrimps

Each lot of tiny shrimps should be checked for its organoleptic qualities, transportation conditions, means of preservation, and preservation temperature during transportation to the TPE.

Reason

The purpose of checking the raw material's organoleptic qualities, transportation and preservation conditions is to ensure that the raw materials are of high quality, safe for consumption and suitable for use in processing.

Compliance

The following are checked upon receipt of each lot of raw material:

1. Hygiene conditions of the transportation and preservation means.
2. Organoleptic qualities of raw material (color, smell, structure) - Lots that are spoiled, broken or tainted or have off-odours should be rejected.
3. Lots with excessive amounts of foreign materials such as sand, grit, dust, wood and leaves should be rejected.
4. The core temperature of the raw material must not exceed 10°C.

GMP 1.2 Receipt of salt

Upon receipt of each lot of salt, the following must be checked:

- Hygiene conditions during transportation
- Preservation means
- Label

If the lot of salt fulfils the specified criteria, it is weighed, recorded and despatched to a specialized store.

Reason

This is to ensure that the salt complies with food safety regulations and is safe for human consumption.

Compliance

The following are checked upon receipt of each lot of salt:

1. Hygiene conditions of the transportation means.
2. Condition of the package and proper labeling.
3. The following criteria should be observed:
 - Color: white, yellowish, pinkish.
 - Smell: odourless
 - Taste: Purely salty
 - Appearance and particle size: dry, clean, particle size of 1-1.5mm
 - Percentation of indissoluble substances: 0.4%.
 - Foreign matter: without grits, shells, pieces of wood and other foreign materials.
4. Salt must be used on a First-In-First-Out (FIFO) basis or according to the plant's rotation/inventory control schedule. Salt should not be beyond their expiry/used by date.

Section 2 Washing

GMP 2.1 Washing

Washing of the tiny shrimps should be carried out hygienically using chilled water from approved potable water sources and sorted out from unwanted foreign materials.

Reason

The purpose of washing is to minimize contamination by removing all extraneous foreign materials. The use of approved potable water sources will prevent possible contamination of the product by the water. Using chilled water will prevent or reduce microbial growth during the washing process.

Compliance

1. The water used must be from an approved potable source.
2. The temperature of the water should be maintained at below 5°C by refrigeration or with the addition of ice.
3. The washing area must be maintained in a clean condition and free from all pests.
4. All workers must observe good personal hygiene practices.
5. Washing utensils and containers must be constructed from food grade materials and free from corrosion. They should be properly washed and sanitized before and after use.

Section 3 Salting and Grinding

GMP 3.1 Salting

Salting should be carried out hygienically in a clean area. The amount of salt used should be carefully controlled to attain the desired product.

Reason

Mixing with salt should be carried out hygienically to prevent contamination and to help control the growth of microorganisms such as halophilic bacteria and moulds. Salting in a required concentration can inactivate the decomposing bacteria to ensure the normal activity of yeasts and other useful bacteria in transforming tiny shrimps into shrimp paste.

Compliance

1. Mixing with salt should be carried out in a clean and properly sanitized area which is free from all pests.

2. All workers must observe good personal hygiene practices.
3. Utensils and containers used for mixing must be properly sanitized before and after use.
4. Utensils and containers used must be constructed from food grade materials and free from corrosion.

GMP 3.2 Grinding

Grinding should be carried out using equipment that are clean, well maintained and suitable for the purpose.

Reason

Using clean and well maintained grinding machine will ensure that the products do not become contaminated by dirty equipment.

Compliance

1. Grinding equipment must be constructed from food grade materials and free from corrosion especially all food contact surfaces
2. Grinding equipment must be properly sanitized before and after use.

Section 4 Fermentation

GMP 4.1 Fermentation

Fermentation should be carried out hygienically in a clean area.

Reason

As the fermentation process is long from about two to six months, the careful control of hygiene and environment is necessary to prevent contamination and spoilage of the tiny shrimp paste.

Compliance

1. The fermentation area should be clean and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The fermentation containers/tanks should be washed and sanitized properly before and after use.
3. All utensils, containers and equipment used must be clean, made of non-corrodible materials capable of tolerating a high degree of salt and well maintained without any rust, cracks or crevices or any other damage.

Section 5 Packing and Storage

GMP 5.1 Bottling, Capping and Labeling

Bottling, capping and labeling should be carried out in a clean, hygienic manner and environment.

Reason

As these processes are carried out manually, the careful control of hygiene and sanitation is necessary to prevent contamination of the tiny shrimp paste. The use of unclean bottles and caps will also result in product contamination

Compliance

1. All bottles and caps must be washed and sanitized properly just before use.
2. All workers must observe good personal hygiene practices and properly attired with disposable gloves, face masks and hair covers.
3. The packing and storage area should be protected and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
4. The labels should have sufficient information such as product name, name and address of the producer, code (if available), date of production, date of expiry.

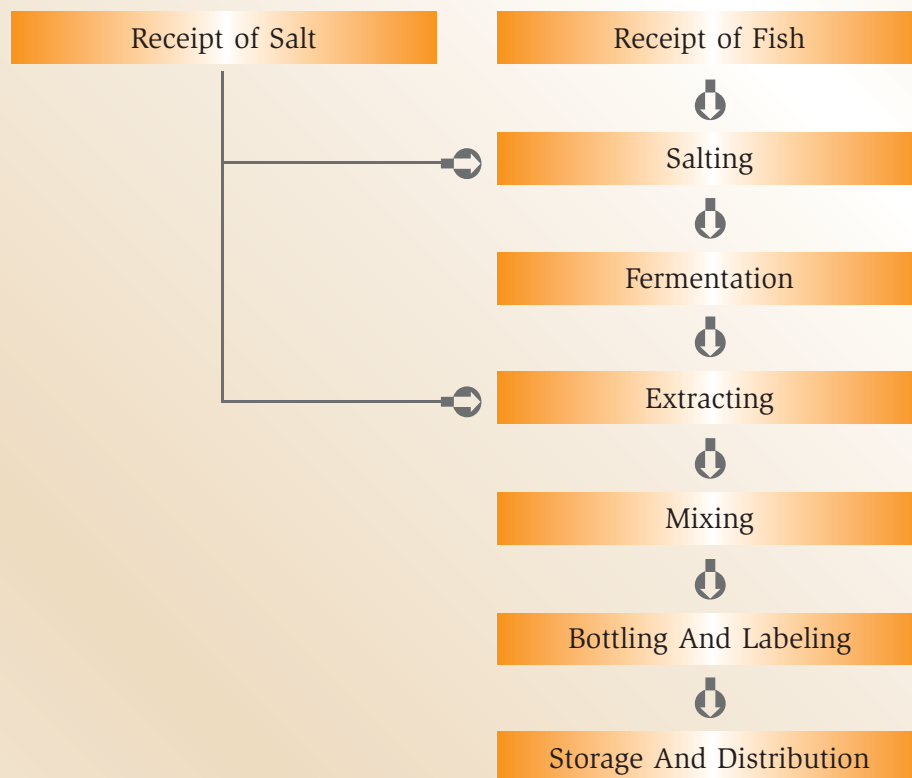
Product Name

Fish sauce – *Nuoc mam*

Product Description

Fish sauce or *Nuoc mam* is produced predominantly along the coastal and island provinces of Vietnam. Its two main ingredients are marine fish and salt. These two ingredients are mixed together at a given ratio. The fish used in the production of *Nuoc mam* may vary between a single fish species to a mixture of different fish species. This mixture is left to ferment for 6 - 12 months. Depending on the method used, the colour of the fish sauce may vary between light yellow to a dark brownish-yellow. *Nuoc mam* has its own distinctive flavour and odour. The final product is sold locally for domestic consumption and also exported.

Process Flow Diagram



Outline of Processing Steps

1. Receipt of Raw Materials

a. Receipt of fish

Raw fish must undergo organoleptic and quality inspection. Upon receipt of raw fish, the fish is rinsed with water and other miscellaneous fish species and foreign materials removed. The fish is then placed in iced water, drained and weighed.

b. Receipt of salt

The salt, which is approved under the national standard for edible salts, is received and stored in a separate store. This is to ensure that the salt remains clean and hygienic for use.

2. Salting

The fish is washed with water and drained before mixing with salt. The fish is mixed well with salt in a ratio of four parts fish to one part salt (fermentation method without stirring) or two parts fish to one part salt (fermentation method with stirring). The fish-salt mixture is then filled into earthenware jars leaving a gap of 20 to 30 cm from the mouth of the jar. A 1 to 1.5 cm thick layer of salt is then added into the jar on top of the fish. During the salting stage, it is necessary to control the salinity of the mixture. If the salinity does not reach 23-25° Be, it is necessary to add more salt.

3. Fermentation

Without stirring:

A woven bamboo mat is then placed over the fish-salt mixture in the jar. The entire set up is then weighed down with a wooden bar. The starting date of fermentation of each jar is carefully recorded. After two or three days, the turbid and bloody fluid inside the jar is extracted, left exposed to the sun and then poured back over the fish in the jar. This step is repeated at stipulated intervals over the period of 12

months of fermentation. Weekly checks must be conducted on the jars to avoid the development of mould-causing bacteria, to check on the blooming status of the fermented fish and to remove the foam on the top of the jar and to ensure that the fish are well submerged in salt water. After each month, the bamboo mats and wooden bar are removed, washed, dried under the sun and then re-placed in the set up.

With stirring:

The fish-salt mixture is left to ferment for two to three day after which 20-25% by weight of potable water is added. This percentage may vary depending on the type of fish used. A rake is used to stir the mixture to ensure the dissolution of the salt. In the absence of rain, the jars may be left uncovered during the day and covered at night. The mixture must be stirred on a daily basis. Within two to five days upon the addition of water, if the following are observed, it is advisable that more salt (5-10%) is added:

- Fish belly broken
- Fish fillet torn
- Fish floating on top of mixture
- Sour and stinking odour
- Bubbles develop when stirring the mixture

Upon the addition of salt, it is important to stir the mixture carefully. The stirring must continue in the following days as the fishes are left exposed to the sun. The addition of salt must occur four to five times until the fish have absorbed a sufficient amount of salt and have sunk down to the bottom of the jar. The fish should not be found floating on top. The salt percentage should be approximately 30-35%. The jars are uncovered daily to expose the fish to the sun. After 5-6 months, the distinctive odour of fish sauce will begin to materialize.

Classification of fish used to make fish sauce:

- Class A: Include fishes like Anchovies, Mackerels and Mud carps. Fish sauce made from Class A fish is considered as Top grade fish sauce.
- Class B: Include other fishes of good quality. Fish sauce made from Class B fish is considered Special and First grade fish sauce.
- Class C: Pelagic fishes such as goatfish and lizardfish.

Parameters to determine when the fermentation is complete:

- Colour is dark brown or grey. The first extracted liquid is reddish brown in colour.
- Distinct aroma and flavor without sour and off odour.
- State of fish:
 - Fermentation without stirring: The fish are still whole.
 - Fermentation with stirring: The fish are completely broken up and no foam emerges when the mixture is stirred.



Figure 1

Fish sauce fermenting in earthenware jars

4. Extraction

After fermentation, the fish sauce can be extracted.

a. Preparation of salt water

Edible salt is used to produce the salt water. One part of salt is added to three

parts of water. The mixture is stirred to allow all the salt to dissolve. The salinity of the water is then measured using a Baume meter. A salinity of 25 to 27°Bé is considered satisfactory. This clear and clean salt water is used in the extraction of fish sauce.

b. Extracting fish sauce

After 10-12 months, when the fish is sufficiently fermented, the earthenware jar is opened. The spigot on the bottom of the jar is then adjusted to drain all the liquid from the earthenware jar in a small stream into a tank. The woven bamboo mat is replaced and all the removed liquid is poured back into the jar over the fermented fish. The extraction procedure is repeated to obtain the top-grade fish sauce. The extraction and the re-addition of liquid must be done at a speed of 100 litres/10 hours, within a span of four to five days. The last extraction can be done within two to three days at a speed of 100 litres/12 hours to obtain top-grade fish sauce, which normally contains a protein level of over 35°N.

After the above procedure, the prepared salt water is added into the jar. The jar is connected to five to seven tanks. The finished product is the lower grades of fish sauce that is extracted from the last tank in the chain which usually contain a protein level of 15-20°N.



Figure 2

Siphoning fish sauce to the top of the jar



5. Mixing

Depending on customers' requirements, the top grade and lower grades of fish sauce may be mixed to obtain commercial fish sauce with a specific protein level.

6. Bottling and Labeling

The completed fish sauce is contained

in a tank. The fish sauce is packed into glass or plastic bottles, sealed and labeled as required.

7. Storage

The fish sauce is stored in a clean, dry and cool store and at an optimal temperature.

GMP for Fish Sauce (*Nuoc mam*)

Section 1 Receipt of Raw Materials

GMP 1.1 Receipt of fish and salt

Each lot of raw materials should be checked for its organoleptic qualities, transportation conditions, means of preservation, and preservation temperature during transportation to the TPE.

Reason

The purpose of checking the organoleptic qualities, transportation and preservation conditions is to ensure that the raw materials are of high quality, safe for consumption and suitable for use in processing.

Compliance

Fish:

The following are checked upon receipt of each lot of raw material (anchovy, mackerel, sardine, goatfish, etc.):

1. Hygiene conditions of the transportation and preservation means.
2. Organoleptic qualities of raw material (color, smell, structure) - Lots that are stale/spoiled, broken or tainted or have off-odours should be rejected.
3. Lots with excessive amounts of foreign materials such as sand, grit, dust, wood and leaves should be rejected.

4. The core temperature of the fish must not exceed 10°C.

Salt:

The following are checked upon receipt of each lot of salt:

1. Hygiene conditions of the transportation means.
2. Condition of the packaging material and the presence of proper labelling.
3. The following criteria should be observed:
 - Color: white, yellowish, pinkish.
 - Smell: Odourless
 - Taste: Purely salty
 - Appearance and particle size: dry, clean, particle size of 1-1.5mm
 - Percentage of indissoluble substances: 0.4%.
 - Foreign matter: without grits, shells, pieces of wood and other foreign materials.
4. Salt must be used on a First-In-First-Out (FIFO) basis or according to the plant's rotation/inventory control schedule. Salt should not be beyond their expiry/used by date.

Section 2 Salting

GMP 2.1 Salting

The fishes are washed/rinsed before being mixed with salt. Salting should be carried out hygienically in a clean area. The amount of salt used should be carefully controlled to attain the desired product.

Reason

The fishes are washed/rinsed to remove all foreign extraneous materials. Mixing with salt should be carried out hygienically to prevent contamination and help control the growth of microorganisms such as halophilic bacteria and moulds.

Compliance

1. Fish should be washed/rinsed using potable water and mixed with a percentage of salt depending on the processing method used - 25% by weight of salt for the woven bamboo mat placing method and 45-50% by weight of salt for the stirring method.
2. Mixing with salt should be carried out in a clean and properly sanitized area which is free from all pests.
3. All workers must observe good personal hygiene practices.
4. Utensils and containers used for mixing must be properly sanitized before and after use.
5. Utensils and containers used must be constructed from food grade materials and free from corrosion.

Section 3 Fermentation

GMP 3.1 Fermentation

Fermentation should be carried out hygienically in a clean area.

Reason

As the fermentation process is long (6-12 months), the careful control of hygiene and environment is necessary to prevent the contamination and spoilage of the fish sauce. This stage is essential in creating the distinct odour and flavour of fish sauce.

Compliance

1. The fermentation area should be clean and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.

2. The fermentation containers/tanks should be washed and sanitized properly before and after use.
3. All utensils, containers and equipment used must be clean, made of non-corrodible materials capable of tolerating a high degree of salt and well maintained without any rust, cracks or crevices or any other damage.
4. For fermentation method without stirring, after each month, the bamboo mats and wooden bar are removed. They are washed, dried under the sun and then re-placed in the set up described in step 2 in the outline of the processing steps.



Section 4 Extraction

GMP 4.1 Preparation of salt water

Salt water should be prepared hygienically using clean, good quality salt and potable water.

Reason

As the salt water will be used to extract the fish sauce, its hygienic preparation and the use of clean, good quality salt and potable water will prevent contamination and spoilage of the fish sauce.

Compliance

1. The salt used must comply with the national standard for salt and be fit for human consumption. The salt is received and stored in a separate storage place to ensure that it is hygienic for use in processing.
2. Water used must be potable.
3. Salt water should be prepared in a clean and hygienic area which is free from all pests.
4. All workers must observe good personal hygiene practices.
5. Utensils and containers used for mixing must be clean and properly washed and sanitized before and after use.
6. Utensils and containers used must be constructed from food grade materials and free from corrosion.

GMP 4.2 Extracting fish sauce

Extraction of fish sauce should be carried out hygienically in a clean area.

Reason

As the extraction process takes place over a few days, the careful control of hygiene and environment is necessary to prevent contamination and spoilage of the fish sauce.

Compliance

1. The extraction area should be clean and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The containers/tanks used should be washed and sanitized properly before and after use.
3. All utensils, containers and equipment used must be clean, made of non-corrodible materials capable of tolerating a high degree of salt and well maintained without any rust, cracks or crevices or any other damage.
4. All workers must observe good personal hygiene practices.

Section 5 Mixing

GMP 5.1 Mixing

The mixing of different grades of fish sauce should be done in a clean, hygienic manner and environment.

Reason

The careful control of hygiene and environment is necessary to prevent contamination and spoilage of the fish sauce during the mixing process.

Compliance

1. The mixing area should be clean and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
2. The containers/tanks used should be washed and sanitized properly before and after use.
3. All utensils, containers and equipment used must be clean, made of non-corrodible materials capable of tolerating a high degree of salt and well maintained without any rust, cracks or crevices or any other damage.
4. All workers must observe good personal hygiene practices.
5. The finished product should be stored in a dry and cool place.

Section 6 Bottling and Labeling

GMP 6.1 Bottling and Labeling

Bottling and labeling should be carried out in a clean, hygienic manner and environment.

Reason

As these processes are carried out manually, the careful control of hygiene and sanitation is necessary to prevent contamination of the fish sauce. The use of unclean bottles and caps will also result in product contamination

Compliance

1. All bottles and caps must be washed and sanitized properly just before use.
2. All workers must observe good personal hygiene practices and properly attired with disposable gloves, face masks and hair covers.
3. The bottling and labeling area should be protected and free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
4. The labels should have sufficient information such as product name, total nitrogen and sodium chloride content, name and address of the producer, code (if available), date of production, date of expiry.



Section 7 Storage

GMP 7.1 Storage

The bottled fish sauce (finished product) should be stored in a hygienic, cool and dry place.

Reason

Proper storage of finished products will help maintain quality and extend shelf life.

Compliance

1. The storage area should be clean, dry and well maintained.
2. The storage area should be free from pests such as cockroaches, flies and other insects as well as rodents and animals such as dogs and cats.
3. Finished products must be used on a First-In-First-Out (FIFO) basis or according to the factory's rotation/inventory control schedule and should not be used beyond their expiry or use-by dates.

APPENDIX



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