Reading Manual for Mussels Products

Under PMFME Scheme

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ABBREVIATIONS & ACRONYMS

Sr: No.	Abbreviations &Acronyms	Full Forms
1.	APEDA	Agricultural and Processed Food Products Export Development Authority
2.	FAO	Food and Agriculture Organization
3.	FBO	Food Business Operator
4.	FLRS	Food Licensing and Registration System
5.	FPOs	Farmer Producer Organizations
6.	FSSAI	Food Safety and Standards Authority of India
7.	Kcal	Kilocalorie
8.	MoFPI	Ministry of Food Processing Industries
9.	PA	Polyamide
10.	PET	Polyesters
11.	PFA	Prevention of Food Adulteration
12.	SHGs	Self Help Groups
13.	UK	United Kingdom
14.	US	United States
15.	WVTR	Water Vapour Transmission Rate

CHAPTER- 1

INTRODUCTION

Mussels are sedentary bivalve molluscs found attached to submerged hard substratum with the help of byssus thread. They are found in the inter tidal zone up to a depth of fifteen meters along the coastal area. Mussels can withstand wide variations in salinity and are found in rivers, in harbors, and the mouths of estuaries. They are filter feeders and feed on phytoplankton, zooplankton, and detritus. *Perna viridis*, is found in abundance along the rocky coastal belt, in the indo -pacific region. The brown mussel *Perna indica* is found only on the Indian coast. Mussels are found all along the east and west coast and occur abundantly from Kollam to Kasargod in Kerala and the south coast of Karnataka. The brown mussel, *Perna indica* is limited to a coastal stretch of 150 km from the south Kerala coast off Kollam to the Kanyakumari coast in Tamil Nadu. In the Malabar region, green mussel (*Perna viridis* - locally known as Kallumakai, Kadukka) is a major fishery.

The external color of the shell of the green mussel is jade green to bluish-green, whereas it is dark brown in brown mussel. The interior of the shell is shining in both cases. Two equal-sized shells protect the internal organs. The shells are thick, equivalve, triangularly ovate in outline, and hinged at the anterior end. The posterior end is almost round. The growth of the mussel is influenced by several environmental factors such as water quality, food availability, water current, tidal exposure, and settling density. Green and brown mussels attain a length of 80-88 mm with 35- 40 g weight and 65 mm with 25-40 g in 5 months under average culture conditions. The average edible portion of the meat in cultured mussels ranges from 34.5% - 40.5% whereas in the natural bed the meat yield is 27.2% -33.3 %. (CMFRI).

1.1 Post Harvest Technology

The local population uses mussel meat in fresh conditions for the preparation of different delicacies like arikaduka (rice mussel), mussel curry, and fried mussel fried and mussel biriyani. Central Institute of Fisheries Technology has successfully developed the technology/process for the preparation of dried and smoked mussel meat, marinated mussel meat, mussel meat pickle, mussel meat chutney powder, canned mussel meat, and ready-to-serve fried mussel meat, and thermally processed ready to eat mussel in retort pouches, etc. The mussel shells are composed of calcium carbonate which can be commercially exploited to make lime.

1.2 Depuration of mussels

The process of depuration consists of storing the live organisms in clear and clean seawater for a continuous period of 24 hours, whereby the intestines are flushed out. The organisms are stored in large containers or tanks, which ensure the circulation of fresh, filtered seawater. No feed or nutrient is given during this period. This depuration process is found to reduce the bacterial load of the meat by nearly 90 %.

Green Mussel

Depuration Process in tanks

1.3 Shucking

Bivalve molluscs have two main shells or valves which are joined together by a hinge and held shut by adductor muscles which function to open and close the valves, when open, pump in seawater containing food. Shells of fresh mussels are either tightly closed or will close when touched. If the shells are open or gaping, the mussels are dead or dying, and may well have an unpleasant smell. Unless the mussels are to be eaten raw, cooking the mussels in steam or boiling water normally removes the meat from the shell. There is also 60-70 % shrinkage with an accompanying weight loss. The meat is then manually removed from the shell.

Steam shucking

Steamed shell open

Mussel meat

CHAPTER 2
PROCESS & MACHINERY REQUIREMENT

2.1 Raw Material Aspects

Mussels freezing is a preservation process. In this process, mussels and their products are converted into ice within the water at a lower temperature. This technique boosts the shelf life and this approach is used internationally to monitor the quality of mussels and their items at the time of conservation. There are many ways in which mussels can be frozen, but both need specialized equipment to affect the necessary rapid temperature drop and adequately decrease the core temperature to ensure that the commodity can be safely stored in cold storage. If unfrozen fish are merely positioned in a cold store running at -300c, the temperature will decrease rapidly enough and the result will be frozen fish of poor quality; cold stores are built to keep fish already frozen at low temperatures.

Equipment and machinery are inevitable for the large-scale processing and manufacturing of fishery products. Manually it is not easy to process mussels that are landed in bulk quantities. Machinery help to maximize production with minimize human handling and reduce the wastage of mussels, which is otherwise a highly perishable commodity. For the mass production of mussels products, machinery is needed for mussels pre-processing, for suitable preservation techniques to be applied (i.e. chilling, drying, freezing, retorting, etc.), for value addition and pack it in appropriate containers and store it till it reaches the consumer in a good form. The use of appropriate equipment and machines along the fish value chain will help in producing better quality products and fetch a higher price.

2.2 Processing and value addition

2.2.1 Chilled mussel meat with advanced packaging

Mussel meat being highly perishable, proper chilling immediately after separating the meat will help it retain the quality for an extended period of up to a few days. Adoption of vacuum packaging, modified atmosphere, and active packaging will further enhance the shelf life by 2 to 3 times.

2.2.2 Frozen Mussel Meat

Raw and cooked mussel meat can be frozen either using individual quick freezing, plate freezing methods and packed in an attractive suitable packs. Mussel in frozen form can be marketed as bulk and retail pack and has a very long storage life when stored at -18°C.

2.2.3 Half Shelled Mussel

The half-shelled mussel has very high demand in both domestic and international markets. In this, the mussels are cleaned and steamed after which only one shell is removed. The product is either chilled or IQF frozen and stored and marketed.

2.2.4 Ready to eat mussel meat in metal cans

Thermal processing is an efficient processing method to achieve extended shelf life (one to two years) without using any preservatives and products can be stored at normal room temperature. Mussel meat along with mediums like oil, brine, or tomato sauce in the metal can is a delicacy in many countries. Apart from this, smoked mussel with a refined oil in metal cans is also an attractive product that has good demand in the international market.

2.2.5 Ready to eat Products from Mussel

Thermal processing of mussel meat in retortable pouches is an attractive alternative to the metal can as it increases nutrient retention and reduces the cost of production. Fried mussel with condiments and mussel curry, mussel soup, and biriyani are some of the products which have very good demand. The product can be stored at room temperature and has a shelf life of one year.

Ready to eat fried mussel

Mussel curry in retortable pouches

Mussel biriyani in thermoform trays

2.2.6 Arikaduka - A traditional mussel product

This is a traditional mussel preparation of north Malabar. Rice stuffed steamed mussel is dipped into a batter containing chilly powder, turmeric and fried in oil. In certain cases, the mussel is not removed from the shell. It is fried directly after stuffing with rice. During consumption, the shell is

removed. The product is marketed in the fried form. This product can also be processed in retortable pouches and has a shelf life of one year.

2.2.7 Dried Mussel Meat

Drying helps in reducing the moisture content and controlling water activity to inhibit the growth of spoilage organisms. Good quality dried mussel can be produced using modified sun drying or hot-air drier, solar driers, or advanced microwave and infrared driers. The dried mussel has a very long shelf life and can be stored at normal room temperature in appropriate packaging materials. The dried mussel meat can be re-hydrated by soaking in water and used for the preparation of various products. Here preservation is done by reducing the water activity. Mussels are cleaned, depurated, shucked, washed, and blanched in 5% brine for 5 minutes. Further dehydrated - sun-dried or artificially dried to a moisture level of 10-15%. The shelf life of dried mussels is about 6 months.

2.2.8 Battered and Breaded Mussel products

Battering and breading is another important segment of value-added products in which the meat is mixed with condiments and is coated with different types of batter and bread crumbs which results in crispy products upon frying. The product is frozen and stored at -18°C and has a shelf life of a minimum of 6 months.

2.2.9 Mussel soup powder

Mussel soup powder, which has very good demand in the domestic and international market can be prepared by cooking and drying mussel and other ingredients. Different flavored and combination soup powders of high protein content can be prepared.

2.2.10 Mussel Meat Pickle

Mussels of smaller sizes are usually used for the preparation of different types of pickles. Depurated and shucked mussel meat is blanched in 3% brine for 5 minutes. Addition of spices , condiments and and acetic acid aids in preservation. Pickles are then packed into dried glass bottles or polymer pouches and have a shelf life of 6 months.

2.2.11 Mussel Meat Marinade

Marination is ideal for preserving mussel meat for 2-3 months. Depurated and shucked mussel meat is blanched in 3% brine for 5 minutes. This cooked meat is packed in glass jars containing a solution of 3% salt and 3% acetic acid. The meat can be used for making mussel curry/pickle / etc.

2.2.12 Wafer from mussel meat

Wafer, a crispy snack product can be prepared using mussel meat. This is a very low-cost technology that can be started from any cottage industry or as a household business. The product can be stored at normal room temperature.

2.2.13 Nutrimix from mussel meat

A well-balanced Nutrimix, by incorporating required ingredients, vitamins, and mineral mix can be prepared to incorporate mussel meat. Incorporation of mussel meat results in an attractive flavored product.

2.2.14 Condiment-incorporated Fried Mussel Meat

Condiment incorporated fried mussel meat, a very tasty convenient product using mussel meat can be prepared and stored at room temperature for 3 months

2.2.15 Smoked Mussel

Smoking improves the flavor and succulence of the product. Depurated mussels are shucked, washed, and blanched in 5% brine for 5 minutes. Dried to a moisture level of 40-45%. Dried meat is smoked at 70 ^{o}C for 30 minutes. The further product dried to 10% moisture. Product shelf life is about 6 months

2.2.16 Bioactive peptides from mussel

Mussels are reported to contain many bioactive peptides, which can be extracted for developing products with health benefits for ailments like arthritis, etc.

2.2.17 Calcium from mussel shell

Mussel shells being thrown as waste can be utilized for extracting bioactive calcium and other minerals, which reduces the burden on the environment apart from creating a business opportunity.

The meat of mussels is highly nutritious and is in great demand in the internal as well as the export market. The local population of the Malabar Coast in Kerala prepares several products from mussels. CIFT has standardized several local recipes which can be popularized through proper preservation and packaging techniques. Value-added ready to eat products like condiment incorporated vacuum-packed fried mussel, mussel meat curry in different forms, like masala curry, chilly mussels, coconut mussel curry, mussel biriyani, mussel fried rice, and fried mussel in retort pouches and advanced packaging interventions developed by CIFT can be promoted considering the easiness of development, enhanced shelf life and convenience.

2.3 Types of Equipment

2.3.1 Steamer

In a steamer, Production is based on the client´s needs maximum of 3000 kgs/hour. The steamer has a Pneumatic door loading/unloading system for mussels, a Reception hopper for storage of products, Stainless steel indoor conveyor with high-performance oxidation resistance, Cyclone is mounted on the side to channel the steam discharges out of the factory. The steamer is also having Fully automated cycles with the option to re-program. The steamer is made of stainless steel AISI 316 and other stainless steel with high-performance oxidation resistance.

Steamer

2.3.2 Fryers

Frying is one of the fastest heat transfer methods available for cooking. It is a simple and commonly used technique for developing flavor, color, and unique product characteristics that cannot be duplicated by any other methods. Frying can be accomplished in a batch or continuous system. A Batch system is recommended for small-scale production and a continuous system for large-scale commercial production. The type of product and its sensory qualities and physical dimensions all have to be considered while selecting a frying system.

Fryer

2.3.3Freezers

For freezing mussel products, different types of freezers are available. The freezers selected for freezing depends on the type of products, quality requirements of the products, and type of packaging. The common freezers used are plate freezers, air blast freezers, and cryogenic freezers.

a) Plate freezers

In a contact freezer or plate freezer the mussels are frozen by direct contact with a refrigerated surface, typically between two hollow metal plates cooled by a refrigerant, such that the distance between the plates can be varied up to 100 mm or more. Horizontal and Vertical types of plate freezers are available. Horizontal freezers are generally used in processing plants in which mussels, especially in flat packs such as laminated blocks, is frozen between two or more hollow, horizontal, parallel plates through which refrigerant passes. In a vertical plate freezer, the refrigerated, parallel plates are vertical and it is used mainly at sea or onshore for freezing large 25 or 50 kg blocks.

Horizontal plate freezers

Vertical plate freezer

b) Air Blast Freezers

In an air blast freezer, fish is frozen in a stream of high-velocity cold air either in a batch or continuously, typically in a duct or tunnel in which a stream of cold air is guided over the product on shelves (batch) or a conveyor (continuous air blast freezer); also called blast freezer, freezing tunnel, tunnel freezer. The advantage of the blast freezer is its versatility. It can cope with a variety of irregularly shaped products and whenever there is a wide range of shapes and sizes can be frozen. Continuous air blast freezers and batch air blast freezers are used.

Air Blast Freezer

c) Tunnel Freezer

The equipment has a food-grade conveyor belt passing through an insulated chamber. It has an air-cooling system and an air blower to blow the air through the tunnel. Cold air is blown to the tunnel counter to the movement of the belt. The product to be frozen is passed through the belt. Circulating cold air at high speed enables the product to be frozen at a moderately rapid rate. Usually, the air temperature is between-18 and -34°C or lower. The moving of the product counter current to the cold

air at a speed of 1 to 20 meters/second enables freezing to take place at a rapid rate. It is the popular method to prepare frozen fish products as IQF (Individually Quick Frozen).

Marine products of small size in different forms and styles can be fluidized by forming a bed of the products on a perforated mesh belt and then forcing cold air upwards through the bed at a rate sufficient to partially lift or suspend the particles. The air used for fluidization should be sufficiently cooled; freezing can be achieved at a rapid rate. An air velocity of at least 2 meters/sec. or more is necessary to fluidize the particles and an air temperature of - 35°C is common.

Tunnel Freezer

d) Spiral belt freezer

Modern designs of belt freezers are mostly based on the spiral belt freezer concept. In these freezers, a product belt that can be bent laterally is used. It usually consists of a self-stacking and self-enclosing belt for compactness and improved airflow control. The number of tiers in the belt stack can be varied to accommodate different capacities and line layouts. The belt is continuous. The products are placed on the belt outside the freezer where they can be supervised. As the belt is continuous, it is easy for proper cleaning. Both unpacked and packed products are frozen and the freezer gives large flexibility both about the product and freezing time. Both horizontal and vertical airflow can be used.

Spiral belt freezer

e) Cryogenic Freezer

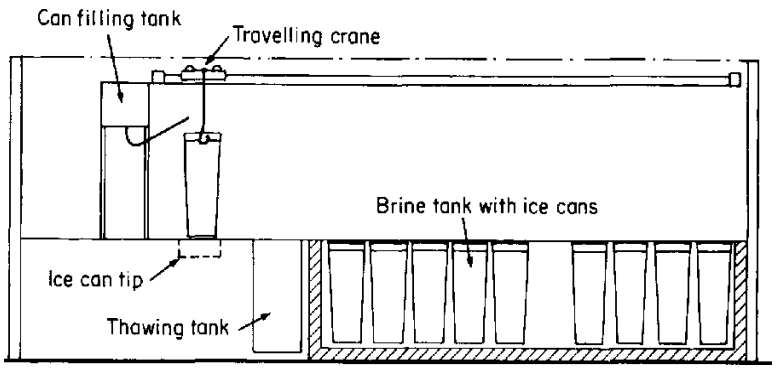
Cryogenic freezing refers to very rapid freezing by exposing food products to an extremely cold freezant undergoing change of state. The fact that heat removal is accomplished during a change of state by the freezant is used to distinguish cryogenic freezing from liquid immersion freezing. The most common food-grade cryogenic freezants are boiling nitrogen and boiling or subliming carbon dioxide. Liquid nitrogen is used in most cryogenic food freezers. Usually, liquid nitrogen is sprayed or dribbled on the product, or very cold gaseous nitrogen is brought into contact with the product.

Equipment for manufacturing ice

Cold preserves and maintains the quality of mussel products. Ice is a reliable coolant that has been put to good use for cooling both on and offshore. Ice can be produced in different shapes; the most commonly utilized in fish utilization are a flake, plate, tube, and block.

a) Block ice maker

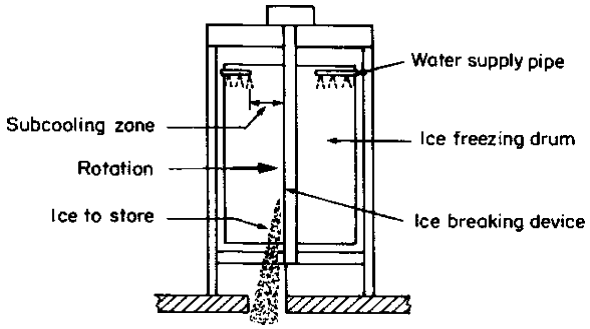
The traditional block ice maker forms the ice in cans which are submerged in a tank containing circulating sodium or calcium chloride brine. The block weight can vary from 12 to 150 kg, depending on requirements. A traveling crane lifts a row of cans and transports them to a thawing tank at the end of the freezing tank, where they are submerged in water to release the ice from the molds. The cans are tipped to remove the blocks, refilled with fresh water, and replaced in the brine tank for a further cycle. With an appropriate ice crushing machine, block ice can be reduced to any particle size but the uniformity of size will not be as good as that achieved with some other forms of ice. In some situations, block ice may also be reduced in size by a manual crushing method.



Block ice maker

b) Flake ice maker

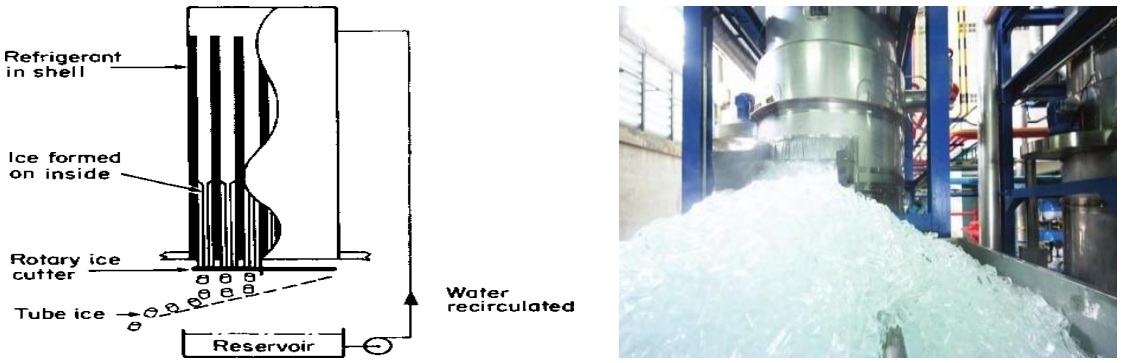
This type of machine forms ice 2 to 3 mm thick on the surface of a cooled cylinder and the ice is harvested as dry sub-cooled flakes usually 100 to 1,000 mm² in area. In some models, the cylinder or drum rotates and the scraper on the outer surface remains stationary. In others, the scraper rotates and removes the ice from the surface of a stationary drum, in this case, built in the form of a double-walled cylinder. It is usual for the drum to rotate in a vertical plane but in some models, the drum rotates in a horizontal plane. The refrigerant temperature, degree of sub-cooling, and speed of rotation of the drum are all variable with this type of machine and they affect both the capacity of the machine and the thickness of the ice produced.



Flake ice maker

c) Tube ice maker

Tube ice is formed on the inner surface of vertical tubes and is produced in the form of small hollow cylinders of about 50 x 50 mm with a wall thickness of 10 to 12 mm. The tube ice plant arrangement is similar to a shell and tube condenser with the water on the inside of the tubes and the refrigerant filling the space between the tubes. The machine is operated automatically on a time cycle and the tubes of ice are released by a hot gas defrost process. As the ice drops from the tubes a cutter chops the ice into suitable lengths, usually 50 mm.



Tube ice maker

d) Plate ice maker

Plate ice is formed on one face of a refrigerated vertical plate and released by running water on the other face to defrost it. Other types form ice on both surfaces and use an internal defrost procedure. Multiple plate units are arranged to form the ice-making machine and often these are self-contained units incorporating the refrigeration machinery in the space below the ice-maker. The optimum ice thickness is usually 10 to 12 mm and the particle size is variable. An ice breaker is required to break the ice into a suitable size for storage and use.

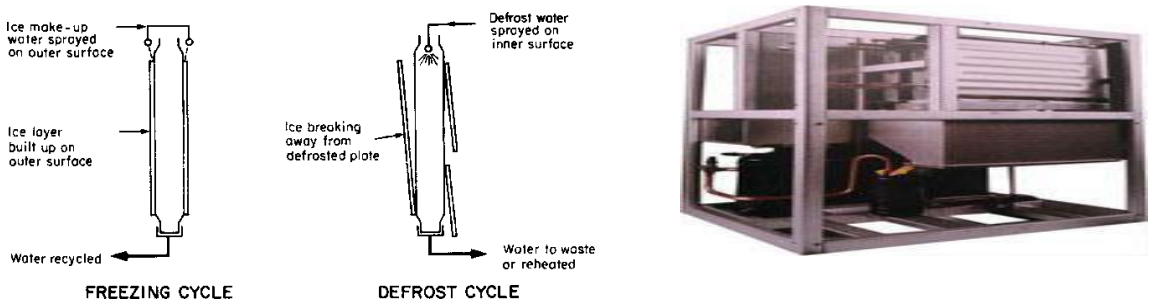


Plate ice maker

2.3.4 Dryers

Mussels smoking and drying are preservation techniques that are widely used in small-scale fisheries communities in developing coastal regions. This is advantageous compared to fresh or frozen mussels which requires cold storage that is largely inaccessible due to electricity scarcity in rural areas.

a) Mechanical dryers

In mechanical dryers, the removal of water from the mussel is achieved by an external input of thermal energy. This is an expensive method since there is a need for fuel for heating and maintenance of the temperature. The drying chamber consists of a long tunnel in which the washed and cleaned mussels are placed on trays or racks. A blast of hot air is passed over the material to be dried. After the required degree of drying the product is removed from the drier and packed. In mechanical dryers usually, the heat is transferred into the product through the hot gas. eg. Kiln dryers, cabinet dryers, tunnel dryers, and fluidized bed dryers.

b) Solar Dryers

In solar dryers during sunny days mussels will be dried using solar energy and when solar radiation is not sufficient during cloudy/ rainy days, another backup heating system will be automatically actuated to supplement the heat requirement. Thus continuous drying is possible in this system without spoilage of the highly perishable commodity to obtain a good quality dried product. Designs of solar dryers vary from very simple direct dryers to more complex hybrid designs. The hybrid model Solar Dryers having LPG, Biogas, Biomass, or Electricity as an alternate backup heating source for continuous hygienic drying of mussels even under unfavorable weather conditions. The capacity of these hybrid solar dryers varies from 6 sq. m to 110 sq. m tray spreading area for drying mussels (capacity 10kg to 500kg). CIFT has developed different models and capacities of solar dryers for hygienic drying of mussels

CIFT developed a hybrid solar dryer

2.3.5 Machinery for thermal processing of mussels

Thermal processing of mussels by canning or retorting is a method of food preservation in which food is packed in metal or glass or plastic containers, sealed airtight, and heated sufficiently to

destroy the spoilage, pathogenic, and food poisoning organisms making the food safe for consumption. The process involves a lot of machinery and the important ones are mentioned below.

2.3.5 **Pre-cookers**

Mussels are given a pre-cook by heating at a temperature range of 100 ºC. This operation is necessary to make it possible to handpick the meat from the shell. The most common pre-cookers are live-steam cookers fitted with condensate drains, vents, and safety valves. The mussels are placed in baskets which are placed on racks. The mussels are rolled into the cookers which are usually of rectangular cross-section and made of reinforced steel plate with a door, or doors, at one or both ends. The pre-cooking is a batch-type operation. Steam is admitted through a steam spreader on the floor of the cooker. Steam vent and drain valves are provided to permit the removal of air and condensate. Pre-cooking may also be carried out in boiling brine.

2.3.7 Exhaust boxes

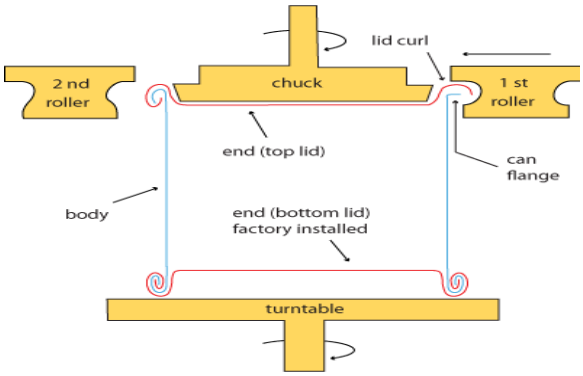
The exhaust box is used to heat the contents of cans, so that they may be sealed hot, thus ensuring that, after cooling, a vacuum has formed in the container. Exhausting also drives entrapped air from the pack. Exhaust boxes may take many shapes and forms, depending on the requirements of the cannery; basically, they consist of a tunnel through which the open and filled cans pass while being exposed to atmospheric steam.

Exhaust box

2.3.8 Sealing machines or can seamers

It is a machine used to seal the lid to the can body. The simplest of machines are hand-operated or semi-automatic single-head equipment with motorized drives. For those with a low output, hand-operated models are ideal. The sealing operation is initiated by depressing a foot pedal which lifts the can to the chuck on the sealing head and into position for double seam rolling.

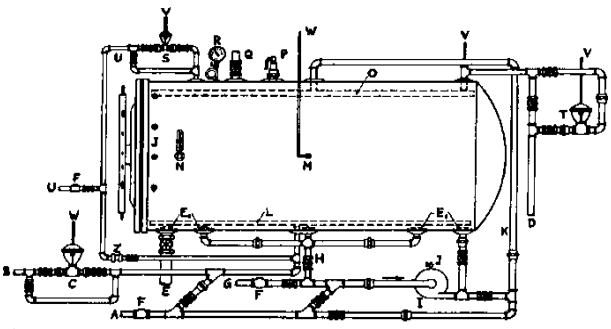
The first and second action rollers are sequentially brought into action while the can is rotated by the spinning seaming head. After the seaming operation, the sealing chamber is opened to the atmosphere and the hermetically sealed container is removed. Machines of the type described can frequently have the facility for steam flow closing, in which case steam is injected across the headspace of the container immediately before double seaming.



Can seamer

2.3.9 Retorts

All canned mussel products are sterilized at temperatures above 100 ºC. Thermal process sterilization takes place in retorts, with or without water. Overpressure is between 2-3 kg/cm². The simplest and most common retorts today are horizontal, or vertical, batch retorts. The most frequently used style of retort found in commercial canneries today is the static batch system for processing cans in saturated steam. The most significant difference between static retorts and continuous systems is that the latter must have container transfer mechanisms to regulate the movement of cans at a predetermined rate through the heating and cooling sections. Batch retorts heated with water under pressure are vertical or horizontal and are most frequently used for sterilization of products packed in aluminum cans with score-line easy-open ends.



Horizontal retort

2.3.10 Machinery for packaging

Packaging is a crucial element in the safety and protection of processed mussels products during their shelf life. It uses a variety of different materials to protect food and provide surfaces for labeling. Important machinery used for common packaging applications is discussed.

a) Sealers

Sealers are used in multiple forms of flexible packaging applications. A heat sealer uses heat to melt plastic or adhesive together to seal off a package. Heat sealers are used for many different products to help protect from product tampering and contamination. They can be used in small operations and fully automatic operations. Heat sealing systems use a combination of heat, time, and pressure to create a seal with a set of crimp seal heating bars. When the jaws come together, this melts a layer of plastic and bonds the two layers of film together. Different types of sealers are:

Band sealers are used to seal pouches and can be horizontal or vertical. In the typical embodiment, a moving pair of bands grasp the top of the package and moves it past the heating elements. Packages can be supported from beneath by a moving conveyor or in the case of lightweight packages, held by the sealing bands themselves.

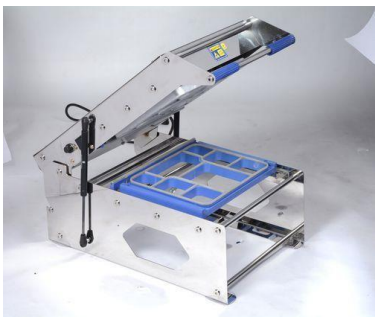
Blister sealers and tray sealers are used to attach thermoformed blisters to paperboard or film backings and can range from single package per cycle manual shuttle units to automated rotary type machines. In the case of tray sealers, plastic films are sealed over open ends of thermoformed plastic trays.

Vacuum packaging involves the removal of air from the package and the application of a hermetic seal. Vacuum sealers are used primarily for packaging owing to the benefit of low oxygen levels for retarding spoilage. Vacuum machines often incorporate a chamber for evacuating the package or tray before sealing the top layer or cover into place. They can be manual, semi-automatic, or automatic machines.

A vertical form fills sealing machine is a type of automated assembly-line product packaging system. The machine constructs plastic bags and stand-up pouches out of a flat roll of film, while simultaneously filling the bags with product and sealing the filled bags. Both solids and liquids can be bagged using this packaging system.

Hand sealer

Band sealer



Tray sealer

2.3.11 Labeling and coding machines

Labeling and coding machines are used for industrial and retail packaging applications. Most packaged products use some form of labeling or coding. Labeling machines are used for applying branded labels for advertising and/or bar codes for inventory and batch management.

Labeling and coding machines

2.3.12 Strapping and bundling machines

The most popular use for strapping machines is a reinforcement of heavy boxes during shipping and retail sales. Polypropylene strapping is commonly used. Strapping machines use heat to mend ends together for durable reinforcement. Another use for a strapping machine is bundling applications. Strapping can help unitize multiple products together and secure products for transport.

Strapping and bundling machine

2.4 Export Potential & Sales Aspect

Factors driving the global frozen seafood industry are growing the demand for frozen mussels products globally. Manufacturers concentrate on delivering healthy offerings of items. Frozen mussel products are frozen with cryogenic technology that aims to prevent the bacterial growth of frozen seafood products. Several frozen seafood companies worldwide use cryogenic freezing equipment to retain low temperatures of solid carbon dioxide or liquid nitrogen that is specifically added to frozen mussel products. Frozen mussel items can be preserved for a long period with the aid of advanced freezing technologies. Most customers change their choice to frozen foods over prepared foods because the nutrients are not destroyed in frozen foods and the food items are also eaten worldwide. The consistency of the products is preserved by these frozen mussel products and is therefore mainly eaten globally. Accordingly, robust growth over the projected timeframe is anticipated in the global Frozen fish food industry.

Some of these major parameters are discussed below: Many parameters regulate the consistency of the final product:

- Appearance: The most significant aspect of the appearance of any food is its color, particularly when it is directly correlated with other features of food quality. Form, surface profile, and clear texture are additional attributes. The appearance of food is just as important as its flavor and color to the success of a food product.
- Taste: The sensory system, or sense of taste, is the sensory system that is partly responsible for taste sensing (flavor). Taste is the perception produced or induced when a material in the mouth, often on the tongue, chemically interacts with taste receptor cells located on taste buds in the oral cavity. Any divergence from them would result in deviation in the final dish

of the different food items with their particular tastes, so it is important to preserve a uniform taste in refined food products.

- Content of Nutrition: A well-balanced ratio of the essential nutrients of carbohydrates, fats, proteins, minerals, and vitamins in food or dietary supplements is a measure of the nutritious content or nutritional value as part of the consistency of the food about the nutrient needs of the user. The higher the nutritional content of a food is its consistency, as appropriate ingredients have to be added to increase nutritional value along with the base ingredient.
- Shelf Life: Shelf life is the amount of time a substance can be processed without being unsafe for use, consumption, or sale. Provided a range of products with the same nutritious quality and flavor, it comes into play after presentation, taste, and nutrition, one appears to opt for the product with longer shelf life.
- The packaging: The quality of the product is often established, apart from the basics such as food-grade packaging material, the form of process and technology further increases the quality of the product, such as the incorporation of anti-microbial packaging to the value of the product and hence the quality.

CHAPTER- 3

PACKAGING

3.1 Introduction to packaging

Packaging is crucial to our modern food distribution and marketing systems. Without protective packaging, food spoilage and wastage would increase tremendously. The advent of modern packaging technologies and new methods of packaging materials made possible the era of convenience products. In the past packaging emphasized the expectations of the producers and distributors but now it has shifted towards the consumer since they are becoming more demanding and aware of different choices to choose from. A food package usually provides several functions in addition to protection.

Mussel is one of the most perishable foods. The best package material cannot improve the quality of the contents and so the mussel must be of high quality before processing and packaging. Different products have different packaging requirements and it is important to choose suitable packaging material accordingly. The intended storage conditions of the product, i.e., temperature, relative humidity, and expected shelf life have to be known. Multilayered plastics are very popular since the properties of different films can be effectively used to pack different products. The basic function of food packaging is to protect the product from physical damage and contaminants, to delay microbial spoilage, to allow greater handling, and to improve presentation.

3.2 Shelf Life of Product

Mussel freezing is a preservation process. In this process, mussels and its products are converted into ice within the water at a lower temperature. This technique boosts the shelf life of mussels and its products. This approach is used internationally to monitor the quality of mussels and its items at the time of conservation. There are many ways in which mussels can be frozen, but both need specialized equipment to affect the necessary rapid temperature drop and adequately decrease the core temperature to ensure that the commodity can be safely stored in cold storage. If unfrozen mussels are merely positioned in a cold store running at -300c, the temperature will decrease rapidly enough and the result will be frozen fish of poor quality; cold stores are built to keep fish already frozen at low temperatures. Any frozen fish or shellfish will be healthy indefinitely; after long storage, though, the taste and feel will fade. Freeze (0 °F / -17.8 °C or less) cooked fish for up to 3 months, for the highest consistency. Frozen raw mussel is best used within 3 to 12 months.

The shelf life of food stored depends on these 4 main criteria:

- Temperature:

  Foods stored at room temperature or cooler (75°F/24°C or lower) will be nutritious and edible much longer than previously thought according to findings of recent scientific studies. Foods stored at 50°F to 60°F (which is optimal) will last longer than foods stored at higher temperatures. Heat destroys food and its nutritional value. Proteins break down and some vitamins will be destroyed. The taste, color, and smell of some foods may also change.
- Moisture:

  The reason long-term food storage is dehydrated or freeze-dried is to eliminate moisture. Too much moisture promotes an atmosphere where microorganisms can grow and chemical reactions in foods causing deterioration that ultimately can sicken us.
- Oxygen:

  Too much oxygen can deteriorate foods and promote the growth of microorganisms, especially in fats, vitamins, and food colors. That is the reason to use oxygen absorbers when dry packing your food products.
- Light:

  Exposure to too much light can cause deterioration of foods. In particular, it affects food colors, vitamin loss, fats and oils, and proteins. Keep long-term food storage in low-light areas for the longest shelf life.

  Most expiration dates on foods in can range from 1 to 4 years but keep the food in a cool, dark place and the cans undented and in good condition, and you can likely safely double that shelf life from 3 to up to 6 years. It shall also conform to the following standards.

3.3 Types of Packaging Material

3.3.1 Glass

Glass containers have been used for many centuries and are still one of the important food packaging materials. Glass has its unique place in food packaging since it is strong, rigid, and chemically inert. It does not appreciably deteriorate with age and offers an excellent barrier to solids, liquids, and gases. It also gives excellent protection against odor

and flavor and product visibility. Glass can also be molded to a variety of shapes and sizes. But it has disadvantages like fragility, photo-oxidation, and is heavier in weight.

3.3.2 Cans

The most frequently used container for packing food for canning is a tin plate can. Tin plate containers made their appearance in 1810. The tin can is made of about 98% steel and 2% tin coating on either side. The base steel used for making cans is referred to as CMQ or can-making quality steel. Corrosion behavior, strength, and durability of the tin plate depend upon the chemical composition of the steel base. The active elements are principally copper and phosphorous. The more of these elements present the greater the corrosiveness of steel. Cans are traditionally used for heat sterilized products and different types are standard tin plates, tin-free steel, and vacuum deposited aluminum on steel and aluminum cans. For food products packing they are coated inside to get desirable properties like acid resistance and sulfur resistance. But care has to be taken to avoid tainting of the lacquer.

Polymer-coated two-piece cans of 6 oz capacity (307 x 109) with a universal polymer coating can be widely used for a variety of products. The can is made of Electrochemically chromium coated steel (ECCS) plate with clear polyethylene terephthalate (PET) coating on either side The finished plate has a thickness of 0.19mm (0.15 mm of base steel + 20 µ PET coating on either side). The cans are made out of the steel plate by the draw and redraw (DRD) process. The chromium coating along with the PET coating provides the can with a smooth, greyish, glistening appearance, in addition, to act as a barrier between the product and the base steel. The bottom of the can is designed for better stackability so that it can be stacked vertically without the risk of toppling on the shelf. This also helps to reduce the storage space required for the cans. These cans are found to be suitable for the thermal processing of fish and fish products. These cans are having easy-open ends. Metal cans are advantageous as packages because of superior strength, high-speed manufacturing, and easy filling and dosing. The disadvantages of metal cans are weight, difficulty in reclosing, and disposal.

3.3.3 Paper

A very considerable portion of packaged foods is stored and distributed in packages made out of paper or paper-based materials. Because of its low cost, easy availability, and versatility, paper is likely to retain its predominant position in the packaging industry. Paper is highly permeable to gases, vapor, and moisture and loses its strength when wet. Ordinary

paper is not grease and oil resistant but can be made resistant by mechanical processes during manufacturing.

3.3.4 Paper board

Thicker paper is called a paper board. There is not a clear-cut dividing line between the heaviest grade of paper and the lightest board. Moreover, the lightest standard board is 0.19 mm thick, and heavy papers are of 0.125 mm thickness. Paper boards are used for making corrugated fiberboard cartons.

3.3.5 Polymer Packaging

Plastics offer several advantages over other packaging materials since they are light in weight, flexible, and offer resistance to cracking. Plastics have the advantage that most of them possess excellent physical properties such as strength and toughness. The requirements with a particular food may not be met within a single packaging material, as it may not possess all the desired properties. In such cases, copolymers or laminates consisting of two or more layers of different polymers having different properties can also be used.

3.3.6 Low-Density Polyethylene (LDPE)

Most commonly used as it possesses qualities such as transparency, water vapor impermeability, heat sealability, chemical inertness, and low cost of production. Organic vapors, oxygen, and carbon dioxide permeabilities are high and have poor grease barrier properties. Resists temperature between – 40°C to 85°C. Polyethylene (polythene, PE) is the material consumed in the largest quantity by the packaging industry.

3.3.7 High-Density Polyethylene (HDPE)

HDPE resins are produced by the low-pressure process. HDPE posses a much more linear structure than LDPE and has up to 90% crystallinity, compared with LDPE which exhibits crystallinities as low as 50%. It is stronger, thicker, less flexible, and more brittle than LDPE and has lower permeability to gases and moisture. It has a higher softening temperature (121°C) and can therefore be heat sterilized. High molecular weight high-density polythene (HM-HDPE) has very good mechanical strength, less creep, and better environmental stress crack resistance properties.

3.3.8 Linear Low-Density Polythene (LLDPE)

Linear low-density polythene is low-density polythene produced by a low-pressure process. Normal low-density polythene has many $-C_5H_{11}$ side chains. These are absent in

LLDPE, allowing the molecules to pack closer together to give a very tough resin. It is virtually free of long-chain branches but does contain numerous short side chains. Generally, the advantages of LLDPE over LDPE are improved chemical resistance, improved performance at both low and high temperatures, higher surface gloss, higher strength at a given density, and greater resistance to environmental stress cracking. LLDPE shows improved puncture resistance and tear strength. The superior properties of LLDPE have led to its use in new applications for polyethylene as well as the replacement of LDPE and HDPE in some areas.

3.3.9 Polypropylene (PP)

Polypropylene is produced by the polymerization of propylene. All PP films have permeability about ¼ to ½ that of polyethylene. It is stronger, rigid, and lighter than polyethylene.

3.3.10 cast polypropylene (CPP)

It is an extruded, non-oriented film and is characterized by good stiffness, grease, and heat resistance and also has a good moisture barrier. However, it is not a good gas barrier.

3.3.11 Oriented, Heat-set Polypropylene (OPP)

Orientation can be in one direction (unbalanced) or two directions equally (balanced). The resulting film is characterized by good low-temperature durability, high stiffness, and excellent moisture vapor transmission rate. One drawback of OPP is its low tensile strength.

3.3.12 Polystyrene

The material is manufactured from ethylene and benzene, which are cheap. The polymer is normally atactic and it is thus completely amorphous because the bulky nature of the benzene rings prevents a close approach of the chains. The material offers a reasonably good barrier to gases but is a poor barrier to water vapor. New applications of polystyrene involve coextrusion with barrier resins such as EVOH and polyvinylidene chloride copolymer to produce thermoformed, wide-mouthed containers for shelf-stable food products and multi-layer blow-molded bottles. To overcome the brittleness of polystyrene, synthetic rubbers can be incorporated at levels generally not exceeding 14% w/w. High impact polystyrene is an excellent material for thermoforming. Co-polymerisation with other polymers like acrylonitrile butadene improves flexibility. Since it is crystal clear and

sparkling, it is used in blister packs and as a breathing film for packaging fresh produce. These materials have low heat sealability and often tend to stick to the jaws of the heat sealer.

3.3.13 Polyester

Polyester can be produced by reacting ethylene glycol with terephthalic acid. Polyester film's outstanding properties as a food packaging material are its great tensile strength, low gas permeability, excellent chemical resistance, lightweight, elasticity, and stability over a wide range of temperatures (-60° to 220°C). The latter property has led to the use of PET for boil in the bag products which are frozen before use and as over bags where they can withstand cooking temperatures without decomposing.

Although many films can be metalized, polyester is the most commonly used one. Metallization results in considerable improvement in barrier properties. A fast-growing application for polyester is ovenable trays for frozen food and prepared meals. They are preferable to foil trays for these applications because of their ability to be microwave processed without the necessity for an outer board carton.

3.3.14 Polyamides (Nylon)

Polyamides are condensation products of diacids and diamine. The first polyamide produced was Nylon-6,6 made from adipic acid and hexamethylenediamine. Various grades of nylons are available. Nylon-6 is easy to handle and is abrasion-resistant. Nylon-11 and nylon-12 have superior barrier properties against oxygen and water and have lower heat seal temperatures. However, nylon-6,6 has a high melting point and hence, it is difficult to heat seal. Nylons are strong, tough, highly crystalline materials with high melting and softening points. High abrasion resistance and low gas permeability are other characteristic properties.

3.3.15 Polyvinyl Chloride (PVC)

The monomer is made by the addition of a reaction between acetylene and hydrochloric acid. It must be plasticized to obtain the required flexibility and durability. Films with excellent gloss and transparency can be obtained provided that the correct stabilizer and plasticizer are used. Thin plasticized PVC film is widely used in supermarkets for the stretch wrapping of trays containing fresh red meat and produce. The relatively high water vapor transmission rate of PVC prevents condensation on the inside of the film. Oriented films are used for shrink-wrapping of produce and fresh meat. Unplasticized PVC is a rigid sheet material that is thermoformed to produce a wide range of inserts from

chocolate boxes to biscuit trays. Unplasticized PVC bottles have better clarity, oil resistance, and barrier properties than those made from polyethylene. They have made extensive penetration into the market for a wide range of foods including fruit juices and edible oils.

3.3.16 Copolymers

When polyethylene resins are being manufactured it is possible to mix other monomers with ethylene so that these are incorporated in the polymer molecules. These inclusions alter the characteristics of polythene. Vinyl acetate is commonly used and the resulting ethylene vinyl acetate (EVA) copolymers display better sealing than modified polythene. Butyl acetate is incorporated with similar effects.

3.3.17 Aluminium foil

Aluminum foil is defined as a solid sheet section rolled to a thickness less than 0.006 inches. Aluminum has excellent properties like thermal conductivity, lightweight, corrosion resistance, grease and oil resistance, tastelessness, odourlessness, heat and flame resistance, opacity, and non-toxicity. Aluminum foil free from defects is a perfect moisture and oxygen barrier. In all flexible packaging applications using aluminum foil where good moisture and oxygen barrier properties are important, the foil is almost always combined with heat sealing media such as polyethylene or polypropylene. It is the cheapest material to use for the properties obtained. Foils of thickness 8 to 40 microns are generally used in food packaging. Foil as such is soft and susceptible to creasing. Hence, foil is generally used as an inner layer.

3.4 Packaging Materials for Mussels Products

3.4.1 Mussel pickles

Mussel pickle is a value-added item whose bulk is contributed by low-value items like ginger, chilly, acetic acid, etc. Conventionally glass bottles are used as containers, which offer properties like inertness, non-toxicity, durability, non-permeability to gases, moisture, etc. But they are heavy, prone to break, voluminous, and expensive. New flexible packaging materials developed for fish pickle is based on plain polyester laminated with LDPE-HDPE Co-extruded film or Nylon/Surlyn or LD/BA/Nylon/BA/Primacore. These are inert to the product, can be attractively fabricated as stand-up packs, and can be printed on the reverse side of the polyester film.

3.4 2 Mussel soup powder

Mussel soup powder is a specialty product containing partially hydrolyzed protein, carbohydrates, fat, and several other seasonings including salt. The product is hygroscopic and hence the selection of the package assumes great significance. The appropriate package developed for such products is 12 microns plain polyester laminated with LDPE-HDPE co-extruded film or 90-100 micron LD/BA/Nylon/BA/Primacore multilayer films which ensure safe storage of the product for up to six months.

3.4.3 Extruded products

Ready-to-eat breakfast cereals, pasta, ready-to-eat, snacks, pet foods, and textured vegetable protein (TVP) are prepared by the extrusion process. An extruder consists of one or two screws rotating a stationary barrel and the mixed raw material is fed from one end and comes out through a die at the other end where it gets puffed up due to the release of steam. It is either in the ready to eat form and hence has to be hygienically packed for consumption. The extruded products are highly hygroscopic and hence they should not come into contact with moisture. Since the extruded product contains fat, the product should not be exposed to air. It is also highly brittle and may powder when crushed. Hence packaging films of high barrier strength and low permeability to oxygen and water vapor are required. Generally, extruded products are packed in LDPE/metalized polyester laminated pouches flushed with Nitrogen.

CHAPTER 4

FOOD SAFETY REGULATIONS AND STANDARDS OF FROZEN

4.1 Introduction to FSSAI

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards, 2006 which consolidates various acts & orders that have hitherto handled food-related issues in various Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

Highlights of the Food Safety and Standard Act, 2006-

Various central Acts like Prevention of Food Adulteration Act, 1954, Fruit Products Order, 1955, Meat Food Products Order, 1973, Vegetable Oil Products (Control) Order, 1947, Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992, etc will be repealed after commencement of FSS Act, 2006.

The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities shall enforce various provisions of the Act.

Establishment of the Authority-

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of the Food Safety and Standards Authority of India (FSSAI) have already been appointed by the Government of India. The Chairperson is in the rank of Secretary to Government of India.

4.2 FSSAI Registration & Licensing Process

According to Section 31(1) of the Food Safety and Standards (FSS) Act, 2006, Every Food Business Operator (FBO) in the country is required to be licensed under the Food Safety & Standards Authority of India (FSSAI).

As per FSS (Licensing & Registration) Regulations, 2011, Licenses and Registrations are granted to FBOs in a 3 tier system

- Registration - for petty FBOs with annual turnover less than Rs 12 lakhs
- State license - for medium-scale food manufacturers, processors, and transporters
- Central License - for large-scale food manufacturers, processors and transporters

FSSAI registration is done online on the FSSAI website through Food Safety Compliance System (FoSCoS)

- FoSCoS has replaced the Food Licensing and Registration System (FLRS).
- Petty food business operators are required to obtain FSSAI Registration Certificate
- "Petty Food Manufacturer" means any food manufacturer, who manufactures or sells any article of food himself or a petty retailer, hawker, itinerant vendor or temporary stallholder (or) distributes foods including in any religious or social gathering except a caterer;

Or

- Other food businesses including small scale or cottage or such other industries relating to food business or tiny food businesses with an annual turnover not exceeding Rs. 12lakhs and/or whose production capacity of food (other than milk and milk products and meat and meat products) does not exceed 100 kg/ltr per day

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

FSSAI License - two types - State FSSAI License and central FSSAI License

Based on the size and nature of the business, the licensing authority would change.

- Large food manufacturers/processors/transporters and importers of food products require a central FSSAI license
- Medium-sized food manufacturers, processors, and transporters require a state FSSAI license.

- License period: 1 to 5 years as requested by the FBO.
- A higher fee for obtaining an FSSAI license for more years.
- If an FBO has obtained the license for one or two years, renewal may be done, no later than 30 days before the expiry date of the license.

4.3 Food Safety & FSSAI Standards & Regulations

2.6. Fish and Fish Products: 2.6.1 Fish and Fish Products- Frozen fish fillets or minced fish flesh or mixtures thereof are products obtained from fresh wholesome fish of any species or mixtures of species with similar-sensory properties. Fillets may be pieces of irregular size and shape with or without skin. Minced fish flesh consists of particles of skeletal muscle". and is free from bones, viscera, and skin. The product may be glazed with water. The products shall conform to the following requirement: -

Particular	Characteristics	Requirements
1.	Total Volatile Base (Nitrogen)	Not more than 30 mg/ 100gm
2.	Histamine	Not more than 20 mg / 100gm

Note I: Products under articles 1, 2, 3, 4, and 5 shall be frozen in appropriate equipment quickly to minus (-) 18º C or colder in such a way that the range of temperature of maximum crystallization is passed quickly. The quick-freezing process shall not be regarded as complete unless the product temperature has reached minus (-) 18º C or colder at the thermal center after thermal stabilization. The product shall be kept deep frozen to maintain the quality during transportation, storage, and sale. The entire operation including processing and packaging shall ensure minimum dehydration and oxidation. The product may contain food additives permitted in Appendix A except for the listed product under regulation 2.6.1 (3). The product shall conform to the microbiological requirement given in Appendix B. The products shall be free from any foreign matter and objectionable odor/flavor[i]

Food Safety

Part I - General Hygienic and Sanitary Practices to be followed by Petty Food Business Operators applying for Registration

Sanitary and hygienic requirements for food manufacturer/ processor/handler

The place where food is manufactured, processed, or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain an overall hygienic environment. All new units shall be set up away from environmentally polluted areas.

2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain an overall hygienic environment.

3. The premises shall be clean, adequately lighted and ventilated, and have sufficient free space for movement.

4. Floors, Ceilings, and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per the requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead, fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors, and other openings shall be fitted with a net or screen, as appropriate to make the premise insect-free The water used in the manufacturing shall be potable, and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.

6. A continuous supply of potable water shall be ensured on the premises. In the case of intermittent water supply, adequate storage arrangements for water used in food or washing shall be made.

7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.

8. No vessel, container, or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing, or storage of food. (Copper or brass vessels shall have proper lining).

9. All Equipment shall be kept clean, washed, dried, and stacked at the close of business to ensure freedom from the growth of mold/ fungi and infestation.

10. All equipment shall be placed well away from the walls to allow proper inspection.

11. There should be an efficient drainage system and there shall be adequate provisions for disposal of refuse.

12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.

13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all times and the person should not be allowed to come in direct contact with food.

14. All food handlers shall keep their fingernails trimmed, clean, and wash their hands with soap, or detergent, and water before commencing work and every time after using the toilet. Scratching of body parts, hair shall be avoided during food handling processes.

15. All food handlers should avoid wearing, false nails or other items or loose jewelry that might fall into food and also avoid touching their face or hair.

16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.

17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.

18. The vehicles used to transport foods must be maintained in good repair and kept clean.

19. Foods while in transport in packaged form or containers shall maintain the required temperature.

20. Insecticides/disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

4.4 Labelling Standards (Regulation 2.5 of FSS)

Labeling requirements for packaged food products as laid down in Part 2.4 of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name, or description
2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colors, and Flavors
6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number, or volume of contents
9. Distinctive batch, lot, or code number
10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre-packaged assorted vegetables, flours, vegetables and products that comprise of single-ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

Wherever applicable, the product label also must contain the following

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of coloring material.

Non-vegetarian food – any food which contains whole or part of any animal including birds, freshwater or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown color-filled circle inside a brown square outline prominently displayed on the package, contrasting against the background on the display label near the name or brand name of the food.

Vegetarian food must have a similar symbol of the green color-filled circle inside a square with a green outline prominently displayed.

All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or Maybe made on a card or tape affixed firmly to the package and bearing the required information before customs clearance.

Exporters should review Chapter 2 of the "FSS (Packaging and Labelling) Regulation 2011" and the Compendium of Food Safety and Standards (Packaging and Labelling) Regulation before designing labels for products to be exported to India. FSSAI revised the labeling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO member countries and the comments received are under review and the publication date remains unknown.

According to the FSS Packaging and Labelling Regulation 2011, "pre-packaged" or "pre-packed food" including multi-piece packages, should carry mandatory information on the label.

Conclusion

Sheetal is a very popular fish product in northeast India. Irrespective of rich or poor, Sheetal is a daily requirement of all the tribal and majority of the non-tribal population of the region. Moreover, there is a great demand for this product amongst the NE-Indians residing in other states of the country or in abroad. If Sheetal could be produced following the method mentioned here, the product will be safe from a nutritional point of view. With the help of packaging technology, Sheetal could be made available in all grocery shops and malls. Moreover, due to similar food habits, Sheetal has the potential to be exported to neighboring as well as other Southeast Asian countries. In the present situation of unemployment, entrepreneurship development through Sheedal technology is a very promising field.

CHAPTER 5

OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

5.1. PM-FME Scheme

Ministry of Food Processing Industries (MoFPI), in partnership with the States, has launched an all India centrally sponsored "PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)" for providing financial, technical, and business support for up-gradation of existing micro food processing enterprises. The objectives of the scheme are:

I. Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards, and Udyog Aadhar;
II. Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene, and quality improvement;
III. Handholding support for the preparation of DPR, availing bank loan and up-gradation;
IV. Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure, and support branding and marketing.[ii]