CHAPTER 4
PROCESSING OF CEPHALOPODS

INTRODUCTION

In recent years the processing of cephalopods has shown a rising trend due to greater world demand. About 24 – 26 seafood factories in Cochin process cephalopods and they account for 60% of the cephalopod processing in India. Cephalopods are considered a delicacy in foreign markets and high quality is the norm especially in international trade. It is a remarkable feature that almost all the cephalopods processed are exported. Indian Standards Institution brought out standards for squid and cuttle fish in 1976(IS8076) outlining physical, sensory and bacteriological quality. The emphasis today is on high quality ensuring freshness of the material.

Studies have been made on storage characteristics of iced and frozen squid and cuttle fish (Joseph et al, 1977, Dhananjaya et al 1987; Joseph and Perigreen,1988). James and Iyer (1998) have evaluated the quality of frozen cuttle fish and squid by organoleptic, microbiological and biochemical means.

Borgstrom 1965, Learson and Ampila (1977) Thrower and Thrower 1978 have found that cephalopods remain good in frozen condition up to eight months.

Lakshmanan et al (1993) have studied the quality levels of squid (Loligo sp) and cuttlefish (Sepia sp) for export in the sensory, biochemical and

Sophia and Sherief (2003) indicate that treatment with 2% salt and 0.2% citric and improved quality of cuttlefish fillet and improved quality was observed up to eight weeks of frozen storage. Selvaraj et al (1991) found that ascorbic acid treated squid (Loligo sp) had improved quality and shelf life and no discoloration was seen even after nine months. Several studies have shown that ascorbic acid treatment improves quality of seafood in general.

Proteolytic degradation is probably the single most important characteristic affecting eating quality of cephalopods. Cephalopods are known to have short life spans of two to three years. Some grow rapidly and die after spawning. For rapid growth an active proteolytic system for protein turnover must exist. Active proteinases are found in the visceral and mantle portion of cephalopods. On death it is assumed that they enter a state of uncontrollable protein degradation from natural and bacterial sources. Rough handling and pressure of icing and storage probably releases proteolytic enzymes resulting in faster degradation.

Though cephalopods can be processed in dried, canned, smoked and other forms, in India freezing is the predominant method especially specially for the export market.
Cephalopods have good nutritive value with the amino acid content almost similar to fish. The meat offers as many calories as white fish meat, has high biological value and rich source of B vitamins and phosphorous. They are fancied as a culinary delicacy in Japan, Spain, Portugal, USA and other countries. About 70% of the cephalopod body is edible forming the mantle, arms, tentacles and fin. And as such the most important use is as human food. In India the entire catch is exported mostly in the frozen form with very little of it is being consumed in the domestic market. A small portion is canned or dried.

The high protein and low fat content make them suitable for human consumption (Roper et al. 1984)

While several products are made from cuttlefish, squid and octopus in various forms the dominant products are in the frozen form for export, Mainly forms an cuttlefish whole, whole cleaned, fillets etc. squids – whole, whole cleaned, tubes, rings etc. and octopus as whole, whole cleaned etc. An effort is made to study the handling and processing of various cephalopod products followed by the industry and propose improvements to enhance the quality of products.

Materials and Methods

The material used for the study were the raw material available for processing at various seafood processing plants, processing cephalopods for export from Cochin. The main studies were at M/s Bhatsons Aquatic Products
Ltd, Aroor, Cochin. The company is a multi seafood product company dealing in frozen fish, shrimps and cephalopods mainly. It has steady supplies of raw material from suppliers and is operational round the year.

The company is a European Union Certified Company processing seafood products exclusively for export to the demanding international market. The operations of the preprocessing and processing lines and methods were closely monitored and recorded. The Company has in place a HACCP system to produce the finest quality material. Suggestions were tried to modify the processing operations and results evaluated.

**Cephalopod processing**

Maintenance of good quality begins with the fishing operations itself and the main factors for taking care of the good quality are listed below:-

1. Careful and speedy handling to avoid crushing and freshness of the material is an indispensable requirement for foreign market. Crushing will result in breakage of ink sacs and cause black colour spoiling the appearance.

2. Contact with dirty surface on board should be avoided and if frozen on board, must be kept cool before freezing and must be frozen quickly.

3. Fresh skin colour is an indispensable requirement and contact with warm air should be limited to the shortest time possible.
Trawling, jigging and gillnetting are the main methods of fishing. Squid jigging causes the minimum damage and it is the most appropriate fishing method for the Japanese market where freshest quality is required. Trawling can cause physical damage during the fishing operation and when the catch is hauled on to the deck. Netted squid often exhibits torn and spilt mantles. One of the causes of damage in trawl fishing is the presence of large amount of debris, especially mussel shells and other bottom wastes. This can be avoided to a large extent by the use of free hanging chains and floats that accentuate the lift of the net.

The unprocessed squid is cooled in chilled sea water and iced immediately for processing on the shore. Direct contact with sun is avoided by the use of plastic sheets, so that skin discolouration can be avoided. The squid are kept in plastic/polystyrene crates and iced with crushed block ice or flake ice for processing later. Care is taken to avoid direct contact of melting ice with the body of the squid. The squid caught by trawl net are immediately washed and sorted according to size and iced. In the case of onboard processing the squid are laid out evenly, according to size category tail by tail with tentacles folded underneath and along the squid.

Methods and equipment used in freezing the squid are same as that of fin fish. The product shape, product temperature, thickness of the layers in the freezing tray etc are some of the factors that influence the freezing time. Both squid and cuttle fish are processed as whole, fillets or tubes. Mainly the cuttle
fish and squid are gutted in the factory only and it involves four steps. First the part of the head above the eyes and tentacles are cut off. This is followed by pulling away the head with the intestine. Then the mantle is spili and the inside is cleaned. For cutting rings the mantle is turned inside out and the remaining parts of the intestine are scraped off. The opened and eviscerated mantle is cleaned with potable water containing 5mg/kg available chlorine to remove all the impurities. The cleaned mantle is kept in iced water nearest to 0°C before freezing and the duration in iced water should not exceed more than two hours. This is because the contact with water has a protein leaching effect on the meat and hence excessive contact with water during the process must be avoided. The material is quick frozen at temperature of -40°C within four hours after filleting and dressing. It should not take more than 90 minutes to freeze the core of the material. The quick frozen material shall be stored in cold storage at -23°C or below. White appearance of the product is important for the market, especially for IQF products and to attain the white colouration and to avoid the rosy tint on the material, a bath in water containing citric acid and 3-4 Kg of salt per 100 liter is given. The result is that the tube is bleached with the citric acid and prevents the rosy tint while the salt firms up flesh.

The cuttle fish are laid on a table with central side down and the cuttle bone is removed first. This is followed by removal of viscera and cleaning of the mantle. The ink sacs, if required are kept for cooking. Skin is removed by making a cut on the neck and tearing it toward the tail end. The octopus are
washed and the viscera is removed by holding the octopus on one hand exposing the inner parts and pulling out the viscera with the other hand. The viscera are then cut away at the throat and the body is thoroughly cleaned.

The main type of squid products are squid whole, squid whole cleaned, squid tube, IQF whole cleaned squid/ squid tubes, IQF stuffed tube, IQF rings with tentacles, IQF squid ring and squid tentacles. Size grades such as U/3, U/10, 10/20, 20/40, 40/60, 60/80 and 80 up per kg are packed in 2 Kg blocks in waxed cartons. Ten such blocks form the master carton. The cuttlefish products are cuttlefish whole, cuttlefish whole cleaned (cuttlefish fillets with tentacles), cuttlefish fillets, cuttlefish wing on, IQF whole cleaned, cuttlefish fillet rolled. The cuttlefish products are also packed in size grades starting from U/1 per kg and packed in 1 or 2 kg poly bags. Ten or twenty such poly bags forms a master carton.

Canning of cephalopods is of minor importance with only 1 to 2 % of the total landings in the world utilized in this way. However drying of squid are commercially practiced in Japan, other Asian countries and in Canada. The drying is thought to produce tasty and highly nutritious products. Tabashi (1905) maintained that sun drying induces particularly attractive flavour in the product. The sun drying takes about 3-5 days. The squids are hung over ropes with tentacles on one side and the fins on the other side. When the squid are about 70% dry, they are pressed between wooden boards or flattened by hand. This process is called shaping and the squid after shaping is placed in a tray
with tentacles hanging from the tray. When the drying is completed with about 18-22% moisture, the shaping is done again.

For smoking of squid and cuttle fish the cleaned mantle is soaked in hot water at 50-55°C for 2-3 minutes and skinned. This is followed by seasoning the mantle with dry seasoning material. The mantles are then piled in two or three layers on a table and pressed by weights in order to facilitate the penetration of the seasoning material for several hours. The seasoned mantles are smoked at temperature of 60-70°C for about 7-9 hours. The smoked mantle is cut in to rings of 1-2 mm width and seasoned with wet seasoning solution. Then the rings are drying in hot air and packed in plastic bags.

The value added products of cephalopods include battered rings and stuffed squid. For battering the squid rings are dusted with flour and dipped in batter mixture. The battered rings are then flash dried in hot vegetable oil at 180°C for about 20 seconds and rapidly frozen. The frozen, battered rings are packed in transparent polythene bags and stored under refrigeration. The stuffed squid comprises the tube of squid filled with stuffing, made basically from head tentacles and fins, seasoned according to the taste. The tube is not entirely filled and the filling mixture should be thick. The stuffed rings are put in to trays and frozen. Accelerated freeze dried products are also seen today.

The consumption of Cephalopods is mainly in traditional markets of East- South Asia and Europe. The market desires high quality products and the
primary requirement is the freshness of the raw material. This is indicated by fresh sea weedy odour and firm, elastic texture of the frozen material.

The typical operations of processing under commercial condition in a typical seafood processing factory are described below. Some of the main frozen product of cuttle fish and squid are given with description of raw material selection, process operation, Hazard analysis and critical control point checks.
GENERAL PROCESS FLOW CHART FOR FROZEN CEPHALOPODS

INGREDIENT RECEIVING

WASHING, WEIGHING & ICING

PRE-PROCESSING

SALTING, AGITATING & ICING

PROCESSING

FREEZING

GLAZING & WEIGHING

FREEZER STORAGE

SHIPMENT

PACKING MATERIAL RECEIVING

R.M. RECEIVING CHILLED STORAGE

CHILLED STORAGE

GLAZE HARDENING & PACKING

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STANDARD OPERATING PROCEDURE FOR RAW FROZEN
CUTTLE FISH CFW, CFFT, CFFT W AND CFW/C, BLOCK
FROZEN/IQF

Food Description

◊ Raw frozen cuttlefish –

◊ Block Frozen - 10X2KG AND 6X2 KG

◊ IQF - 10X1 KG, 1X10KG, 1X12KG

◊ Items - CFW, CFFT, CFTN

Incoming Materials:

Fresh cuttle fish whole are purchased directly from the landing center. After collecting the necessary information like time of catch, area of harvesting etc. from the suppliers, the raw material is inspected and satisfactory material are purchased. The purchased materials are kept in plastic containers with adequate quantity of ice at a temperature of <+5°C in chilled water and is brought to the pre-processing centre (PPC) in refrigerated trucks. At the PPC the materials are again checked for quality parameters. The raw material is d-eiced and organoleptic evaluation is done, for every 500 kgs, one sample is drawn to assess the quality standards. The observations are recorded in raw material evaluation register. Separate samples are taken from every arrival of raw material for testing the presence of any residues. If the test fails the material will be straight away rejected, they are within the quality
parameters, it is received, weighed and given for pre-processing activities like deskinning, cleaning ice and removal of beaks, tentacles, head etc. Separate raw material samples for bacteriological analysis are also taken.

The excess raw material received are kept in raw material chill room while the material received after the quality inspection are peeled (deskinning), cleaned and graded before it is given for processing. The excess quantities of pre-processed materials are kept in plastic containers of 50 liters capacity with adequate quantity of ice in chill rooms and kept below +5°C.

Packaging materials are delivered in clean, well maintained and covered vehicles. All the materials are checked for the prescribed quality. Only the material, which satisfies the quality standards are accepted. They are hygienically kept in dry storage rooms provided.

Processing:

The pre-processed materials are transported to the factory. The cleaned and graded material are weighted according to the product specifications and then placed in the freezing trays with enough chilled water added to obtain the proper glaze of the product. The weight and labelling instructions are put as per the buyer specification and is monitored by the production supervisors.

Care is taken to wrap the cuttle fish in polythene sheet after adding the glaze water to prevent any freezer burn on the product while freezing. The filled trays with product are then loaded into the horizontal plate freezer and
zen as blocks for a period of 60 minutes at – 40°C. If the product is IQF the
added material is fed into the IQF belt/plastics crates and after freezing
manual glazing is done. The time and temperature are monitored by
maintenance operator.

Packaging:

The frozen product is packed in master cartons according to the buyer
pecification. The weight and labeling instructions are put as per the buyer
order and is monitored by the production supervisors.

Storage:

Packed products are kept in cold store below – 18°C in separate
compartments according to the product type. The temperature of the store is
recorded using a continuous thermograph indicator, and is monitored by
Quality control (QC) supervisors. The QC technologists take one sample for
microbiological analysis.

Shipping:

Shipment of the product is directly done from the store to pre-cooled
containers without disturbing the cold chain. The stuffed containers are taken
to the port for export to destination.
<table>
<thead>
<tr>
<th>No.</th>
<th>Factors</th>
<th>Maximum Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Appearance and odour</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>2.</td>
<td>Dehydration</td>
<td>Nil</td>
</tr>
<tr>
<td>3.</td>
<td>Discoloration</td>
<td>&lt;2%</td>
</tr>
<tr>
<td>4.</td>
<td>Deterioration</td>
<td>Nil</td>
</tr>
<tr>
<td>5.</td>
<td>Broken/Damaged/Bruised Pieces</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>6.</td>
<td>Texture</td>
<td>Soft and firm</td>
</tr>
<tr>
<td>7.</td>
<td>Temperature</td>
<td>&lt;5°C</td>
</tr>
</tbody>
</table>
FLOW DIAGRAM OF BLOCK FROZEN CUTTLEFISH WHOLE

CP +7°C for 3 hours → WHOLE RAW MATERIAL

WASHING

GRADING

WASHING IN MACHINE

CHECKING (ON WHITE BACKGROUND)

ICING (IN CRATE)

TRANSPORTING TO FACTORY

RECEIVING

FILTH & SPRAY WASH → WASHING ← 2 PPM chilled chlorine water

SORTING & GRADING (WHITE BACKGROUND)

WEIGHING

CHECKING

SETTING IN PAN 2 PPM chilled water

CCP Temp. - 40°C → FREEZING
STANDARD OPERATING PROCEDURE FOR RAW FROZEN SQUIDS SQW, SQT, SQW/C, SQT & TN. SQUID STUFED, SQTN, SQRG & SOFT, BLOCK FROZEN/IQF.

**Food Description**

- Raw frozen squids
- Block Frozen -10X2 KG AND 6 X 2KG
- IQF -10X1 KG, 1X10 KG, 6X 1KG
- Items - SQW, SQT & TN, SQT, SQTN, SQFT, SORG

**Incoming Materials:**

Fresh squid are purchased from the landing centre. After collecting the necessary information like time of catch, area of harvesting etc., from the suppliers, the raw material is inspected and satisfactory material are purchased. (Table 4.2) The purchased materials are kept in plastic containers with adequate quantity of ice at a temperature of <+5°C in chilled water and is
Fought to the PPC in refrigerated trucks. At the PPC the materials are again checked for quality parameters. The raw material is de-iced and organoleptic evaluation is done. For every 500 kg one sample is drawn to assess the quality standards. The observations are recorded in a raw material evaluation register. Separate samples are taken from every arrival of raw material for testing the presence of Sulphite residues. If the test fails the material will be straight away rejected. If the materials are within the quality parameters, it is received, weighed and given for preprocessing activities like de-skimming, cleaning, removal of eye and beaks, removal of tentacles, for beheading etc. Separate raw material samples for bacteriological analysis are also taken.

The excess raw materials received are kept in raw material chill room. The material received after the quality inspection are peeled (de-skinned), cleaned and graded before it is given for preprocessing. The excess quantities of preprocessed materials are kept in plastic containers of 50 liters capacity with adequate quantity of ice in chill rooms kept below +5°C.

Packaging materials are delivered in clean, well maintained and covered vehicles. All the materials are checked for the prescribed quantity. They are hygienically kept in dry storage rooms provided.

Processing:

The pre-processed materials are transported to the factory. The cleaned and graded materials are weighed according to the product specifications and then placed in freezing trays with enough chilled water added to obtain the
proper glaze of the product. The weight and labeling instructions are put as per the order given and is monitored by the production supervisors. Care is taken to wrap the squid in polyethylene sheet after adding the glaze water to prevent any freezer burn on the product during freezing and storage. The filled trays with product are then loaded into the horizontal plate freezer and frozen as blocks for a period of 60 minutes at \(-40^\circ\text{C}\). If the product is IQF, the graded material is fed into the IQP belt/plastics crates and after freezing manual glazing was done. The time and temperature are monitored by maintenance operator.

Packaging

The frozen product is packed in master cartoons according to the buyer specification. The weight and labeling instructions are put as per the buyer's order and is monitored by production supervisors.

Storage :

Packed products are kept in cold store at below \(-18^\circ\text{C}\) in separate compartments according to the product type. The temperature of store is recorded using a continuous thermograph indicator, and is monitored by Quality Control (QC) supervisors. The QC technologists take one sample for microbiological analysis.

Shipping :

Shipment of the product is directly done from the store to precooled
containers without disturbing the cold chain; the stuffed containers are taken to the port of discharge.

Table 4.2 Squid Whole Raw Material Specification

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Factors</th>
<th>Maximum Tolerance Limit in a sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Appearance and odour</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>2</td>
<td>Dehydration</td>
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<td>3</td>
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<tr>
<td>4</td>
<td>Deterioration</td>
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<td>Broken/Damaged/Bruised Pieces</td>
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<td>6</td>
<td>Texture</td>
<td>Soft and firm</td>
</tr>
<tr>
<td>7</td>
<td>Temperature</td>
<td>&lt;5°C</td>
</tr>
</tbody>
</table>
FLOW DIAGRAM OF BLOCK FROZEN SQUID – WHOLE

-3°C for 3 hours → HEAD ON RECEIVING
  → ICING
  → WASHING
  → CLEANING
  → GRADING
  → WASHING IN MACHINE
  → CHECKING-IN WHITE TABLE
  → ICING-IN CRATES
  → TRANSPORTING TO FACTORY
  → RECEIVING

FLITH & SPRAY ← WASHING ← 2 ppm chilled chlorine water
SORTING & GRADING – WHITE TABLE

WEIGHING

CHECKING IN WHITE BOARD

SETTING IN PAN ← 2 Ppm Chilled Water

TEMP. −40°C → FREEZING

PACKING in master cartons at −20°C

STORING

SHIPPING

FLOW DIAGRAM OF BLOCK FROZEN SQUID TUBE

CCP+7OC for hours

HEAD ON RECEIVING

ICING

WASHING

PEELING

105
SEPERATING HEAD AND BODY
  ↓
CLeanING
  ↓
GRADING
  ↓
WASHING IN MACHINE
  ↓
CHECKING-IN WHITE TABLE
  ↓
ICING-INCRADES
  ↓
TRANSPORTING TO FACTORY
  ↓
RECEIVING
  ↓
FILTH & SPRAY ← WASHING ←→ 2ppm chilled chlorine water
  ↓
SORTING & GRADING - WHITE TABLE
  ↓
WEIGHING
  ↓
CHECKING IN WHITE BOARD
  ↓
SETTING IN PAN ←→ 2 ppm chilled water
  ↓
CCP Temp. - 40°c ← FREEZING ← master cartons at -20°c
  ↓
PACKING
  ↓
STORING
  ↓
SHIPPING
Standard operating procedures for cooked products

From the in feed elevator the material passes into the cooking chamber through an in feed shaker, where it is blanched or cooked as per the requirement or product specification. The main difference between blanching and cooking is the temperature of processing and the duration of the treatment. Blanching is done for a shorter period of time and at a comparatively lower temperature than cooking. (Table 4.3)

Blanching is done based on the product description, but it is usually done for shrimps, squid rings, tentacles etc, whereas cooking mainly done for clams and mussels. Blanching or cooking time is based on the belt speed. Belt speed of the blancher/cooker is controlled by a motor and time of blanching is calculated by cycles of motor. The belt speed for cooking/blanching is calculated by cycles of motor. The belt speed for cooking/blanching depends on the material and grade.

The temperature in the blancher can be controlled by adjusting the rpm of the conveyor, by adjusting the level of the water in the blancher with water level controller and maintaining the hot water temperature by pumping water through a pneumatic controller.

The above control measures prevents the under/over cooking so that it will give even cooking and helps to maintain the yield of a product. In blanching the minimum temperature is 66°C for 15 to 75 seconds, which is
necessary to destroy the human pathogenic organism. Blanching/Cooking controls enzymatic action.

**Table 4.3 Blanching temperature for cooked product.**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Critical Time</th>
<th>Operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>80/100</td>
<td>75°C</td>
<td>75-77</td>
</tr>
<tr>
<td>100/200</td>
<td>75°C</td>
<td>75-77</td>
</tr>
<tr>
<td>200/300</td>
<td>75°C</td>
<td>75-77</td>
</tr>
<tr>
<td>300/500</td>
<td>75°C</td>
<td>75-77</td>
</tr>
<tr>
<td>500/UP</td>
<td>75°C</td>
<td>75-77</td>
</tr>
</tbody>
</table>

**Chilling**

From the cooker the blanched / cooked material passes into the chiller through the conveyor. The material is chilled in water at a temperature of 2-3°C with 2ppm chlorination.

For continuous cooling of a blanched or cooked product fast cooling is recommended. Cooling ensures minimum weight loss while bringing the product to the requisite freezer check temperature. The product is fed from the blancher to the cooler.

Through a belt where it is immediately cooled by a chilled spray and carried into the cold-water bath. Just near the exit from the bath, another cold-water spray is directed on the product, thereby achieving best freezer infeed temperature. The belt lifts the product out of water bath and drains all the
surface water prior to freezer feed. Cooling time can be adjusted between 30 to 150 seconds.

**Freezing**

From the chiller the material passes into the flo freezer, via pre-cooler and the material is frozen at a temperature of -4°C for 10 to 15 min.

Flo-freezer is based on fluidization, which means fast, gentle, hygienic and individual (IQF) freezing of a wide range of products. Flo-freezer is fully continuous and integrated with the production line. The fluidization principle is that the product is exposed to an upwardly directed air stream that supports and conveys the product through the freezing without any need for a conveyor belt.

On its way through the Flo-freezer, each individual product particle is completely surrounded by air of sufficiently low temperature, suspended separately on a cushion of air the particles not only the freezes quickly but uniformly through out the product tray, it freezes with a minimum damage and clustering is minimized. This ensures complete individual quick freezing (IQF) and highest possible quality. The mass of product, which flows out of the freezer, is at the same rate as they are fed in.

**Glazing**

The frozen materials are surface glazed while passing through a glazer using chilled water at a temperature below 5°C chlorinated at 5ppm level.
The glazers are designed to provide each product a uniform protective ice coating. The product is fed to the vibrating screen of the glazer from the freezer through an adjustable angle chute.

The product is conveyed by the oscillatory vibrating motion of the screen and is sprayed with cold water from top and bottom by specially spray nozzles.

Glazing helps to prevent dehydration, it also enhances the shelf life of the product by reducing rancidity, it even prevents decomposition, gives a shining, desirable appearance. Over glazing causes clustering of product.

Glazing of the product depends on efficiency of the nozzle, movement of the product through conveyor, size of the product, temperature of the glaze water, time of exposure to water spray.

**Glaze Hardening**

From the glazer the glazed material passes into the Glaze freezer. The material is further frozen for glaze hardening at a temperature of -30 to 35°C.

It is a fiber conveyor belt, which takes the glazed product directly to the glazo-freezer (Hardening freezer). It also helps to avoid clustering of the product after glazing.

**Metal Detection & Filling**

The glaze frozen product is channelised through a metal detector, which is sensitive up to 0.1mm diameter metal piece. On passing through that, the
product is collected in the 10 kg. bulk cartoons and then taken for weighing.

Weighing

The filled cartons are now taken to the electronic weighing machine and their weights are made correct according to the glaze percentage.

Packing

Counted numbers of 10 kg master cartons are taken and put into tubs of 50 – 100 kg. capacity. Girls stand with small mugs of 50g capacity along with each tub and fill poly bags with desired product in declared proportions for Seafood Mix & if it’s single product packing then they fill the bags with the same product & check their weight to the filling weight for the packs. The filled poly bags are heat sealed immediately and such bags are packed in a master carton of specified capacity.

The 10kg lots are bulk packed into aster cartons with polythene lining. The amster cartons are sealed and secured by taping by carton sealer.

Storage

Store is adjacent to the packing area. After packing the cases are stacked on trolley and are pulled to the storeroom through anteroom.

In storeroom the materials are grouped material wise, grade wise and packing wise separately.

The packed master cartons are stored at -18°C or below. The QC in charge ensures the correct flow of work and control of temperature. The
thermo printer automatically records the cold storage temperature. The quantity of the finished material is recorded in the packing register. Each day's production is identified by a day coding system (e.g., 3A16) and marked D or day shift and N for night shift and additionally A, B, C, etc. has subdivisions for each lot arriving boat wise to ensure traceability and enable recall procedure in case of non-compliance.
Flow diagram: Cooked Products

RAW MATERIALS

Receiving

Weighing

Storage

Peeling

Cleaning

Soaking

Feeding

Cooking – CCP

Packing

Chiling

Freezing

Glazing

Glaze hardening

Packing

Metal checking - CCP

OTHER INGREDIENTS
DETERMINATION OF CRITICAL CONTROL POINTS AT RECEIVING AND FREEZING AREAS

Preventive Measures

All the products are accepted only if the product temperature is below 5°C and free from decomposition.

Critical limit

Temperature : - +5°C

Decomposition : - NIL

Monitoring Procedures

The raw material arrives in plastic boxes. 25 boxes are considered as one lot and from such a lot one box is checked for decomposition and temperature by trained personnel. If there is any delay in processing, the material is re-iced and held in the chill room to get the temperature below 5 degree C. This is done under the supervision of the trained personnel.

Corrective Action:

If there is any decomposition in the sample, then each box of that particular lot is checked and the boxes, which contain decomposed, materials are rejected and recorded in the corrective action format. If the temperature of the sample box is above the critical limit, then increase the number of sample boxes. From this the boxes, which are above critical limit, are re-iced. All corrective actions are recorded in the Corrective Action Format.
Chemical Hazards:-

Even though the chances of occurring of pesticide and heavy metal contamination is very less a competent external agency is engaged to conduct analysis on these factors and obtain the result once in three months, for antibiotics. All consignments are checked by an outside competent authority.

Preventive Measure

In the case of additional sulphite presence, daily check the raw material with Malachite green solution.

Corrective Action

If any Raw Material shows the presence of additional sulphite, reject that material immediately.

Critical Control Point (Freezing)

Hazards

Biological Pathogen

Preventive Measures

Checking the temperature and time of freezing by the technical person. After freezing the core temperature of product is checked.

The product is loaded into freezer only if it is pre-cooled for 15 minutes. A technical person supervises all these factors.
Critical Limit

Temperature : -40 degree C

Time : 90 minutes

Core Temperature : 18 degree C or below

Monitoring Procedures

The freezer temperature, freezing time and core temperature of the frozen slabs is being carried out by a technical person for each load. All these data are recorded in the Time – Temperature Chart.

The temperature of the freezer is monitored by automatic temperature gauge and the core temperature by Thermometer.

Corrective Action

If there is any fluctuations of the freezer temperature time, and core temperature of the slabs, then we will take following actions.

1. *Freezer temperature and time :-*

   Rectify the defects and record in the corrective action format.

2. *Core Temperature :-*

   If the core temperature of the slab is above – 18 degree C, then it will have to be refreezed and recorded in the Corrective Action Format. The lot which found to be defective is considered as a separate lot and subject to verification procedures in the lab and recorded in the Corrective Action Format.
Packing

Companies have high quality packing system, where separate storage, labelling and packing facilities are provide, the packing material are attractive and of good quality, so that they serve both the functions - consumer attraction and product quality maintenance. The products are packed in the required cartons as per the customer's demand.

Packing materials:

Polythene sheets: 30x30 size transparent polythene sheets are used for packing cuttle fish and squid.

Polythene bags:

Shrimps are usually packed in polythene bags 9x21 size transparent polythene bags are used for shrimp packing. 30x30 size transparent poilythene bags are used for covering 10 frozen blocks of shrimp.

1. Straps: Straps of 12mm width and 0.5mm thickness are used for strapping master carton.

2. Code Slip: It is a pieces of polythene paper containing details of product like, kind, style, count, date of production and expiry date printed on it. Date of production and expiry date are given at the time production it self by the production supervisors.

3. Duplex Carton: Duplex cartons are used only if the buyer specifies so. They are paper board cartons coated with wax to protect the contents
from loss of moisture. Usually scampi is packed in duplex carton.

4. **Master Cartons** : The finished products are packed in 10 wax coated corrugated fiberboard cartons. Usually 5 ply-corrugated cartons are used. Master cartons should be strong enough to withstand the vigorous practice of stuffing and unloading.

Specification on the pack;

1. Name of the product
2. Type of the product
3. Grade of the product
4. Processor's code
5. Year, month and date of processing
6. Net weight of the pack
7. Gross weight of the pack

**NEW PRODUCT**

A new products in the form of sea food mix with cephalopods was tried. The ratio cephalopods fish, shrimp, other sea food in the ratio 3:5:2:1 were tried and exported a sample consignments and the opinion of the buyers gathered.
# HAZARD – ANALYSIS WORKSHEET

**Product Description:** BLOCK FROZEN SQUIDS

**Method of Distribution and Storage:** STORED AND DISTRIBUTED AS FROZEN

**Intended Use and Consumer:**

**TO BE REPROCESSED BY THE IMPORTER**

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ingredient Processing Step</strong></td>
<td>Identify Potential Hazards introduced controlled or enhance at this step</td>
<td>Are any potential food-safety hazards significant</td>
<td>Justify your Decisions for Column3</td>
<td>What preventive measures can be applied to prevent significant hazards</td>
<td>Is this step a critical control point (Yes/No)</td>
</tr>
<tr>
<td>RAW MATERIAL RECEIVING</td>
<td>Biological</td>
<td>Yes</td>
<td>Since there is no further step to reduce the hazards</td>
<td>Time and Temperature keep the temperature below +5 deg C for 3 hrs.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Chemical</td>
<td>Source Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical Foreign Matter</td>
<td>No</td>
<td>It can be removed during further step</td>
<td>Not applicable</td>
<td>No</td>
</tr>
</tbody>
</table>

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HAZARD – ANALYSIS WORKSHEET

Product Description: BLOCK FROZEN CUTTLEFISH

Method of Distribution and Storage:

STORED AND DISTRIBUTED AS FROZEN

Intended Use and Consumer:

TO BE REPROCESSED BY THE IMPORTER

<table>
<thead>
<tr>
<th>(1)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ingredient Processing Step</td>
<td>Identify Potential Hazards introduced controlled or enhance at this step(I)</td>
<td>Are any potential food-safety hazards significant? Yes/No</td>
<td>Justify your Decisions for Column 3</td>
<td>What preventive measures can be applied to prevent significant hazards</td>
<td>Is this step a critical control point? (Yes/No)</td>
</tr>
<tr>
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<td>Biological</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Physical Foreign Matter</td>
<td>No</td>
<td>It can be removed during further step</td>
<td>Not applicable</td>
<td>No</td>
</tr>
</tbody>
</table>
DISCUSSION

All cephalopod processed is exported especially to the sophisticated markets of Japan, USA and Europe. The demand for quality products is exacting and stringent conditions are placed on the quality of the product. The Indian seafood processor even today has a bias towards shrimps and goes in for cephalopod processing only when there is a slump in shrimp catches (Personal communication).

It is a known fact that cephalopods undergo rapid proteolytic changes after catch. While the processing operations in the seafood plant are carried out under the regulations of the European Union which are addressed to in letter and spirit, it is observed that there is delay in product movement from raw material reception, preprocessing center and processing. If this time lag can be reduced it will result in better quality of end product. However it is observed that processing lines in operation have a bias towards shrimp processing and hence this problem arises.

Modification of the processing lines to expeditiously more cephalopods will result in better quality product. It was observed in the study at the plant that cutting operational tome by 10% resulted in products with better organoleptic properties.

Most of the plants process products of the traditional kind and there is a reluctance to innovate and try out non conventional and value added products.
The reason adduced is that there is no time to waste as there will be a time lag in the introduction and acceptance of the product in the export market.

Quality factor are self regulatory as producing the finest quality is incumbent on the discerning buyer demanding it. Quality today in a sophisticated and a global market is the norm of the day.

The plant in the study being Eupion Union compliant has in place quality systems and rejects are minimal or nil. It is suggest that all companies processing cephalophots follow the strict norms of the EU to obtain excellent quality product. The systems relatively provide stable end results. One products tride as sea foods with sephalophods and low value fishes was wel accepted by buyers in Europe. and further enquiries have come in. this should be seen as a trend in the right direoctor as it will telp in export of low value items along with sephalopods insuring value addition and better revenue to the processor at low cost.