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Subject: FISH PROCESSING TECHNIQUES (Industrial Aquaculture and Fisheries) B.Voc. Skilled Component)

Semester – IV

WHAT IS POST HARVEST TECHNOLOGY?

It is the technology regarding the handling and transportation of harvested products, including cooling, packing, packaging, temperature and humidity control and storage facilities.

Post-harvest technology involves all treatments or processes that occur from time of harvesting until the foodstuff reaches to the final consumer. Preservation is a part of the post-harvest chain. In fact, preservation of the taste, smell, look and feel of food and preventing spoilage is also an important function of food processing.

ACTIVITIES AFTER DEATH:

Enzyme Action – All food contains natural enzymes that break down proteins, fats and carbohydrates to facilitate animal and plant growth. After the death, these enzymes if left uncontrolled continue to work, breaking down the food itself and resulting in spoilage.

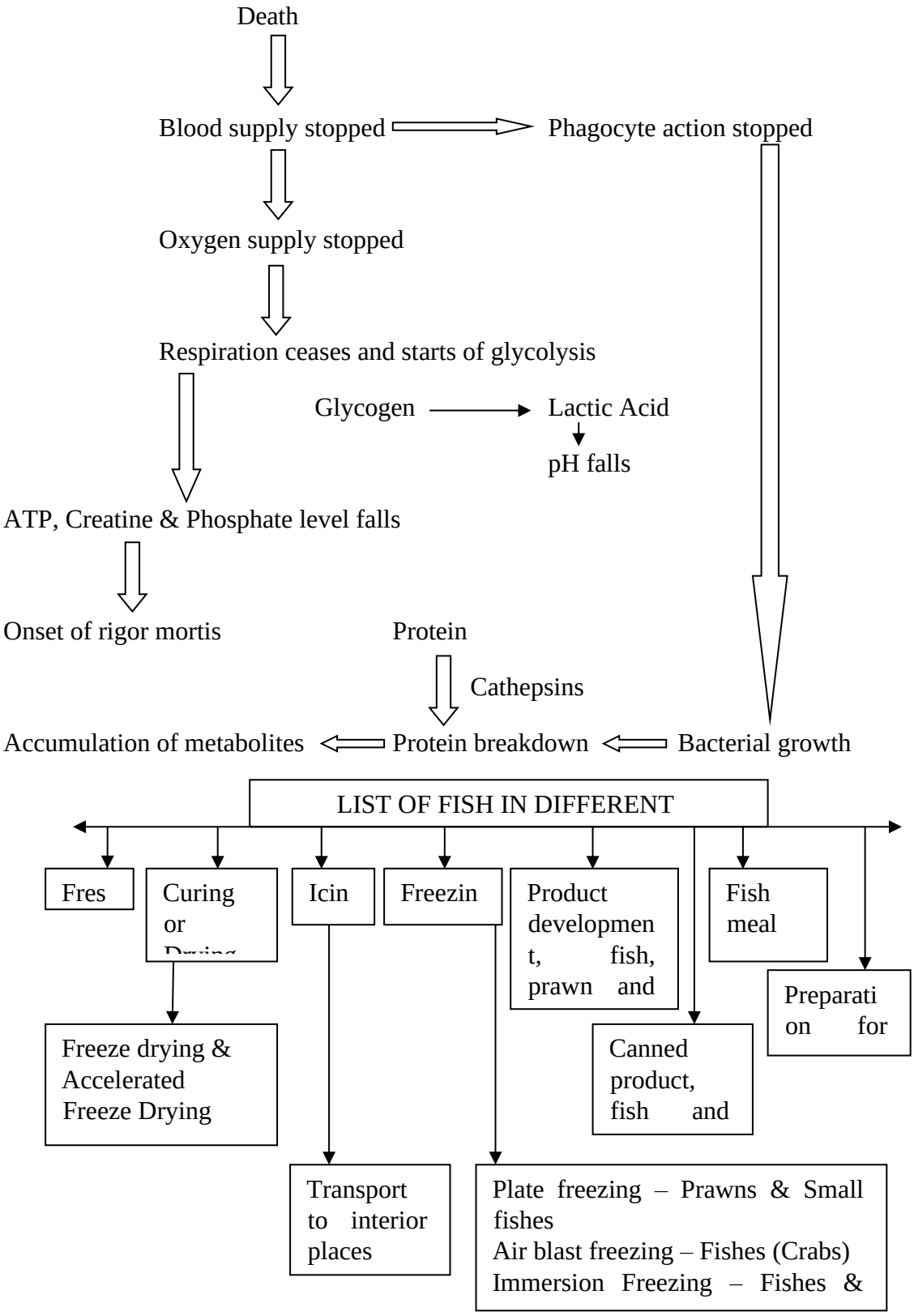
Microbial Action – All food can be attacked by bacteria and fungi that cause food to rot or become moldy. If permitted to multiply, these microbes can cause spoilage.

Oxidation – Many food components can be attacked by oxygen in the air, making them go rancid or resulting in an unpleasant taste. This, too, must be controlled.

POSTMORTEM CHANGES AFTER DEATH:

During the period after death till its consumption a large number of physicochemical changes take place, which can be classed in to 3 stages

1. Pre-rigor state – In which the meat is soft and pliable and is characterized biochemically by a fall in ATP & creatine phosphate and glycolysis.
2. Rigor Mortis – Stiff and rigid condition, which extends from 1 to 7 hrs. is affected by a number of factors.
3. Post rigor – A stage during which meat tenderization takes place making the meat organoleptically acceptable.


Death
Blood supply stopped
Phagocyte action stopped
Oxygen supply stopped
Respiration ceases and starts of glycolysis
Glycogen
Lactic Acid
pH falls
ATP, Creatine & Phosphate level falls
Onset of rigor mortis
Protein
Cathepsins
Accumulation of metabolites
Protein breakdown
Bacterial growth
LIST OF FISH IN DIFFERENT
Fres
Curing or
Icin
Freezin
Product development, fish, prawn and
Fish meal
Preparation for
Freeze drying & Accelerated Freeze Drying
Canned product, fish and
Transport to interior places
Plate freezing – Prawns & Small fishes
Air blast freezing – Fishes (Crabs)
Immersion Freezing – Fishes &

TYPE OF POST HARVEST FISHERY PRODUCTS –

Major types of Post Harvest Fishery Products are as follows –

1. Chilled and Frozen items
2. Canned and heat processed items
3. Cured and Dried Fishery Products
4. Value added Fishery Products
5. Mince based product (surimi etc.)
6. Specialty Products
7. Fishery By-Products
8. Non conventional Fishery Products
9. Fermented Fish Products

1. CHILLING OF FISH AND CHILLED STORAGE –

Chilling is an effective way of reducing spoilage in fish if it is done quickly and if the fish are kept chilled and handled carefully and hygienically. The objective of chilling is to cool the fish as quickly as possible at low temperature.

The important chilling methods of fish and fish products at non freezing temperature:

a) Iced storage
b) Chilled Seawater (CSW) storage
c) Mechanically Refrigerated Seawater (RSW) storage
d) Cold air storage

a. Iced Storage –

The major advantage of using ice for chilling the fish is that it has a high latent heat of fusion so that it is capable of removing large amount of heat as it melts without changing the temperature at 0 ^{0}C.

Types of Ice used for Iced Storage –

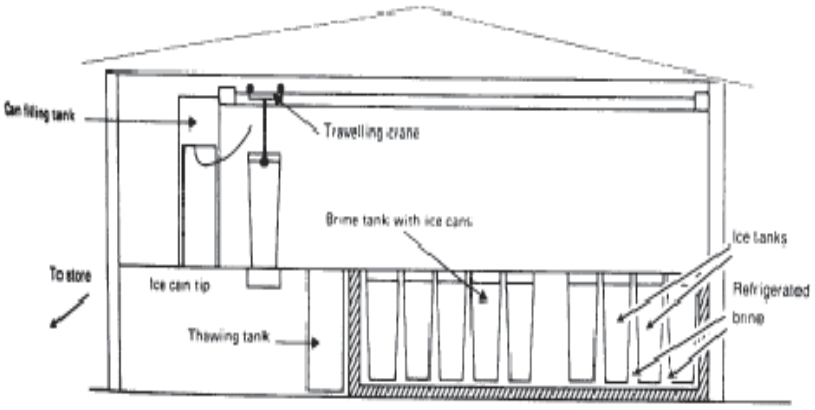
Block Ice – It is most conventional method of icing where block form of ice is crushed to smaller pieces for icing. Ice blocks are formed within 12-24 hours.

Flake Ice – It has a very smooth contours and in the shape of very thin flakes with surface area of 100 – 1000 mm2. Flake ice is usually made by spraying water onto the surface of a refrigerated drum. The ice sheet formed is scraped off in the form of dry sub-cooled flakes.

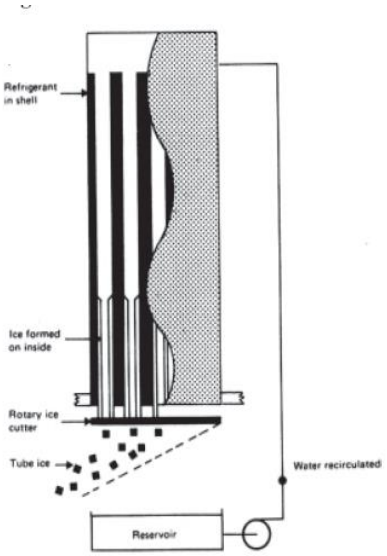
Tube Ice – This type of ice is made in a hollow cylinder of about 50 x 50 mm with a wall thickness of 10-12 mm. The ice is formed on the inner surface of a series of hollow cylinders; the outer surface of the cylinder is surrounded by a refrigerant. Ice is released by hot gas defrosting.

Method of Icing – The fish hold is divided into sections as in bulking, but using removable shelves, where the fish is spread in layers over ice. The lowest shelf is covered with 5 cm thick

ice. Fish is arranged in rows on the ice in thin layers and is covered with ice again. After that fish is arranged in boxes with alternate layers of ice until the box is almost full. Mainly insulated boxes are used for this purpose.



Block Ice Maker



Tube Ice Maker

b. Freezing and Frozen Fish Products –

There are a number of methods by which fish can be frozen. It may be either sharp (slow) freezing or quick freezing. But basically there are four methods of freezing namely –

1. Immersion Freezing
2. Indirect Contact Freezing
3. Air Blast Freezing and
4. Cryogenic Freezing

Immersion Freezer – Liquid immersion freezing or direct immersion freezing is accomplished when a product is frozen by immersion in or by spraying with a freezant that remains liquid throughout the process.

Plate Freezer – It is one type of indirect contact freezer. Fish products can be frozen by placing them in contact with a metal surface cooled by expanding refrigerants.

Air Blast Freezer – Circulating cold air at high speed enables freezing to proceed at a moderately rapid rate and this method is referred to as air-blast freezing. Air blast freezing is usually accomplished by placing the products on a mesh belt and passing it slowly through an insulated tunnel or spiral belt or any other area.

Cryogenic Freezer – Cryogenic freezing refers to very rapid freezing by exposing food products to an extremely cold freezant undergoing change of state. Currently liquid nitrogen is used in most of the cryogenic food freezers. Usually liquid nitrogen is sprayed or dribbled on the product.

Cryogenic Freezer

2. DRIED AND CURED FISH PRODUCTS –

Dried and dehydrated foods are more concentrated than any other persevered food stuffs. They are less costly to produce, processing equipment is limited, storage area required is less and the distribution costs are minimum compared to other processing methods.

Methods of Fish Drying

There are basically two methods of drying fish. The common one is by utilizing the atmospheric conditions like temperature, humidity and airflow. This is **traditional sun drying.** The other is dehydration or **artificial drying** by using artificial means like mechanical driers for removal of moisture from the fish under controlled conditions.

a. **Sun drying**: It is carried out in controlled chamber or area either in a rack or tent or any other means.
b. **Mechanical dryers:** Here the removal of water from the fish is achieved by an external input of thermal energy.

Different types of dryers

(i) Solar Tent Dryer –

This is another form of dryer, using the solar energy. It is based on the principle that black surfaces absorb more sun energy than any light colored one. Clear polythene sheets cover the

four sides of the tent. The black PVC sheet covers the bottom of the dryer. The fish to be dried is placed inside the tent.

(ii) Solar Cabinet Dryer –

This is a rectangular shaped dryer made up of plywood. The front side of the dryer is double walled. Inlet and outlet are provided for air to enter and escape from the chamber. A clear polythene sheet covers the upper portion of the drier. Two doors are present for loading and unloading the fish into the dryer

(iii) Tunnel Dryer –

This type of dryer is most commonly used for drying fish. These are made in the form of long tunnels, 10-15 m long. Trolleys loaded with fish are moved at a predetermined schedule through the tunnel. Temperature and air velocity controls are provided. Hot air blown over the material is circulated with the help of fans.

3. SALTING –

This is one of the oldest methods of preservation of fish. Salting is usually done as such or in combination with drying or as a pretreatment to smoking. During salting osmotic transfer of water out of the fish and salt into the fish takes place, which effect fish preservation. The different salts are used for this purpose are Solar salt, brine evaporated salt and rock salt.

4. SMOKING –

Smoke curing is another traditional method of preservation of fish. It is generally a combination of salting and drying. It is usually done in a specially designed kiln or a room. The source smoke is wood, sawdust or coconut husk etc.

The different types smoking

a. **Cold Smoking –** This is the conventional type of smoking using traditional chimney kilns. Here the temperature is never raised above 40 0C. The fish to be dried is hung on the top or kept in mesh trays. The wood is burned at the bottom of the kiln. The smoke travels upward and imparts flavor to the fish. The fish does not get cooked.
b. **Hot smoking –** It is done in a mechanical kiln, which is of a tunnel type. The fish to be smoked is kept inside on trolleys and heat is supplied either directly or indirectly. Here fish to be smoked is dried at 75 – 800C in order to cook the flesh.
c. **Liquid smoking –** Here liquids are prepared by dry distillation of wood. The fish is salted, and given a dip in a smoke concentrate and dried in an ordinary kiln dryer. The liquid thickens and coats the fish thus imparting the particular flavor to the fish.

Smoking of fish

5. VALUE ADDED FISH PRODUCTS –

a. Battered and Breaded Products –

The most prominent among group of value added products is the battered and breaded products processed out of a variety of fish and shellfish. Battered and breaded sea foods offer a convenience food valued widely by the consumer. The different steps of production breaded and battered products are –

- Porting/ Forming,
- Pre-dusting,
- Application of Batter,
- Application of breadcrumbs,
- pre frying or flush frying,
- Freezing, packing and storage.

The different types of Breaded and battered products

Fish Finger – Fish fingers or portions or sticks are regular sized portion cut from rectangular frozen blocks of fish flesh. They are normally coated with batter, and then crumbed before being flash fried and frozen. It also can be prepared from the skinless and boneless fish mince. The mince is frozen in the form of rectangular slabs. The slabs are sawn into thin fingers and battered and breaded. They then flash fried for 20 seconds.

Fish cutlets – Fish cutlets are prepared using cooked fish mince which is mixed with cooked potato, fired onion and species etc. It is then formed into the desired shape, each weighing approx. 40 g. The formed cutlets are battered, breaded and flash fried for 20 secs.

Fish Burgers – More or less similar to fish cutlets, burgers are made out of mince of lean white fish. Cooked mince is mixed with cooked potato and mild spices and formed into round shapes. Burgers are battered breaded and flash fried for 20 seconds.


Fish Fingers Fish cutlets

6. INDIVIDUALLY QUICK FROZEN PRODUCTS –

IQF products fetch better price than conventional block frozen products. However for the production of IQF products raw-material of raw materials of very high quality need to be used, as also the processing has to be carried out under strict hygienic conditions. The products have to be packed in moisture proof containers and stored at - 30^0C or below without fluctuation in storage temperature. Thermoformed molded trays is the mostly used containers for IQF product.

7. SUIMI AND SURIMI BASED PRODUCTS –

Surimi is fish mince product. It is an intermediate product which because of its characteristic ability to form gels, can be used to develop a variety of products conforming to consumer fancies. Surimi is the myofibrillar protein concentrate produced by the repeated washing of fish mince in order to remove water soluble nitrogenous matter and flavor compounds. Surimi based product originated in Japan

The basic steps of production of surimi are:

- Heading and gutting of fish
- Mincing
- Washing & Screening
- Refining
- Dehydrating
- Mixing with cryoprotectant
- Filling
- Freezing
- Packing
- Storage

Fish Sausage

8. **SPECIALTY PRODUCTS –**

The low priced miscellaneous fish in fish catching operation by trawlers are used for preparation of these type products. Some of the specialty products are as follows –

a. Fish Soup Powder –

It can be formulated from any type of fish having very low fat content. It is prepared from different food materials like vegetables, meat, egg etc.

b. Fish Flakes or wafers -

It is partially deodorized thin flakes of cooked fish meat homogenized with starch and salt. On frying the wafers swell to two to three time of its initial size and become crisp and delicious. Fish mince and starch are the base material for the preparation of wafers.