D.N.R.COLLEGE (AUTONOMOUS)

BHIMAVARAM-534202

Department of Zoology

Subject- Zoology

STUDYMATERIAL

PAPER-7 **POSTHARVEST TECHNOLOGY OF FISH AND FISHERIES**

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Unit – I Handling and Principles of fish Preservation

Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortisand spoilage), spoilage in marine fish and freshwater fish.

Principles of preservation– cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

Unit – II Methods of fish Preservation

Traditional methods - sun drying, salt curing, pickling and smoking.

Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, Irradiationand Accelerated Freeze drying (AFD).

Unit – III Processing and preservation of fish and fish by-products

Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish,fish manure.

Fish by-products – fish glue, using isinglass, chitosan, pearl essence, shark fins, fish leatherand fish maws.

Unit – IV Sanitation and Quality control

Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.

Quality Control of fish and fishery products – pre-processing control, control during processingand control after processing.

Unit – V Quality Assurance, Management and Certification

Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good LaboratoryPractices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.

National and International standards – ISO 9000: 2000 Series of Quality Assurance System, *Codex Alimentarius*

Unit – I

(Handling and Principles of fish Preservation)

1. Handling of fresh fish

2. Storage and transport of fresh fish

3. Post mortem changes (rigor mortis and spoilage)

4. Spoilage in marine fish and freshwater fish.

5. Principles of preservation– cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

(Unit-I)

1. HANDLING OF FRESH FISH

Definition:

- Fish processing can be sub divided in to fish handling which is the preliminary processing of raw fish and the manufacture of fish products.
- In these days, fish processing is undertaken artisan fishermen on broad fishing or fish processing vessels and at fish processing plants.
- Fresh seafood profit potential is substantial because of relatively large margins and increased consumer concern for the nutritional quality of meat.
- Fish begin losing quality with moment they leave the water.
- So the most we can accomplish is to slow the rate of deterioration.
- \It is not enough to buy or produce high quality fresh fish.
- The product must also have a reserve of quality to carry it to the consumers table.
- Consumers are critical judges who ultimately dictate a company sales, profits, growth potential.

Review of fish spoilage:

Bacteria:

- Bacteria are considered to be a primary cause of spoilage in fresh fish.
- The exist as a normal condition in the intestinal tract, slime and gills of fish and contribute the sour and putrid odors, characteristics of spoiled fish.
- Bacterial growth and its effects on quality are detailed.

Enzymes:

- Fish are poikilothermic animals. Their body temperature fluctuates with the surrounding water.
- Many species must tolerate a wide seasonal temperature range.
- In fish, chemically active proteins known as enzymes functioning at low temperature range.
- After death, the enzymes important for body building reactions may reserve and begin to break down muscle while other enzymes eat through the digestive tract into surrounding tissues.
- Perhaps even more significant enzymatic activity release simple protein building blocks (Amino acids and peptide chains) that are readily used as food by bacteria.

Chemical changes:

- Sea foods have a large proportion of soft, poly unsaturated fats and oils that are highly vulnerable to attack from O_2 oxidation. That condition leads to rancidity.

- Although more commonly associated with frozen fish than fresh some fish may develop pronounced fishy flavors due to oxidation even when held fresh fish.
- The problem is aggravated by exposure to light and by some metals such as those found in cigarette ash and the iron present in red flesh.

Other factors:

- Like other meat animals, fish enter rigor mortis (Stiffing due to muscular contraction) after death with a constant drop in PH.
- Fish have natural defenses against bacteria which continue to function at a reduced level until after they come out of rigor mortis.
- Rapid cooling to 32°F can greatly retard rigor mortis.
- Gain or loss of moisture occasionally affects the appearance and flavor of fresh fish.

Temperature:

- The importance of keeping sea food at low temperature cannot be overstated.
- The growth of bacteria and chemicals activity is directly related to temperature.
- Storage can be extended several days when temperature is decreased from 35°F to 32°F.

2. STORAGE AND TRANSPORT OF FRESH FISH

Definition:

- When storing fresh sea food, keep it in the coldest parts of the refrigerator.
- Use a thermometer to make sure your homo-refrigerator is operating at 40°F.
- Fish will lose quality and deteriorate rapidly with higher storage temperature, so use ice when you can.

a) Fill an insulated cooler with water and ice;

- You have two options for maximum freshness.
- First you can keep the fish alive in a live tank well on board your boat and deal with the rest when you get back to shore.
- The second option is to immediately kill the fish and put it into an insulated bin filled with a little water and a lot of ice.
- Make sure to buy an insulated collar with a drain plug.

b) Add ice and drain water from the cooler regularly:

- The fish needs to stay as possible while in the cooler.
- Open the drain plug on the insulated cooler so that matted ice water slowly and continuously drain out, making room for new ice.
- Do not allow the dead fish to sit in matted ice water, because this will spoil the taste.
- If possible, use shaved ice in the cooler position the fish down into the ice in the same position which they swim, bellies down.

c) Remove the gills and stomach or gut:

- Cleaning the fish as soon as possible will preserve the most flavors.
- The gills and stomach or gut contains waste and you need to remove that quickly to avoid spoiling the flavor of the meat. Removing these parts also allows you to pack the empty cavities with ice.
- So we can keep the fish even colder.

d) Clean the fish within 24 hours of catching:

- We should clean the fish after harvest
- Generally fish has lot of mucous on it’s externally.
- Than these cleaned fish should put in the ice containing container
- Cover the fish with more ice.
- Cutting and meat slices will be easier to store.

3. POSTMORTEM CHANGES (Rigor mortis and Spoilage)

- Biochemical changes occur after death of fish is termed as post mortem and it is followed by rigor mortis.
- Rigor mortis is one of the recognizable signs of death that is caused by a chemical change in the muscles after death.

Fish Spoilage:

- Fish spoilage includes changes occurred in odors, flavors, texture and colors.
- Spoilage also includes some biochemical changes (post mortem stage) caused by microbial attack.

1. Post mortem Changes and Rigor mortis

Post mortem Changes and rigor mortis are caused by following steps-

- Chemical changes.
- Stiffening of body after death.
- Asphyxiation.
- Hyperemia-accumulation of blood drops by bursting of blood vessels in gills.
- Putrefaction –swelling of bead body of fish.
- All the above process occurs up to 7 hours of death.
- Post-mortem is followed by rigor mortis (7-12 hours).

Causes of Rigor mortis:-

- Stiffening of body is known as rigor mortis.
- Rigor mortis is caused by contraction of body muscles.
- It is caused due to biochemical and physiological changes.
- Rigor mortis is mainly caused due to aerobic respiration (i.e conversion of carbohydrates in to glucose).
- It is caused by the process of anaerobic respiration also.
  (i.e Conversion of glucose →ATP→ ADP→ AMP→ Lactic acid).
- Lactic acid promotes Actin-Myosin complex by ATP hydrolysis.
- As ATP is hydrolyzed into ADP & AMP.
- APT is not reached in to actin and myosin (muscle proteins).
- Hence, actin and myosin are combined to form a complex called **Actinomyosin.** Hence muscle becomes stiff due to lose of creatine phosphate.

Actinomyosin + H_2O+ATP→ADP+Phosphoric acid+ Contracted actinomyosin.

- ATP is lost, it leads to rigor mortis.
- After capturing the fish from the water, the ATP levels fish becomes Zero.
- ATP always consumes calcium ions which give softness to the muscles.

- As lactic acid is accumulated, PH becomes ≤5 (Acidic).
- This acidity leads to muscle contraction.
- Lee PH leads to Autolysis (i.e rupture of lysosomes)

Precautions to avoid Rigor mortis:

a. Lowering the temperature.
b. Mode of fishing.
c. Mode packing and storage.
d. Anesthesia and electric shock.

2. Spoilage (Post-Rigor mortis)

*Complete spoilage of fish is caused due to chemical changes and microbial action.

A. Chemical changes

a. Rancidity (Chemical)
b. Autolysis (Enzymatic)

a. Rancidity:

- Rapid oxidation of fats is known as rancidity.
- It is commonly occurs in dead fishes like carps, mackerels (marine fishes), Anchovilla (oil sardines).
- Fats contain antioxidants like Tocopherol, Vitamin-E.
- The blood contains oxidative compounds (i.e heme).
- After death, secretion of antioxidants is stopped and heme began to oxidise the fats or lipids.
- Hence skin becomes light yellow or rusty iron in colour.
- Other factors like Enzymes, Chlorides of Mg, Cal, Al, Zn etc., and Copper and ferrous.

Precautions to control rancidity:

- ❖ Supplementation of applied antioxidants like poly phenols, which replace tocopherol and Vitamin-E.
- ❖ Providing storage chambers with nitrogen or carbon dioxide.
- ❖ Salt curing.(applying pure salt)
- ❖ Deep freezing.

b. Autolysis (Enzymatic action):

- Due to accumulation of lactic acid, the PH in the body of fish becomes ≤ 5 (acidity).
- Acid nature leads to rupture of lysosomal membrane, it leads to the release of certain enzymes known as hydrolase, nucleotidase, proteinase, lipase etc., which inturn lead to tissue damage.
- Proteins present in the tissue are breakdown into aminoacids, Indole, scatole and Hypoxanthine.

Proteins→aminoacids+ Indole+ scatole+ Hypoxanthine.

- Indole and Scatole are responsible to foul smell.
- Hypoxanthine gives bitter taste to the fish meat.
- ATP→ADP→AMP→IMP+ hypoxanthine (foul smell and bitter taste).

B. Microbial spoilage:

- Most of the fishes start decaying by the action of microbial organisms and bacteria.
- These microorganisms live over the body surface, gills and intestine.
- Clostridium botulinum causes botulism, it leads to food poisoning.
- Clostridium botulinum is commonly found in died aquatic animals (fish).
- Streptococcus effects on respiratory tract and it is also responsible for food poisoning.
- Other microorganisms like Pseudomonas, Chromobacterium, Holobacterium, Micrococus etc., are decompose 70-90% of proteins to amino acids and hydrogen sulphides.
- Gram negative bacteria hydrolyses fats into fatty acids and glycerol. They turn the fish meat into a strong odor, smell and tasteless.

4. SPOILAGE IN MARINE FISH AND FRESHWATER FISH

1. Spoilage of marine fish :

- Marine fishes contain rich amount of nitrogen compounds.
- The main nitrogen compound is ammonia.
- These nitrogen compounds leads to spoilage.
- In nitrogen metabolism ammonia is converted into Trimethyle Amine Oxides (TMAO).
- TMAO is stored in the muscle of fish.
- During enzymatic action or bacterial action TMAO is broken into Trimethyle Amine (TMA)
- TMA is responsible to spoilage of marine fish.
- The preservatives like Sodium hydrosulphite or antioxidants used in fish preservation.
- These preservatives can reduce TMAO and TMA.

2. Spoilage of freshwater fish:

- Generally E.Coli, Streptococci, Salmonella, Stephylococci and Clastridia are live in fish.
- The above mentioned bacteria not belonging to fresh water but they are infected to fishes through the water, air, plants, animals, soil etc.,
- These bacteria live in the gut and on gills and responsible for decomposition of fish.
- Decomposing fishes have bad smell (foul) bad taste caused by putrisline, cadavarin, pyridine, formic acid, butyric acid, isovanic acid etc.,
- Gill spoilage is caused by catalyzation of enzymes present in the RBC.

5. PRINCIPLES OF PRESERVATION

- In some places, more fish is catch at times than can be consumed.
- Methods are used in keeping the surplus fish in good condition for later consumption.
- Again, fishermen sometimes cannot return to the villages promptly with fresh fish they have catch, and it will be of value to them to know to preserve their catch by simple means. Hence fish preservation follows the following principles.

A) Cleaning

B) Low temperature

C) High temperature

D) Dehydration or Denudation

E) Use of salt

F) Low radiation of gamma rays

G) Use of preservatives

H) Exposure to low radiation Gamma rays

A) Cleaning:

- When the preservation is required for a long period of time, the fishes are passed through the cleaning, gutting and conservation and storage
- During the cleaning, the caught fish are first washed thoroughly in cold clean and fresh water to remove bacteria, slime, blood, feces and mud from the body surface of the fish.

B) Lower temperature:

- It was used to preservation of fishes, prawns and crabs.
- In this method temperature can be decreased to -40°**C.**
- This process helps in prevention of microbial growth inside or outside of the body of the fish.

C) High temperature:

- It is traditional method of fish preservation.
- Ex;- sun drying, smoking, canning etc.,
- It consists of removal of water to a final desired concentration, which in turn reduces the water activity of the product, thereby assuring microbial stability and extended shelf-life of the product.

D) Dehydration:

- Dehydration is also known as drying.
- Dried fishes processed through sun drying or dehydration is highly concentrated fish compared to other preserved form of fish.
- As water content become reduced, so microbial activity cannot run at normal rate, thus reduce the spoilage of fish.

- In some time electric lamps also used for dehydration method.

E) Use of salt:

- Salting is one of the oldest methods of preservation of fish.
- In this method salt should be applied inside and outside to the body of the fish.
- This applying salt regulates osmosis and lead to good preservative.
- Salt can remove excess water from the tissue of fish and will prevent the activity of most spoilage bacteria.

F) Use of fish preservatives:

- The following preservatives like chemicals and antibiotics are used to preserve the fishes. They are-
  - **Ascorbic acid(Vit-C)-** to avoid rancidity
  - **Vinegar(Acetic Acid)**-suing in pickling of fish and prawns
  - **Phenolic compounds** (wood smoke)- used to dehydration
  - **Salicylic acid-& Boric acid**-salmons –to protect flavor of meat
  - **SO2 & Sodium bisulphate**- Shrimps- to prevent microorganisms (shrimps and prawns)
  - Sodium acid sulphate mixture-3% & Sodium benzoate-0.25%- good preservatives.
  - **Sodium or Potassium nitrate & NaCl**
  - **Sodium hypocloride** – high expensive but it is good preservative.
  - **Ascarbic acid**- Vitamin-C (good preservative)
  - **Vinegar**: (Pickling)
  - **Salicylic acid-** for preservation of marine fishes
  - **Antibiotics**-Auromycin, Oxytetracycline. Chloromycetin etc.,
  - **Ramocidin**-antibacterial
  - **Sorbic acid**- antifungal

G) Exposure to low radiation Gamma rays:

- Irradiation is a physical treatment that consists of exposing foods to the direct action of electronic, electromagnetic rays to assure the inequity of foods and to prolong the shelf life.
- Irradiation of food can control insect infestation, reduce the numbers of pathogenic or spoilage microorganisms, and delay or eliminate natural biological processes such as ripening, germination, or sprouting in fresh food. Like all preservation methods, irradiation should supplement rather than replace good food hygiene, handling, and preparation practice.
- Gamma rays, which are produced by radioactive substances (called radioisotopes)
- The approved sources of gamma rays for food irradiation are the radio-nuclides cobalt-60.

UNIT-II

(Methods of fish preservation)

1. Traditional methods

i) Sun drying

ii) Salt curing

iii) Pickling and

iv) Smoking.

2. Advanced methods

i) Chilling or icing

ii) Refrigerated sea water

iii) Freezing,

iv) Canning

v) Irradiation and

vi) Accelerated Freeze drying (AFD).

UNIT-II
(Methods of fish preservation)

- Preservation is the process of preventing the decay or spoilage of food thus allowing it to be stored in a proper condition for future use.
- In preserve state, food may be retained over a period of time without contamination by microorganisms or chemicals and losing the quality of colour, texture, flavor and nutritive values.
- Sea foods can be preserved inexpensively in traditional ways through sun drying, salt curing, pickling and smoking etc.,
- Modern and advanced methods of preservation include chilling or icing, refrigerated sea water, freezing, canning, irradiation and Accelerated Freeze Drying(AFD).

❖ Traditional and advanced methods of preservation are discussed below-

A) Traditional methods

a) Sun drying (Natural and artificial Sun drying)

b) Salt curing

c) Pickling

d) Smoking (cold and hot smoking)

B) Advanced methods

a) Chilling or Icing (Super chilling and Icing of fish)

b) Refrigerated Sea Water (RSW)

c) Freezing

d) Canning (Water bath canning and Pressure canning)

e) Irradiation

f) Accelerated Freeze Drying (AFD)

1. TRADITIONAL METHODS

A) Sun drying:

- Removal of moisture of fish in the presence of sunlight.
- Sun light prevents growth of microbial agents.
- Hence it can prevents spoilage of fish.
- It is natural as well as traditional method of fish preservation.
- It is again two types-


Sun drying of fishes

a. Natural sun drying:

In this method, fishes are captured, washed and dried thoroughly in sunlight. This method is depending upon environmental factors and space.

Disadvantages:

- This process slow and show less results.
- Cloudy climate is not suitable to this method.
- Sunlight dried fishes are not much demand than the fresh fish (non-dried fishes) in the market.

b. Artificial drying:

- In this method, the fishes are killed, cleaned and gutted thoroughly.
- They are kept in their length wise on ventral side their viscera
- Than washing in salt water and processed to dry.

B) Salt curing:

- Applied salt removes the moisture from the fish meat by osmosis.
- For this method high salt concentrated salt water is used.
- Processed fishes are dipped in the high concentrated salt water or brine solution.
- Salt promote growth of Lactobacillus bacteria.
- Lactobacillus bacteria release lactic acid.
- Lactic acid prevents growth of pathogens in the fish meat.

a. Wet salting:

- The principle is to keep the fish for a long time in brine.
- The equipment needed consists of a watertight container, which can be a tin, drum, canoe, barrel, etc.
- First of all cut off the head, and gut and clean the fish, and should placed in the brine.

Wet salting

Dry salting

b. Dry salting:

- In this method the fish is salted but the juices, slime and brine are allowed to flow away.
- Dry salting can be done in an old canoe, or on mats, leaves, boxes, etc.
- In any case, the brine formed by the fish juices and the salt must be allowed to run away.
- Some people like the salty taste of fish prepared in this way, but it is always possible to wash the salt away by soaking

C) Pickling:

- It is the process of preservation of raw food in the acid medium.
- It is the oldest method.
- This method requires low cost of ingredients.

- In this process pathogens cannot survive in acid environment (PH ≤ 4.6).
- Vinegar is a fermented product, it can preserve fish and fishery products.

Fish pickle in jars

D) Smoking:

- Landed fishes are cleaned and dried.
- These dried fishes are exposed to cold or hot smoke treatment.

a. Cold smoking:

In this process temperature is decreased up to -38°C from smokeless fire.

b. Hot smoking:

- In this process fire is exposed to 130°C at temperature, the releasing smoke is wet and dense.
- Which controls pathogens on dried fishes
- In this process good controlling methods like over density, density of smoke, temperature, humidity, speed of circulation and time are necessary.
- Wooden smoke contains lot of chemical compounds like phenolic compounds and antiseptic factors, which prevent fish spoilage.

Cold smoking

Hot smoking

2. ADVANCED METHODS

- Prevention means preventing the decay of food spoilage.
- In the advanced methods of fish preservation scientific skill is used.

A) Chilling or Icing:

In this method temperature of fish is greatly reduced to a freezing point. In normal condition fish body temperature range is -0.6°C to -2.2°C.

Icing of fish

a. Super chilling:

- Here the fish is stored at temperature just below freezing point.
  Optimum temperature of fish is -0.6°C to -2.2°C.
  Temperature is reduced from -2.0°C to -5.0°C.
- At this temperature half of the fish is frozen.

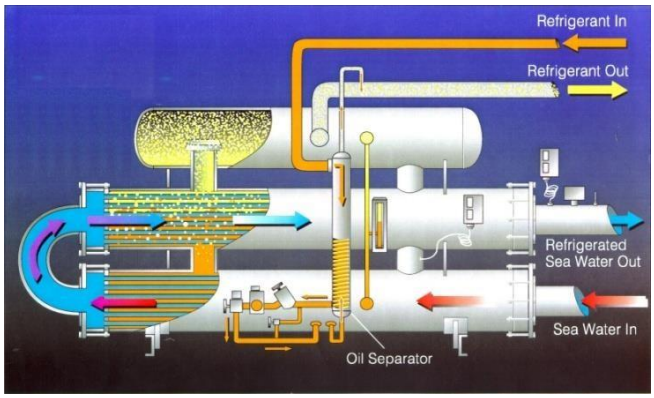
b. Icing of fish:

- It is very easy method.
- Fishes are kept several days in good quality of ice
- Ice reduces post harvest losses and improves quality of ice.
- Block ice, flake ice chip ice and soft ice are preferable for this method.
- Pure water like bore-well water and chlorinated water are used for this method.
- Well insulated boxes are used for making ice.

B) Refrigerated Sea Water: (RSW)

- Refrigerated Sea Water (RSW) systems are used onboard fishing vessels to preserve large catches.
- Storing the catch in an RSW system is an effective and cost-saving method of preserving the catch until offloading ashore or further processing onboard.
- In a minimum amount of time the catch is cooled down close to the freezing point of seawater, assuring its freshness and quality during transport.

- In an RSW system, seawater is re-circulated by pumps through the tanks and the chilling system.
- Before entering the tanks, the seawater is chilled by the refrigeration equipment.
- The seawater is distributed evenly over the complete bottom cross-section of the tanks through a set of perforated plates or similar distribution devices.
- The chilled seawater passes upwards through the tank and layers of fish, thus keeping the fish semi-floating and simultaneously cooling it.
- The water returns through suction screens in the top of the thanks to the chilling unit of the system and, subsequently, the circulation process is repeated.



C) Freezing:

- Freezing reduces the temperature of the food below their freezing point.
- Freezing reduces biochemical, enzymatic, microbial activities of frozen or preserved fish.
- When the temperature is reduced microbial growth is also reduced.
- This is because of allowing in the product temperature besides reducing the free liquid water activity required for the microorganisms to metabolism.
- Freeze and dried foods are closest to natural composition with respect to a structure and chemical.

Freezing of fishes

D) Canning:

- This is a process involving heat treatment of fish in sealed containers made of tin plates, aluminum cans or glass, until the product has been fully sterilized.
- During caning, heat treatment should be sufficient to destroy all heat sensitive bacterial and spores, in activate, the enzymes and cook the fish so that the product remains acceptable to the consumer after prolonged storage.
- Commercialized sterilization this is used in thermal processing to describe the heat treatment designed to kill substantially all microorganisms and spores which is present and cable of growing in the product.
- The canned food fish is also prevented from contamination by pathogenic organisms by storing them in a virtually airtight package.
- If heat treatment is properly carried out canned fish may remain in storage for several years without refrigeration.
- Traditional canned fish are obtained from small pelagic fish species such as herrings (*Clupea spp*), Sardines (*Sardinella sp*), Mackerels (*Scomberomerus sp*), Anchovies (*Engraulis sp*), Tuna (*Thunnus sp*). Bonga (*Ethmalosa sp*) etc.,
- Fish intended for canning must be in first class condition and must be handle in hygienic manner to reduce microbial load on the fish.
- Poor quality fish will produce canned fish with offensive odor and flavor, poor texture.

Canning of fish meat

a. Water bath canning:

- It is a hot water canning method.
- Using a large kettle or boiling water.
- Filled jars are submerged in the water and heated up to 212°C for a specific period of time.

b. Pressure canning:

- It is must be used for a fresh fish and sea food.
- Fresh should be cleaned and removed blood and slime from the body surface as soon as possible before canning.
- It is restricted to only good quality of products.

Process:

- Clean the fish thoroughly.
- Remove gut and viscera from the fish.
- Cut length wise to get lengthy pieces.
- Pack with skin side of fish and adjust the jar or tin lids.

E) Irradiation:

- Food is exposed to high radiation in the form of Gamma rays, x-rays or electric beams.
- Irradiation process kills good or bad bacteria.
- This process is not able to control certain microbes like Hepatitis.

Effects:

- Irradiation creates a complex series of reactions on molecular structure of food.
- Irradiation can also change the colour, flvor, texture and nutritional content of food.
- It destroys Niacin and Vitamin-A.
- Irradiation may not eliminate all bacteria from foods.

F) Accelerated Sea Water Freeze Drying (AFD):

- While freezing dry ice reduces water activity of foods.
- AFD removes whole water from the food, hence this process reduces growth of microorganisms.
- Ni this method food is quickly frozen
- Rapid chilling or flash freezing or cryogenic freezing decreases microbial effects.
- When a product frozen, ice crystals are distributed over the food, which keep up the quality and taste in natural.
- Use Carbon dioxide, Nitrogen gases not only lower the temperature quickly but also process the food in good quality during transport.
- Dry ice is very effective and easy to use cooling medium with its temperature of -70°C.
- The solid phase of CO_2 kept in mixers, blenders, containers, cartons and combos.
- AFD is the safest mode of handling entire fish products, shrimps, Clams, shell fishes etc.,

UNIT- III

(Process and preservation of fish and fish by- products)

1. Fish products

i) Fish minced meat

ii) Fish meal

iii) Fish oil,

iv) Fish liquid (ensilage)

v) Fish protein concentrate

vi) Fish chowder

vii) Fish cake

viii) Fish sauce

ix) Fish salads

x) Fish powder

xi) Pet food from trash fish

xii) Fish manure.

2. Fish by-products

i) Fish glue

ii) Using isinglass

iii) Chitosan

iv) Pearl essence

v) Shark fins

vi) Fish leather and

v) Fish maws**.**

UNIT- III

(Process and preservation of fish and fish by- products)

1. Fish products

Fish and fish products:

- Fish and fish products are consumed as food all over the world.
- With other sea foods, it provides the world's prime source of high quality protein.
- 14% to 16 % of the animal protein consumed worldwide comes from fish.
- Over one billion people rely on fish as their primary source of animal protein.
- Besides, fish is a unique source of micro-nutrients.
- However, many parts of larger fish processing despite the high levels of micro nutrients, and particularly macro-nutrients.
- Thus the promotion and use of fish products to create low cost, high quality food could help reduce malnutrition.
- This practice illustrates the nutritional benefits of incorporating fish by-products in the diet and suggests recipes to guide their preparation.

Fish products:

Fish products are directly or indirectly used as food.

a) Fish minced meat:

- The best method of utilizing such fishes is perhaps recovery of meat.
- The recovered or picked meat from the fish frame is known as "fish mince".
- Fish mince is prepared not only from under-utilized fish species but also from fish frames generated during filleting of commercially important species, both of marine and freshwater origin.
- The removal of flesh and subsequent mincing masks the original nature of the fish.
- This also improves consumer acceptance of the otherwise low value fish, or fish of bad appearance, or unfamiliar fish which has no consumer acceptance.
- Fish mince is popularly known as fish kheema.

Fish minced meat

b) Fish meal:

- It is made from cooked and dried fish.
- It is a highly nutritive product.
- It is widely used in poultry and aquaculture as animal feed.
- It increases egg and milk production.

Fish meal

Chemical composition:

Moisture – 6-12%, Protein- 55-70%, Fat- 2-15%, Minerals 10-20%, Vitamins-A, B, B_{12}, D, K & E.

Preparation:

- Fish is first minced and then cooked.
- To remove moisture, the cooked fish is pressed.
- This cake is dried in the sun light under flame.

Uses:

- Used in poultry and animal feed.

- Fish meal contains Ca, P, Iodine and rich variety of vitamins, which promotes growth of cattle.
- Fresh fish meal mixed with rice bran and vitamins forms an excellent feed in aquaculture.

c) Fish oil:

- Fish oil is obtained from Herrings, Sardines, Salmons, Mackerels, Anchovy etc.,
- Fish body oil varies according to season, sex, size and age etc.,
- Fish body oil is poor in vitamins then liver oil.
- Fish oil is made up of mixed triglycerides.
- Fish oil are colorless to golden yellow, greenish yellow and red

Fish oil

Extraction:

It is followed by two methods, they are-

1. Dry method:

- It is used in fishes with low body oil content.
- Fishes are grounded in a grinder, cooked and pressed to recover the oil.

2. Wet method:

- It is used in fishes with rich body oil content like oil sardines.
- In this method fishes are crushed to a pulp and cooked in vertical or cylindrical cookers.
- The cooked material is then pressed and mixture oil is collected in to setting tanks and continues to separate the oil.

Uses of fish oil:

- Used in the paint and varnishes.
- Used in the dressing of leathers and tanning of skin.
- Used in laundry soaps, toilet soaps, insecticidal soaps.
- Used in silk and iron industry for tempering.
- Used in poultry, aquaculture and cattle medicine.
- Used in manufacture chemical like Silicon, Ammonia salts etc.,

- Used in manufacture of Cosmetics, Lubricants, Candles, fungicides etc.,
- Used in manufacture of printing ink, water proof preparation, plastic, rubber etc.,
- Used in screening of the surface of the boats.

d) Fish liquid (Ensilage):

- Silage means fodder preserved in a silo (Cylindrical tanks).
- It is a liquid or semi-solid meal.
- It is a highly nutrient animal feed.
- It is produced by adding 3-4% of an acid to minced fresh fish offal.
- Generally formic acid is used but sulfonic acid and propionic acid can be used for fermentation of fish meal in cylindrical tanks.
- By adding these acids the PH of mixture can be lower to 4.0 or below. This inhibits bacterial decay.
- The enzyme present in the chopped fish, which converts mixture into slurry.
- An antioxidant is added to prevent rancidity of fats and the liquid can be stored into a silo up to 6 months.
- Fish ensilage is also obtained by fermentation with lactic acid bacteria in molasses.

Use:

In aquaculture practices the silage is mixed in equal proportion with commercial feed meal containing vitamins and binding agents to prepare pellet feed.

e) Fish chowder:

- Fish chowder is one type of soup and prepared with milk or cream and thickened crushed biscuits.
- Common chowders includes sea food chowder which includes fish clams and shell fishes.
- Fish chowder, corn chowder and clam chowder are especially popular in North American regions.
- Fish chowders are made with salmons, cods and other fishes.
- Potatoes, Onion, carrots etc., are additionally added to fish chowder.

Fish Chowder

f) Fish sauce:

- Fish sauces are prepared from minced fish flashed.

- For the fish sauce preparation spices and additives are added to improve the taste, flavor and good quality.
- Spices include salt, sugar, chilies, onion, coriander, egg white, vegetable oil etc.,
- Additives include antiseptics and antioxidants.
- This product is commercially manufactured in Japan, Russia and USA.
- Fish sauce is prepared from less valuable trash fish.

Fish sauce

g) Fish Powder:

- It is a good grade of nutritive product for human consumption.
- It contains high protein content made from dried fish by grinding and subjected to various sanitary processing.
- Fish powder is also used for edible and industrial purposes have a substitute egg white in baking, ice cream and pharmaceutical.
- It is also used in paint, varnish, textile, paper and cosmetic industries.

Fish powder

h) Fish cake:

- Fish cakes are usually made from pre-cooked fish, after mixing with a mashed potatoes, salt and spices
- These cakes are either fried in butter or may be uncooked and they are often coated with bread crumbles.

Fish cake

i) Fish manure:

- Fish manure is prepared from leftover fish, dead or destroyed fish and unwanted fishes.
- They are dried and ground to make manure and after mixing of wax.
- It is not for human consumption.
- Fish manure is a by-product of fishing yards.
- Mackerels, horse mackerels, sardines like fishes are used for making of manure.
- This manure has a high content of nitrogen (5-7%), Phosphorus (4-6%), lime (Calcium oxide- 1-5%).
- Generally fish manure is used for raising coffee, tea and tobacco crops.

Fish manure

j) Fish salads:

- Fish salads are prepared from raw fish pellets.
- Finely chopped fish into thin slices and sprinkled with paper and add salt, lime juice and served before food dish is served.
- It is served as hepatizer (to increase hungry).

2. Fish by-products

- Fishes provide necessary amount of proteins to human beings.
- Fish food constitutes the supplementary food to most of the Indians.
- Fish meat is easily digestible and highly dependable.
- Doctors recommended fish meat for quick recovery from kwashiorkor disease.
- Though fish is mainly used as food, a number of byproducts from fishes have great economic value.
- Biological value for fishes is about 76% and their protein efficiency ratio is 3:5.

By-products from fishes:

a) Fish glue:

- Fish glue is a good adhesive material obtained from bones and skin of fishes like Cods, Pollack, Hakes etc.,
- The raw materials are washed in steam jacketed cookers.
- The mass is than covered with water and to it added small quantity of acetic acid.
- Now then it is cooked for 6 to 10 hrs.
- The liquor is extracted and concentrated then glue is formed.
- This residue is dried and used as a manure and binding product.

Uses:

- Fish glue is using the backs of glued stamps and labels.
- Used in photo engraving.
- Used for paper boxes, shoes, furniture etc., where joining is required.

b) Isinglass:

- Isinglass is a gelatin like material obtained from the air bladders of certain fishes.
- When isinglass put in water it dissolves in it.
- At high temperature it hydrolysis in a water to produce strongly adhesive gelatin.
- The inner layer of swim or air bladder used to derive isinglass preparation.
- Air bladders are collected thoroughly to remove blood and other matters.
- Then the outer thick and fibrous layer of the wall is separated from the inner layer.
- The inner layer is sundried and marketed.

Isinglass

Uses:

- It is mainly used in purification of wine, bear, vinegar etc.,
- It is used for the preparation of special grade cement and plasters.
- Used as gelatin.

c) Chitosan:

- It is also called chitin and it is a cellular substance obtained from exoskeletons of marine shrimps, lobsters and crabs.
- It is chemically processed form chitin.
- Crustacean shells are treated with NaOH.
- It is used as medicine to treat obesity, high cholesterol, anemia and dental cure.
- In pharmaceutical industries chitosan is used as a filler tablets.

- Chitosan has been used in water purification plants to absorb unwanted gases, oils, metals and toxic substances.
- It is also used in cosmetics and fabric industries.
- It is used in agriculture for seed treatment and bio-pesticide.

Fish Chitoson

d) Shark fins:

- Shark fins are used for preparation of fin soup.
- Fin soup is one of the favorite dish in Honkong and Bangkok restaurants.
- Except caudal fin all other fins are cut near the root and wash in the sea water and dusted with a mixture of wood ashes then dried in sunlight or smoked.
- Then these dried fins are ready for making of soup.

e) Fish skin or leather:

- The skin of larger marine fishes is used as leather.
- Fish skin is collected and soaked in brine and left for a day.
- On the next day it is salted and put in dry brine containing 10% Hcl.
- The skin is taken out from the brine and dried then scraped on the surface particularly to remove scales.
- Then it is lined and tanned by common process.

Uses:

- Used in making of war helmets in olden days.
- In Japan fish leather is used as making of lanthers.
- Skin of larger fishes like Cods, Salmons, Sharks, Fords and Rays are used as ornamental leather to make different items in different colours.
- Leather of sharks is used in making of shoes, wallets, purses, belts, bags, tobacco pouches etc.,
- Dry leather of sharks use to making of shagreen.
- Shagreen is a dry skin of sharks which is used in polishing and ivory industries.

f) Pearl essence:

- The shiny material from the scales of fishes is used as internal lining of glass beads.
- Such coats of beads are sold as artificial pearls.

g) Fish maws:

- The swim bladder and air bladder or gas bladder is otherwise called as fish maws.
- It is an internal gas filled balloon like organ contributing to the ability of many bony fishes to float or stay still in water to saved energy besides acting as a stabilizing agent.
- Additionally, the swim bladder functions as a resonating chamber, to produce or receive sound.
- The swim bladders of certain large fishes are considered a food delicacy.
- They can be made into strong, water resistant glue or used to make isinglass for the purification of beer.
- In earlier times they were used to make condoms.

UNIT-IV

(Sanitation and Quality Control)

1. **Sanitation in processing plants**
   - **i) Environmental hygiene in processing plants and**
   - **ii) Personal Hygiene in processing plants.**
2. **Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.**

UNIT-IV

(Sanitation and Quality Control)

1. SANITATION IN PROCESSING PLANTS

Sanitation in fish processing plants

- Sanitation refers to public health conditions related to clean drinking water and adequate treatment and disposal of excreta and sewage.
- Preventing human contact with feces is part of sanitation.
- This is generally done by hand washing with soap.
- Sanitation system aims to protect the fish products by providing a clean environment which will stop the transmission of diseases to humans especially through the oral route.
- For example diarrhea a main cause of food adulteration human beings, can be reduced through ecological and personal sanitations.

Purpose of sanitation:

- The overall purpose of sanitation is to provide a healthy living environment for everyone to protect the natural resources such as surface water, groundwater,
- soil and to provide safety, security.
- One of the main challenges is to provide sustainable sanitation in developing countries like India.
- Maintaining and sustaining sanitation involve technological, institutional and social aspects.
- Sanitation infrastructure has to be adapted to meet several specific contexts including consumers expectations and local resources.
- In food processing plants, both technological and personal sanitation play an important role in providing safety and security to the health of public who consume this food products.

Ecological sanitation or Ecological hygiene:

- This is an approach characterized by a desired to close the link between sanitation and agriculture in safe manner.
- In other words, ecosan system safely recycle excreta resources to crop production in such a way that the issue of non renewable resources is maximized.

- Properly designed and operated ecosan systems provide a hygienically safe economical and closed loop system to convert extra data into nutrients to be returned to the soil and water to be returned to the land.
- Ecosan is related to the prevention of contamination of natural resources.
- Hence it is also called resource oriented sanitation.

Environmental sanitation:

- Environmental sanitation compasses the control of environmental factors that are connected to disease transmission.
- Subjects of this category are the treatment of solid waste water, waste water, industrial waste and sound based Pollution Control.
- When analyzing the environmental samples, various types of indicator organisms are used to check for fecal pollution of the sample.
- Commonly used indicators for bacteriological water analysis include the bacterium Escherichia coli and non specific fecal coliforms.
- Relating to samples of soil, sewage sludge, bio-solids or fecal matter from dry toilets, helminth eggs are the commonly used indicators.
- With helminth egg analysis, eggs are extracted from the sample after which a viability test is done to distinguish between viable and non viable eggs.
- The viable fraction of the helminth eggs in the sample is then counted.

Sanitation in food industry:

- Sanitation within the food industry means, the adequate treatment of food contact surfaces by an effective process in destroying vegetative cells of microorganisms having significance related to public health.
- This helped not only reduces the microbial strength but also the other undesirable pathogens, but without adversely affecting the food or it safety for the consumer.
- SSOP's mandatory for food industries in some countries like USA and Japan.
- In the food Industries sanitary equipment means equipment that is fully cleaned using cleanable in place (CIP) and sterilizing in place (SIP) procedures.
- The design should have a minimum amount of turbulence during cleaning.

- In general to improve our ability this equipment is made from stainless steel of 316L capacity with surface roughness of the less than 0.5 micrometers to reduce the possibility of bacterial adhesion.

Fish processing:

- This refers to various aspects associated with fish and the fish products from the time of fish catch to the time of delivery of the final product to the customer.
- Although the term refers especially to fish in practice it is extended to cover all the aquatic organisms harvested for commercial purposes.
- Larger fish processing companies often and operate their own forming operations.
- The products of the fish industry are usually sold to intermediaries.
- Fish are highly perishable.
- The main purpose of fish processing is to prevent fish from such deterioration under needs proper handling and preservation to have a long shelf life and retain a desirable quality and nutritional value.

Which crossing can be subdivided in to-

a) Primary for pre processing involved in the filleting and freezing of fresh fish.

b) Secondary processing to producers chilled frozen on the canned products for the retail and certain trades.

- Most obvious method for preserving the quality of fish is to keep them alive until they are ready for cooking and eating.

Other methods used to preserve fish and fish products include-

1. The control of temperature using ice refrigeration or freezing.
2. The control of water activity by drying salt in smoking or freeze drying.
3. The physical control of microbial loss through microwave heating or ionizing irradiation.
4. The chemical control of microbial loads by adding acids.
5. Developing oxygen such as vacuum packing.

Usually more than one of this method is used.

- When chilled or frozen fish or fish products are transported by road, rail, sea air, the cold chain must be maintained.

- This requires insulated containers of transport vehicles and adequate refrigeration.
- Modern shipping containers can combine refrigeration with a controlled atmosphere.
- Fish processing is also concerned with proper waste management and with adding value to fish products.
- There is an increasing demand for ready to eat fish products are products that do not need much preparation.

Handling the catch:

- When fish are captured or harvested for commercial purposes they need some pre-processing so as to be delivered to the next part of the marketing chain in a fresh and undamaged condition.
- Fish catch by a fishing vessels need handing for storing safely until the boat lands the fish on shore.

Typical handling processes are-

1. Transferring the fish catch from the fishing gear to the fish loading vessel.
2. Catch before for the handling.
3. Sorting and grading.
4. Bleeding, cutting and washing
5. Chilling
6. Storing the chilled fish.

2. ENVIRONMENTAL HYGIENE IN PROCESSING PLANTS

Introduction:

- Seafood is supplementing the Agricultural Products in human life.
- It has attained the commercial status because of its nutritive value.
- In view of this environmental hygiene is necessary for preventing the food from contamination and spoilage from environmental factors such as microbe existing clients and waste products are released into the environment from the industries and sewage from households.
- Environmental hygiene has greater role in making the food suitable for consumption.

Reasons for environmental contamination:

- ❖ Large quantities of wastewater or generated through activities such as fish and holding equipments place transportation and facility cleaning. This wastewater is typically discharge into local water bodies or into municipal sewers. Fish processing effluents can be toxic to fish and other aquatic organisms.
- ❖ Pollutant issues typically related to the presence of high levels of solids in water content and high organic levels are elevated levels of solids oil and greases Ammonia cleaning agents at etc.,
- ❖ Solid wastes include skin, viscera, fish heads and carcasses. solid waste can be recycled in fish meal plants are it can be treated as Municipal waste.
- ❖ Liquid waste this includes blood water brine from drained storage tanks and water discharges from washing and cleaning.

Methods of control:

a) Physical control of microbial loads:

- Heat or ionizing irradiation can be used to kill the bacteria causing decomposition. Heat is applied by cooking blanching for microwave heating to pasteurize or sterilize fish products. This is followed by refrigeration and packing in metal cans before the heat treatment.

b) Chemical control of microbial loads:

- Microbial growth and proliferation can be inhibited by a technique called bio-preservation by adding antimicrobials are increasing the acidity through fermentation, marination or by

directly adding acids (Acetic, Citric, lactic) to fish products. Lactic acid bacteria produce the antimicrobial nisin which further enhances preservation. Other preservatives include nitrates sulfides, nitrites, sulfites, sorbets, benzoates and essential oils.

c) Disposal of solid waste:

- The disposal of waste must meet the requirements of the governing body and any associated regulations which may control the collection transport storage and handling processing use and disposal of animal carcasses are parts of animal carcasses.

d) Disposal of liquid waste:

- Many countries dispose of such liquid waste through their Municipal sewage systems or directly into the water way. The receiving water body should be able to degrade the organic and inorganic waste components in a way that does not damage the aquatic ecosystem.

e) Refrigerants:

- Refrigerants used at fish processing facilities are likely to be either ozone depleting chemicals and ammonia. Release of this compounds into the atmosphere, however would be expected to result in damage to the local and global environment.

3. PERSONAL HYGIENE IN PROCESSING PLANTS

Personal Hygiene:

- The keystone of all pre-requisite programs in any food processing or service operation is to be personal hygiene of its employees.
- If workers hygienic practices are improper then the sanitation standard operating procedure for environmental and food equipment becomes essential.
- Programs and training should help to improve personal hygiene that includes knowledge of food borne illnesses, employee's responsibility, management responsibility and third party services.

Ongoing problems with hygiene:

- Despite common sense under extensive training tools used by the food industry there are major issues with personal hygiene resulting in serious food dorne diseases outbreaks.
- Upon analysis it is proved that the contamination is because of the working of workers with bare hands and poor hand washing practices.
- Majority of the workers were carrying Norovirus and Salmonella aureus commonly found on porous surfaces washrooms and sinks.
- These are responsible for vomiting, diarrhea, hepatitis, respiratory and skin diseases.
- These viral or bacterial pathogens can survive for long duration on inanimate surfaces contaminating ready-to-eat (REF) food products.

Hand and surface hygiene:

- Regarding hand washing practices to remove Norovirus and other bacterial pathogens it's being shown that antibacterial hand soaps plus water with vigorous rubbing remove the most viral particles.
- Alcohol based hand sanitizers are also very effective against pathogens.
- But these are mainly effective on Noroviruses and other enteric pathogens.
- Elimination of as many porous surfaces in washrooms and within the food plant including food contact belts is critical.
- Salmonella shigella, Staphylococcus aureus, staphylococcus progenies, Enterobacter can be controlled in all areas using bleach and rigorous washing with antibacterial and soaps.

Restroom issues and recommendations

- Disinfectant wipes can eradicate the infections of Salmonella areas, E.coli, Enterobacter, and poliovirus present on the fingers of the workers from ceramic tiles lamination and granite linings.
- According to three established food safety and inspection service sanitation performs standard compliance.

1. Adequate facility for the current number of employees.
2. Sanitary in good condition.
3. Arranging self closing doors.
4. Adequately ventilated and an offensive odors.
5. Using lockers that are regularly emptied cleaned and periodically fumigated.
6. Free of old clothes and trash.

- Sanitary requirements for food plant equipment and environmental surfaces are the same for washrooms.
- The washrooms toilets letter in floor coverings ceilings and drains must be non-porous with waterproof services and slope of floors.
- Proper hygienic design enables sanitation employees to control both bacterial and viral pathogens.
- Furthermore all sinks toilets and letter should be hands free which include soap and sanitizer dispensers.
- If there are doorways, hands-free swing doors are strongly recommended for all food plant restrooms to avoid another cross contamination vector.
- Same rules apply for all hand wash stations in the plant.

Preventive measures;

- Employees can help prevent food borne illness by avoiding work when ill, not touching ready to eat food with their hands and washing hands frequently, especially whenever they are soiled or have touched anything that has contaminated them.
- Along with the food borne illness allergens can be spread without proper personal hygiene and hand washing.
- All employees must wash their hands properly before entering the workplace from a break.

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4. QUALITY CONTROL OF FISH AND FISHERY PRODUCTS

Quality control:

- It is the totality of features and characteristics of a product or service that bear on its ability to safety stated or implied needs.
- The quality of fish and fish products relies principally on safe and hygienic early produced products.
- Good hygienic practices in the handling, manufacturing, refrigerating and transportation of fish and fish products and sufficient different refrigeration throughout the processing greatly reduced outbreaks of fish borne diseases.
- Measure ensuring high standards of quality and safety, in turn reduce post harvest losses.
- The fishing industry must ensure that their fish handling processing and transportation facilities meet the established standards.
- Adequate training of both industry and the staff of the controlling authority must be provided by supporting institutions and channels for feedback from consumers.
- Ensuring high standards for quality and safety results in economics minimizing losses that result from spoilage, damage to trade and from illness among consumers.
- Fish processing involves latest it controls and measurements in order to ensure that all processing stages have been carried out hygienically.
- Hence, all fish processing companies are strictly recommended to join a certain type of food safety system.
- One of the certifications that are commonly known is the Hazard Analysis Critical Control Points (HACCP).
- Although fish quality is not a determinant as fish safety it has a direct impact on market price.
- Accurate assessment and prediction of fish quality or of main importance to set prices, increase competitiveness resolve conflicts of interest and prevent food wastage due to conservative product shelf-life estimations.
- In last few years, research in Food Science and Technology has focused on developing new methodologies to predict fish freshness under different storage conditions.
- ISO 22000 is a standard designed to help argument HACCP on issues related to food safety.
- Several companies especially big ones have either implemented or are on the point of implementing ISO 22000, there are many others which are hesitant to do so.

- The main reason behind that is the lack of Information and the fear that the new standard is to demanding in terms of bureaucratic work.

Fish processing Technology

- Fish is catch and brought for preparing them for human consumption and all the steps included constitute the processing Technology.
- This is subdivided into three phases, they are Pre-processing, Food processing or Manufacturing and Post processing stages.

a) Pre-processing Technology:

- This is mainly concerned with the learning of fish catch and its storage.
- In Marine fisheries, primary processing is often conducted on ships with wastes typically being disposed of directly into the sea.
- In case of fresh water fish are typically land based requiring high quality processed water for washing fish, cleaning process areas, cooling and production purposes.
- Physical methods such as flotation, screening and sedimentation are used to remove oil, grease and other suspended solids besides fish dressing, freezing, glazing, reo processing, milt processing, salting and smoking.

b) Processing technology:

- Processing of sea foods include the dressing, filtering and manufacturing of different food items together from primary fish or from their by products.
- The received fish is subject to secondary treatments by using biological and physical physico-chemical means.
- Biological treatments use aerobic or anaerobic microorganisms to metabolize the organic polluting matter into energy and biomass.
- The most used aerobic process is activated sludge system, aerated lagoons, trickling filter for bacterial beds and the rotating biological contractors.
- In anaerobic process, the anaerobic microorganisms digest the organic wastes and matters in the tank into biogas.

c) Post processing technology:

- After the manufacturing of food products, the processed products are usually distributed from the processing facility or docks by road to consumers, wholesalers and commercial food product manufacturers.

Unit – V

(Quality Assurance, Management and Certification)

1. Seafood Quality Assurance and Systems

i) System, *Codex Alimentarius* Good Manufacturing Practices (GMPs)

ii) Good Laboratory Practices (GLPs)

iii) Standard Operating Procedures (SOPs)

iv) Concept of Hazard Analysis and Critical Control Points (HACCP)in seafood safety**.**

2. National and International standards

i) ISO 9000: 2000 Series of Quality

ii) Assurance**.**

UNIT-V
(Quality Assurance, Management and Certification)

1. SEAFOOD QUALITY ASSURANCE AND SYSTEM

Sea food quality Assurance:

- Quality Assurance is the modern term for describing the control evaluation and Audit of food processing system.
- It is the strategic management, function establishing policies adapting programs to meet established goals and provides confidence about their effective application to the consumer.
- A large part of a quality education program is built around quality control.
- Quality control is the operational techniques carried out as the problems established by the quality assurance.
- Quality control is the tool for the production worker to help him operate the line in accordance with the predetermined parameters for any given quality level.
- In contrast to the principles in traditional quality programs Hazard analysis critical control point (HACCP) system is introduced by microbiologist more than 20 years ago to increase safety of food products.
- The principles of the HACCP system can very easily be used also in the control of other aspects of quality.
- This system of quality assurance is now adopted in many parts of the world since it is made mandatory by European economic Council through its directives No. 91/493/EEC in 1993, 1994.

Significance of quality assurance in fishing Industry:

- The artisanal fisherman fishing for a few hours and returning to shall the first catch on the beach does not need a complicated quality assurance system, since the customers know very well about the quality of the fish.
- Most often the fish are catch, sold and consumed within the same day.
- However, no food production, processing or distribution company can be self sustained in the medium for long term unless the issues of quality or properly recognized and addressed.
- An appropriate quality system is put into operation in the processing industry.
- The need for effective quality assurance systems is the fact that Global demand for fish and fishery products is continuously growing.
- Production level is approaching its maximum with limited possibilities for future increase.
- The need for improved utilization of present harvest with minimum wastage due to spoilers is possible only by introducing an effective Quality Assurance system.
- This also facilities efficiency employee satisfaction and less cost to the processing industry.

- Traditionally, fish processor recorded Quality Assurance as the responsibility of the regulatory governmental agency by formulating food laws and regulations inspection of facilities and product testing.
- Such a system is costly, ineffective, provides no guarantee of quality but merely a false sense of security.

2. GOOD MANUFACTURING PRACTICES (GMPs)

- Catching, handling and storing seafood with care can maximize the quality and potentially the value of seafood, thus making fishing operations more profitable and products more desirable to buyers.

GMP guidelines:

- GMP guidelines are not prescriptive instructions on how to manufacture products.
- They are a series of general principles to be observed and followed scrupulously during manufacturing.
- When a company is setting up its quality program and manufacturing process, many ways are available to fulfill GMP requirements.
- It is the responsibility of the company to determine the most effective and efficient quality process meeting the business and regulatory needs.
- All species of seafood have specific requirements, when it comes to handling and storage.
- This necessitated the development of good manufacturing practice guides for used by fishermen.
- The guidelines offer clear information on handling and storing the catch.

Good Manufacturing Practices (GMP):

- This all the practices required in order to conform to the guidelines recommended by agencies controlling the authorization and licensing of the manufacture and sale of food and beverages, cosmetics, Pharmaceutical products, dietary supplements, and medical devices.
- The guidelines provide minimum requirements that a manufacture must meet to assure that their products are consistently high in quality from batch to batch for the use by consumers.
- The rules that govern each industry may differ significantly.
- The main purpose of GMP is always to prevent damage to the end user.
- Additional information from GMP ensures, that the end product is free from contamination constancy of its manufacture documentation of manufacturing process capacities of the trained personnel and the quality check of the end product.
- GMP is typically ensured through the effective use of a quality management system (QMS).

Details at higher level:

- Guidelines of GMP provide guidance for manufacturing, testing and quality assurance in order to ensure that a manufactured product is safe for human consumption or use.
- Many countries have legislated that manufactures follow GMP procedures and create their whole GMP guidelines that correspond with their legislation.

Basic principles of GMP:

Industries or manufacturing units-

- ❖ Must maintain a clean and hygienic manufacturing area.

- ❖ Must maintain controlled environmental conditions in order to prevent cross-contamination from adulterants and halogens rendering the product and safe for human consumption or use.
- ❖ Must clearly define and validate the control processes.
- ❖ Periodically evaluate the manufacturing processes.
- ❖ Must get the validation from the regulatory authority on their consistency and utility.
- ❖ Project the instructions and procedures clearly using understandable language and known documentation practices.
- ❖ Appoint old trained operators to carry out their work besides documenting the procedures.
- ❖ Must maintain the records both in written and electronic forms.
- ❖ Must exhibit a declaration stating about the procedures manufacturing processes, quality checks and sustainability of the end products for used by the end users.
- ❖ Must record the deviations which need investigation and documentation.
- ❖ Maintain the records having the details of history batch and date of manufacture and distribution in comprehensible and accessible form.
- ❖ See that the distribution of products must minimize any risk to their quality.
- ❖ How is system for recalling any batch from sale or supply.
- ❖ Examine the complaints about marketed products.
- ❖ The causes of quality defect must be investigated.
- ❖ Must take appropriate measures with respect to the defective products and to prevent recurrence.

- Good manufacturing practices are recommended with the goal of safeguarding the health of consumers and patients as well as producing quality products.

3. GOOD LABORATORY PRACTICES (GLPs)

- Good Laboratory Practices or GLP is a set of principles intended to ensure the quality and integrity of laboratory studies intended to support research or issuing marketing permits for products regulated by government agencies.
- GLP applies to Pharmaceutical agents such as color additives, food additives, food contamination limits, food packaging and medical devices.
- India has become the third key emerging economy, after South Africa and Singapore to join the organization for Economic co-operation and development system (OECD) for mutual acceptance of data in the assessment of chemicals, ensuring that the results of non clinical chemical safety test done here will be accepted in all other member countries.
- GLP is concerned with a quality management system and quality assurance relating to the monitoring of the entire study, conduct, analysis and reporting of the results of the product.
- The purpose of quality assurance is to verify that all written procedures for carried out throughout the study.
- This quality audit firms its confidence that procedures were followed.
- This audit does not ensure about the quality of procedures followed and that the results are error less.

Essential aspects of Good Laboratory Practices

- GLP is relatively new area and CIFT has implemented several programs for achieving good laboratory practices.
- The raw material quality, the process monitoring as per HACCP, the GMP the SSOP, personal hygiene etc., depend heavily on monitoring physical, chemical or microbiological parameters.
- Consequently the success of all the above process and procedure will depend on the facilities of the laboratory in the plant.
- In fact, the laboratory shall have all test methods and testing equipments in tune with the following requirements.

a) Methods /standard operating procedures (SOPs)

- All the methods used by the lab shall be methods approved by national or International Agencies like FAD, EU Norms, US FAD, Codex, HACCP etc.,
- Under no circumstances unapproved procedure shall be used for monitoring any process for quality parameter.

b) Instruments:

- The measuring instruments shall be subject to periodic calibration with reference to National or International standards before they are used for actual measurements.
- This are maintained at National Metrology department, National Physical Laboratory, New Delhi or the International standards at Paris.

c) Certified Referee Materials (CRM)

- Various chemical standards used for estimation of several chemical parameters like titration, chromatography, spectrophotometry etc., shall follow certified reference materials for certified lab of National or International Agencies.
- All labs attached to food processing plants, must be accredited by qualified assessors appointed by agents is like National accreditation Board of Laboratories (NABL) or International Laboratory Accreditation Conference(ILAC) or Inter laboratory Calibration (ILC) to ensure accuracy and reproducibility of test results.

d) Proficiency Testing Programs:

- Proficiency testing involves preparation of homogenized test samples and testing the same in the nodal to be ensure reproducible results in all the participating Laboratories.
- CIFT is a nodal laboratory, identified by NABL and ILC.
- It has been important training to the personnel from Energy Information Administration Laboratories of US and MPEDA laboratories in India.

e) Record Keeping:

- The lab shall maintain all the records (CCP monitoring records, corrective action records, calibration records, hygiene and sanitation monitoring records, GMP records, ETP records, raw material and finished product testing records) relating to production and quality assurance as per HACCP, SSOP, GMP etc.
- All these records shall be supported with appropriate procedures and schedule for enduring as well as to counter check their adequacy.
- This record shall be available for review and Audit for at least three years.

4. STANDARD OPERATING PROCEDURES (SOPs)

INTRODUCTION

- A Standard Operating Procedure (SOP) is a set of written instructions that document a routine or repetitive activity followed by an organization.
- The development and use of SOPs are an integral part of a successful quality system as it provides individuals with the information to perform a job properly, and facilitates consistency in the quality and integrity of a product or end-result.
- The term "SOP" may not always be appropriate and terms such as protocols, instructions, worksheets, and laboratory operating procedures may also be used. For this document "SOP" will be used.

Purpose

- SOPs detail the regularly recurring work processes that are to be conducted or followed within an organization.
- They document the way activities are to be performed to facilitate consistent conformance to technical and quality system requirements and to support data quality.
- They may describe, for example, fundamental programmatic actions and technical actions such as analytical processes, and processes for maintaining, calibrating, and using equipment.
- SOPs are intended to be specific to the organization or facility whose activities are described and assist that organization to maintain their quality control and quality assurance processes and ensure compliance with governmental regulations.

- If not written correctly, SOPs are of limited value. In addition, the best written SOPs will fail if they are not followed.
- Therefore, the use of SOPs needs to be reviewed and re-enforced by management, preferably the direct supervisor.
- Current copies of the SOPs also need to be readily accessible for reference in the work areas of those individuals actually performing the activity, either in hard copy or electronic format, otherwise SOPs serve little purpose.

Benefits

- The development and use of SOPs minimizes variation and promotes quality through consistent implementation of a process or procedure within the organization, even if there are temporary or permanent personnel changes.
- SOPs can indicate compliance with organizational and governmental requirements and can be used as a part of a personnel training program, since they should provide detailed work instructions.
- It minimizes opportunities for miscommunication and can address safety concerns.
- When historical data are being evaluated for current use, SOPs can also be valuable for reconstructing project activities when no other references are available.
- In addition, SOPs are frequently used as checklists by inspectors when auditing procedures.

- Ultimately, the benefits of a valid SOP are reduced work effort, along with improved comparability, credibility, and legal defensibility.
- SOPs are needed even when published methods are being utilized.
- For example, if an SOP is written for a standard analytical method, the SOP should specify the procedures to be followed in greater detail than appear in the published method.
- It also should detail how, if at all, the SOP differs from the standard method and any options that this organization follows.
- Standard Guide for Documenting the Standard Operating Procedures Used for the Analysis of Water, "a significant part of the variability of results generated by different laboratories analyzing the same samples and citing the same general reference is due to differences in the way the analytical test methods and procedures are actually performed in each laboratory.
- These differences are often caused by the slight changes or adjustments allowed by the general reference, but that can affect the final results." Using a correct well-written SOP can minimize such differences.

Procedure:

- An SOP is a procedure specific to your operation that describes the activities necessary to complete tasks in accordance with industry regulations, provincial laws or even just your own standards for running your business.
- Any document that is a "how to" falls into the category of procedures.
- In a manufacturing environment, the most obvious example of an SOP is the step by step production line procedures used to make products as well train staff.
- An SOP, in fact, defines expected practices in all businesses where quality standards exist.
- SOPs play an important role in your small business. SOPs are policies, procedures and standards you need in the operations, marketing and administration disciplines within your business to ensure success.
  These can create:

  - ❖ efficiencies, and therefore profitability
  - ❖ consistency and reliability in production and service
  - ❖ fewer errors in all areas
  - ❖ a way to resolve conflicts between partners
  - ❖ a healthy and safe environment
  - ❖ protection of employers in areas of potential liability and personnel matters
  - ❖ a roadmap for how to resolve issues – and the removal of emotion from troubleshooting – allowing needed focus on solving the problem
  - ❖ a first line of defense in any inspection, whether it be by a regulatory body, a partner or potential partner, a client, or a firm conducting due diligence for a possible purchase
  - ❖ value added to your business should you ever wish to sell it Developing an SOP is about systemizing all of your processes and documenting them

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- Every business has a unique market, every entrepreneur has his/her own leadership style, and every industry has its own best practices.

- No two businesses will have an identical collection of SOPs. Below is a listing of just a few typical SOPs, which you will want to consider writing for your own small business.

Production/Operations

- ❖ production line steps
- ❖ equipment maintenance, inspection procedures
- ❖ new employee training

Finance and Administration

- ❖ accounts receivable – billing and collections process
- ❖ accounts payable process – maximizing cash flow while meeting all payment deadlines

Marketing, Sales and Customer Service

- ❖ Approval of external communications: press releases, social media, advert, etc.
- ❖ preparation of sales quotes
- ❖ service delivery process, including response times
- ❖ warranty, guarantee, refund/exchange policies
- ❖ acknowledgment/resolution of complaints, customer comments and suggestions

Employing Staff

- ❖ Job descriptions
- ❖ Employee orientation and training
- ❖ Corrective action and discipline
- ❖ Performance reviews
- ❖ Use of Internet and social media for business purposes

Legal

- ❖ Privacy- an explicit privacy policy is required, specifying what information you will collect, why you are collecting it, how it will be used, and how long you will keep the information on file. Ensure that everyone in the organization is only asking for the information they need to do their job.
- ❖ Accessibility- having accessible locations, goods and services is going to be a legislated right of all Ontarians, with the definition of accessibility going well beyond traditional concepts, like providing wheelchair access washrooms.
- ❖ Companies with fewer than 20 employees are required to create a plan for how they will comply with the Customer Service Standard and then train their employees. Companies with 20 or more employees must also put their plans in writing and report to the government on how the company is doing.

Tips

- ❖ establish prior to opening; review at least annually
- ❖ develop procedures in the language, style and format best for the establishment

- write SOPs in clear, concise language so that processes and activities occur as they are suppose to the level of detail in SOPs should provide adequate information to keep performance consistent while keeping the procedures from becoming impractical
- keep written SOPs on-site so that they can be used by supervisors and employees
- drafts should be made and tested before an SOP is released for implementation
- The more decision makers, employees and complexity in the business, the more SOPs are required.

5. HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP)

Hazard Analysis Critical Control Points (HACCP)

- It the system of assuring food safety and quality to the consumers.
- It has now gained worldwide recognition AS the most cost-effective and reliable system available.
- This system was developed in 1969 and got approval for implementation by member countries in 1970.
- The concept of HACCP in food processing it is possible to assure and to document residents of the quality standard as specified in the product specification.
- Hazard analysis under 60 of critical control points occur.
- Various stages involved in the processing of seafood or live fish catch, handling of catch arrival of the catch at the industrial site, processing handling, weighing under packaging stages.
- However there is commonality at all stages relating to the hazards analysis and interpretation of critical control points.

This can be summarized as described below.

- Possible hazards and their analysis at all processing steps.
- Hazards generally encountered for the growth of bacteria and cross contamination by enteric pathogens.

(a) Control measure for the growth of bacteria is the establishment of short processing time to be checked on a daily basis by the concerned in charge.

(b) Control measure for contamination is the personal hygiene to be supervised continuously by the product manager through their medical certificate report on illness dress etc.

- Microbiological control of water quality must be carried out by the quality control manager on a regular basis.
- If chlorination of water is applied the level of chlorine must be determined on a daily basis.

(c) Critical limits for water quality or standards for drinking water limits for chlorine is 0.5 mg/L infected or contaminated persons are allowed to work in direct contact with unwrapped fish.

(d) Records on tests for water quality:

- Action and observation on personal hygiene must be recorded.

(e) Correct to action suggested in microbiological testing of products. Reject all contaminated products.

(f) Chilling or freezing:

- Control is the continuous temperature control or frequent check of icing.
- Accuracy of thermometer must be checked regularly against and accurate Mercury thermometer.
- Critical limits are +1 degree centigrade for chilled fish and -18 degree centigrade for frozen fish.

- Log on all temperature readings must be kept.
- Correct to action is Re inspection of fish exposed to elevated temperature and rejection of low quality products.
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Advantages of HACCP:

- ❖ The HACCP system is an ideal tool when resources are scarce.
- ❖ The general principle of the HACCP concept is to direct energy and resources towards Areas where they are necessary and most useful.

The main advantages can be summarized as follows-

- ❖ Control is active in the remedial action can be taken before a problem occurs.
- ❖ Control is true the features that are easy to monitor such as time temperature and appearance.
- ❖ Control is cheap in comparison with data and chemical and microbiological analysis.
- ❖ The operation is controlled by persons directly involved with the fish products.

- HACCP he is a total quality management system with emphasis on safety based on a systematic approach to identification assessment and control of hazards.
- It is a proven to control system in which hazard is controlled or eliminated before it occurs.
- It concentrates on prevention strategies on loan hazards and the risks arising out of them occurring at specific points in the processing schedule.

HACCP concept:

- Food must be safe to consume and conforms to certain standards.
- Some properties or monitored by the plant but without supplementary information that will provide only a poor means for controlling and operation.
- If the product does not confirm to specifications it may have to be reprocessed are discarded.
- This content and C can be avoided if certain key variable in the process are monitored and controlled.
- Such a system is provided by HACCP.

HACCP is based on effect of seven principles

They are -

- ➢ Hazard Analysis- assess the hazard associated with the capture storage of raw materials and ingredients free process and process operations and all other activities up to consumption. Prepare a flow diagram of the steps in the process. Identify and list hazards and specify control measures.
- ➢ Determination of critical control points (CCP).
- ➢ Specification of criteria-establish target levels and Critical limits that must be met to ensure that each CCP is under control.
- ➢ Establishment of processor and monitoring system to ensure control of the CCP and their implementation.

- Corrective action when the monitor indicates any deviation from the critical limits is thatthe process is out of control.
- Establishment of procedures to verify that the HACCP system is working correctly andeffectively.
- Establishment of documents concerning all procedures and records appropriate to thisprinciples and their application.

**********THE END**********