PACKING AND LABELLING OF FISH AND FISHERY PRODUCT

UNIT-1:

Introduction to food packaging:

The term packaging refers to wrapping or covering any items including food to protect from damage / spoilage and present aesthetic look. More often, packaging of food items are used to extend the keeping quality and minimize contamination. Packaging of food including fish and fishery products is a huge industry and in this section some basic aspects of packaging has been dealt.

Functions of packaging:

Primarily, there are three functions for packaging as follows.

- To contain the product
- To protect (and preserve) the product
- To present the product to the consumer in attractive way

In addition to the above mentioned primary functions, there are some subsidiary functions. They are,

- By acting as a dispenser when it reaches the consumer, e.g. Milk carton after opening, can be folded into a spout so that milk can be poured without spillage. Another example is that a spout is attached near the bottle opening to prevent spillage oil form the bottle while emptying.
- As a container in which fast foods may be heated or in which hot foods may be deposited (as in the case of a plate)Some important factors to be considered for the type of packaging material to be used in the food are,
    - the raw material used for packaging is easily available and economically viable
    - the material should withstand the stress and strain of machineries which often operate at high speeds.
- The package must not have any adverse effects on the contents and must comply with all legal requirements. Also, due consideration should be given to the ultimate disposal of packaging materials and their effect on environment.

Containment is fairly obvious and basic function since the package must hold all that is within a unit and keep it together during transport and storage. The package must not leak and must contain a convenient and correct quantity of a material.

Purpose of food packaging :

The primary purpose of packaging is to provide physical or barrier protection for your food products. This may include:

Physical protection –

- The objects enclosed in the package may require protection from, among other things, mechanical shock, vibration, electrostatic discharge, compression, temperature

Barrier protection –

- A barrier from oxygen, water vapor, dust, etc., is often required. Permeation is a critical factor in design. Some packages contain desiccants or Oxygen absorbers to help extend shelf life

Containment or agglomeration –

- Small objects are typically groupedtogether in one package for reasons of efficiency. For example, a single box of 1000 pencils requires less physical handling than 1000 single pencils. Liquids, powders, and granular materials need containment.

Information transmission –

- Packages and labels communicate how to use, transport, recycle, or dispose of the package or product. With pharmaceuticals, food, medical, and chemical products, some types of information are required by governments. Some packages and labels also are used for track and trace purposes.

Marketing –

- The packaging and labels can be used by marketers to encourage potential buyers to purchase the product. Package graphic design and physical design have been important and constantly evolving phenomenon for several decades.

- Marketing communications and graphic design are applied to the surface of the package and (in many cases) the point of sale display.

Security –

- Packaging can play an important role in reducing the security risks of shipment. Packages can be made with improved tamper resistance to deter tampering and also can have tamper-evident features to help indicate tampering.
- Packages can be engineered to help reduce the risks of package pilferage: Some package constructions are more resistant to pilferage and some have pilfer indicating seals.

Convenience –

- Packages can have features that add convenience in distribution, handling, stacking, display, sale, opening, reclosing, use, dispensing, reuse, recycling, and ease of disposal.

Portion control –

- Single serving or single dosage packaging has a precise amount of contents to control usage. Bulk commodities (such as salt) can be divided into packages that are a more suitable size for individual households.

Procedure of food packaging:

Six important safety procedure in food packaging :

1.Food Packaging:

- There are several different kinds of food packaging: the primary packaging, secondary packaging, and tertiary packaging.
- Primary packaging is the outside package that holds the food secondary packaging is what combines the primary packages into one container.
- Finally, tertiary packaging combines all of the secondary packages into one container.

2.Protective Material:

- Even the ink that is used on packaging matters when it comes to safety procedures in packaging food. Consideration needs to be given to the ink

to ensure that it does not contain dangerous substances that may pass through the packaging into the food. The food inside the packaging can have a direct impact on the type of ink used. For example, if the food being packaged is high in fat, like cheese.

Other materials like laminate films have regulations that need to be followed. In the case of laminate films, the layers must be food-safe to stop the migration of hazardous substances into the food being packaged.

3.Safety labels:

- *Proper labelling of food items* is also an essential step when keeping food safe. An adverse health outcome can result from incorrect labeling, like a missing detail on the list of ingredients. For example, there may be a nut-related ingredient in the food that didn't make the food label for one reason or another. This could put someone's life at risk if they have a deadly nut allergy.

4.Food Preparation :

- How is the food being prepared? Are workers using proper handwashing techniques,Are workers wearing appropriate equipment like gloves and masks, All of these things come into play when preparing food.

- The highest of standards need to be applied to ensure no contaminants are getting into the food.

5.Manufacturing standards:

- The manufacturing process is another important procedure in packaging food.

- The manufacturing facility and the practices being used all need to adhere to safety and quality standards to ensure food isn't compromised. An example of this is the environment in which food packaging is manufactured. The environment in the manufacturing facility has a direct impact on the safety of the food.

6.Food Packaging Regulation:

- Governments across the world place food packaging regulations upon manufacturers to ensure the safe and hygenic. manufacturing of packaging that comes into contact with food. These regulations ensure the best quality and hygienically manufactured packaging is used at all times.

Technological aspects of packaging fishery products:

- Novelty and recent trends in food packaging techniques are the result of consumer preferences toward mild processed food products with enhanced shelf life and convenience.

- Moreover, modern trend of retail practices and changing lifestyle are the incentives for the evolution of novel and innovative packaging techniques without compromising food safety and quality characteristics .

Active packaging:

- Active packaging came into existence with the aim of satisfying the consumer demand for natural, recyclable, and biodegradable packaging materials.

- Thus renewable resource based active packaging material capable of degrading by natural compositing process and with less environmental effect was developed .

Intelligent packaging

- Intelligent packaging is rooted on involvement of intentional association of food with its package or surroundings with an attempt to enhance food quality characteristics and safety.

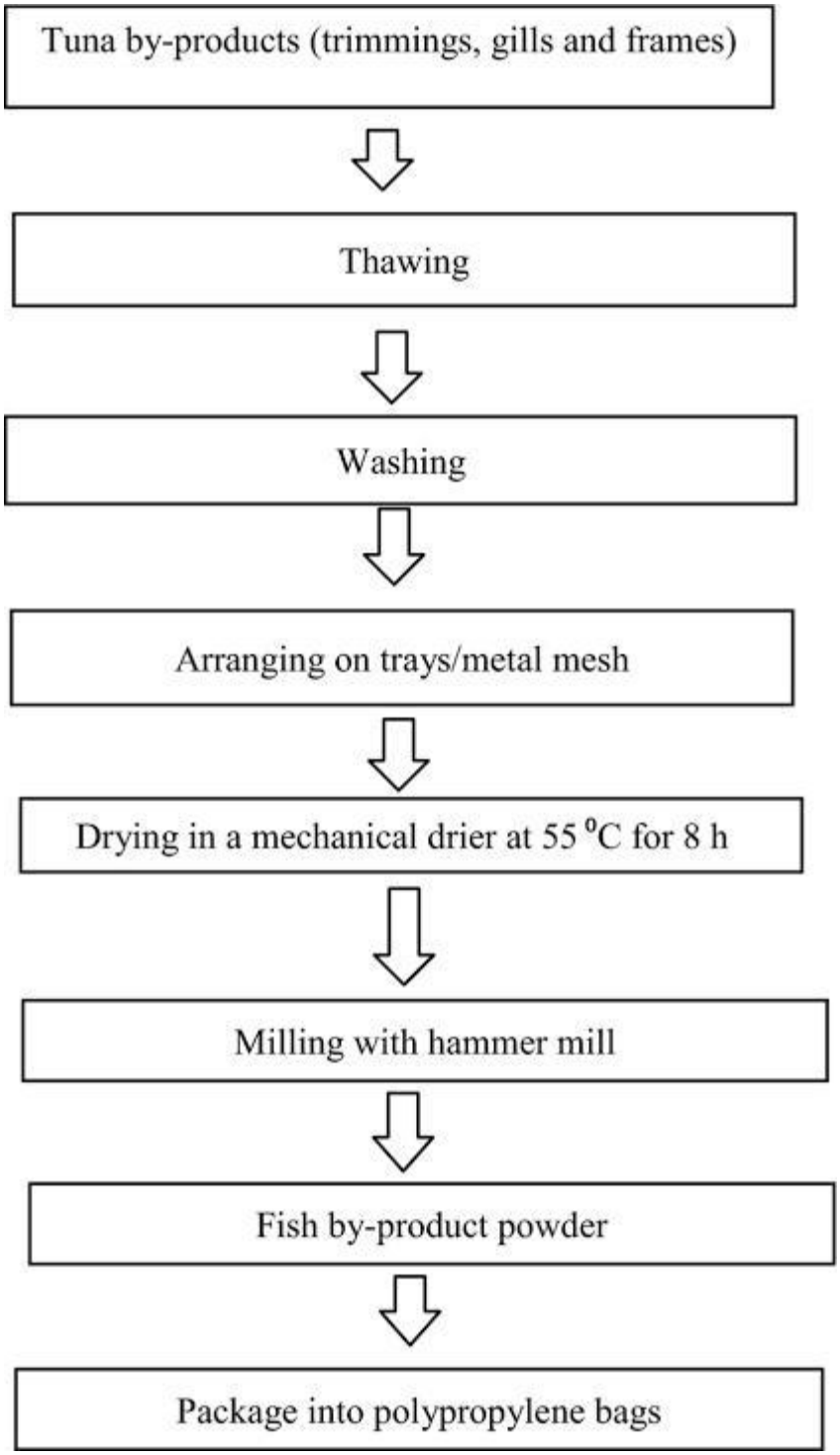
- Intelligent packaging is linked to the advancement in time–temperature regulators, ripeness monitors, biosensors and radio frequency indicators and regulators.

Bioactive packaging

- Bioactive packaging is the novel packaging technology that alters the package or coating in a way so as to have positive effect on consumer's health.

Packaging of Fresh fish:

- To maintain the quality of fresh fish, use of good fish boxes and packaging materials is required. Specially designed and constructed fish boxes are now widely used, such as insulated containers for air shipment. Appropriate packaging also makes handling easier, which reduces labour costs.


Tuna by-products (trimmings, gills and frames)
Thawing
Washing
Arranging on trays/metal mesh
Drying in a mechanical drier at 55 °C for 8 h
Milling with hammer mill
Fish by-product powder
Package into polypropylene bags

III**Important Requirements for Fish Boxes and Containers**

- They must be of a suitable size for the range of fish to be handled or the products to be put into them.
- They should be of a convenient size for manual handling or lifting by mechanical equipment.
- They should be stackable such that the weight of the containers on top rests on the containers underneath and not on the fish.
- They should be constructed of impervious non-tainting materials.
- They should be easy to clean.
- They should provide drainage for the melt –water.

Polyethylene Fish Boxes:

- High density polyethylene is most commonly used for fish boxes as it is strong and light in weight and easy to clean. Polyethylene fish boxes are very popular onboard fishing vessels.

Disposable Fish Boxes:

- The disposable boxes are commonly used. These hold up to approximately 25 kg of fish or fish plus ice. They may or may not be insulated.

- Insulated boxes include fiberboard boxes with polystyrene liners.Non-insulated fish boxes are normally fiber board cartons, waxed or otherwise water-proofed.

- A road transport, disposable packaging can be a water-proofed carton with or without insulation depending on whether the transport vehicle is refrigerated or not.

- Packaging for air transport, has to be light, strong and leak proof, may consist of a heavy duty water-proofed corrugated carton with two polyethylene liners and insulating material between the liners.

Packaging of Frozen fish:

Frozen fish are fish that have been subjected to freezing in a manner to preserve the inherent quality of the fish by reducing the average temperature to -18 ° C or lower and which are then kept at a temperature of -18 ° C or lower.

Frozen fish and fish products can be packaged by laminated plastic bag or pouch, clear plastic bag, etc. sealed and put inside carton boxes. There are three common types of plastic packaging materials available in the market. These are :

1.Polystyrene

2.Polyethylene

3.Polypropylene

In choosing the plastic materials and cartons for fish products, it is to be emphasized that the materials –

ii. should protect the products from moisture and aroma loss, oxidation and rancidity and other odors from permeating into the product;

iii.should not become brittle and torn during storage and display at temperature below –18 ^{o} to –25 ^{o}C. Some of the examples of commonly used packaging materials

for frozen products are-

i.Polystyrene trays over-wrapped with polyethylene/ polypropylene film;

ii. Polyethylene bag;

iii. Plastic bag inside carton box

Polyethylene:

- Polyethylene frequently used as coating or as layer in a laminate with heat sealable films.
- Most polyethylene films used in frozen food packaging are in the low and medium density ranges

Nylon (polyamide PA):

- Nylon films have excellent properties of toughness, tear and breaking strength.

Cellophanes:

- Cellophane are strong, moisture proof, heat sealable and flexible at low temperatures.

Poly vinylidene chloride(PVDC):

- Saran is superior to polyethylene as a water vapour barrier material and has low oxygen permeability.

Polyesters(PES):

- With polyethylene to make pouches which can be filled and heat sealed. These laminates are now used for boil in the bag pouches.

Packaging for Transportaion:

- Fish is transported both through air and land. Land transportation of chilled fish is carried out in insulated or mechanically refrigerated vehicles with minimum inside temperature of 7^0C.

- Boxes for land transportation are made of wood, aluminum, high density polyethylene, expanded polystyrene or polyurethane. The ideal fish transpiration box should be light weight yet strong enough to withstand the combined weight of fish, ice and stacking and should have good insulating properties. Boxes are usually made of double bottom to collect the melt water.

- Air shipment of chilled fish requires a lightweight and protective container. Modern insulated containers are made of high-density polypropylene with polyurethane insulation.

- Instead of ice, pads of nonwoven fabric encapsulating synthetic absorbent powder are used for chilling of air shipped fish. These pads could be soaked in water and deep frozen for use.

- Plywood boxes insulated with 2.5cm thick foamed polystyrene slabs are found to be more useful to transport fish over longer distances involving duration of 60-80hrs.

Considerations for fish transport

Fish transport must be done carefully in order to be successful. A poorly organized effort may easily result in death of fish. The following factors directly influence fish transport.

Tolerance to transport

A famous saying in fish culture is that "fish are not potatoes". They need tender loving care if they are to remain strong and healthy. Tolerance of fish to transport is

related to their ability to resist or adapt to stressful conditions. Their resistance also changes as they pass through various life stages. Larvae are very delicate as are brood fish which are ready to lay eggs. The table below indicates stress tolerance levels of some commonly

- Orechromis- high tolerance
- Catfish - high tolerance
- Common carp - high tolerance
- Big head carp- medium tolerance
- Silver carp -low tolerance

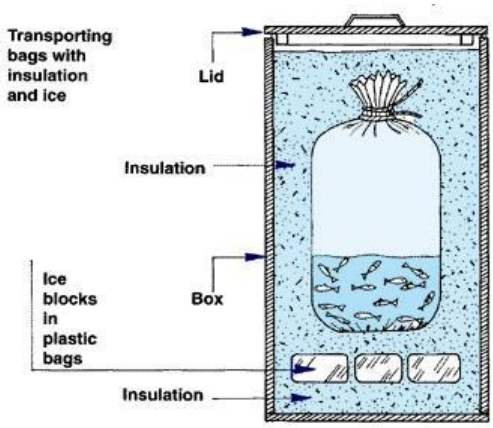
Presence of food in the intestines

- Fish survive transport better if they have no food in their intestines. For this reason, they are not fed for one to two full days prior to the time they will be transported.
- Fish can also be harvested and held in net enclosures or tanks for 24 to 48 hours with clean, preferably gently running, water. The fish pass food out of their intestines and will be in good condition for transport.

Age and size of fish

- A lower weight of small fish can be transported per unit volume of water than large fish. This guide classifies fish broadly into four main groups according to what life cycle stage they are in. Newly hatched fish are called larvae or sac fry.
- They are slow-moving and possess a yolk sac which provides them with at least a 24-hour food supply after hatching.

  Post larvae do not have a yolk sac and are commonly called fry.
- Fry weigh less than 1g. A 3- to 4-week-old fish weighing more than 1g may be called a fingerling



Shipping and Institutional supplies:

1.shipping:

Aquaculture often requires transporting live animals from one place to another. A large shipment of the same type of fish can be delivered via a hauling tank and truck if the distance is not too great. But for long distances, or when the shipment is not large enough to justify a truck with hauling tanks, shipping fish in boxes is a feasible and more economical alternative.

Shipping Containers

- Shipping fish in boxes typically involves a considerable investment in money, time and effort, so the materials used should be the best available.
- Packaging materials should be watertight, should prevent rapid changes in temperature, and should be rugged enough to withstand handling during shipping.
- A plastic bag is the watertight component. It is nestled in an insulated box that protects fish from rapid temperature change. The insulated box is then placed in a sturdy outer box for protection.

Bags

- Fish bags are made of transparent polyethylene plastic and should be at least 3 mil thick to withstand some abuse without leaking. Many experienced commercial shippers opt for a more expensive 4-mil plastic bag.
- Common “pillow slip” bags have a single bottom seal that creates sharp corners when filled with water. Small fish can sometimes become trapped in

these corners during shipment and die. You can “square up” the corners by folding them up and taping them to the side of the bag.

Insulated Boxes

- Fish boxes are typically insulated to keep the temperature relatively constant during transport. Most are made from polystyrene Styrofoam® that is approximately 0.75 to 1 inch (1.8 to 2.5 cm) thick. Boxes are available in standardized sizes made specifically for transporting fish.

Outer Shipping Box

- While Styrofoam® is watertight and provides good insulation, it is not a rugged material and can be easily punctured, chipped or broken during the shipment. So the insulated box must be placed in a rugged outer container.

Inner shipping box:

- The inner, insulated box should fit snuggly inside the outer box to give the best protection possible. A good quality packing tape should be used to seal the outer box.

Institutional supplies

The increasing globalisation of fisheries and aquaculture supply chains, along with changes in policy regulations, as well as climate change and technological development, are confronting the fishing and aquaculture industries with a wide range of challenges.

The rise of fish consumption, along with the increasing competition in the seafood market, has recently brought fisheries and aquaculture producers to adopt differentiation strategies aimed at increasing profits.

Therefore, the fishing industry has been responding to such increasing consumer demand for traceable and sustainable seafood with the introduction of labelling schemes, thus providing further information on product quality .

This marketing practice is quite recent for the fish industry (Roheim and Sutinen 2006) and—as a fast-growing voluntary and market-based labelling strategy—is recognized as an important instrument in global environmental fisheries governance (Oosterveer and Sonnenfeld 2012). Thus, new voluntary schemes such as sustainability certifications for sustainable fish and related eco-labels were adopted (de Haes et al. 2010), allowing for credit of the firms’ engagement to guarantee quality features, to differentiate products from competitors, and to reduce uncertainties on product quality (Riganelli and Marchini 2016).

Concurrently, European policies have repeatedly promoted sustainable fish consumption campaigns, through the Common Fisheries Policy (EU 2011), for stimulating consumers to eat more fish from sustainable sources. In some cases, the proliferation of labelling schemes has brought to general confusion and uncertainty among producers, retailers, and consumers, on how to distinguish a sound certification scheme for fish. Such uncertainty on quality information called for collective and public quality labels for fish, in order to ease decision-making and lessening prices for consumers (European Parliament 2016).

Packaging standards for Domestic and International trade:

- The Indian Government has enacted laws to take care of quality standards of packaged foods. Standards have also been fixed for the particular kind of packaging required to be undertaken, depending on the product to be packed. The regulations on quality standards of packaging that govern food products in our country are given as under

- **Standard Weights and Measures Act (SWMA) 1976 and the Standards of Weight and Measures (Packaged Commodities) Rule, 1977**
  It is mandatory and applicable to all commodities including foods. The emphasis is on quantity and value declaration on the label to facilitate value comparisons and protect consumer interests. The standard specifies quantities to be packed, expressions to be avoided and size of type depending on the size of the panel in a package.
  The SWMA requires certain declaration to be made on every retail package, which includes common/ generic name of the product, net quantity, retail sale price, unit sale price, month and year of manufacturing or pre-packing, and name and address of the manufacturer or the packer. As far as possible, all declarations required to be made under SWMA should appear on the principal display panel (PDP) of the package.

- **Prevention of Food Adulteration Act, 1954 and the Prevention of Food Adulteration Rules, 1955**
  This is basically intended to protect health and safety of consumer and is mandatory for internal trade. The labeling rules are very elaborate and applicable to all packaged foods. The declarations include product name, net quantity, batch number, month and year of manufacture and additives incorporated and ingredients.

- **Fruit Products Order, 1955**
  This is concerned mainly with the regulation of quality and hygiene of fruit and vegetable products including beverages, syrups etc and is mandatory for export and internal trade. It also specifies the type of packages that can be used for various fruit and vegetable products. All labels should be approved by the authority and should carry the license number allotted. The batch/code number along with the date of manufacturing should also be declared.

- **Meat Food Products Order, 1973**
  This order is mandatory and regulates the licensing and labeling of meat products. It also specifies the type of packages that can be used for various meat products. All labels have to be approved by the licensing authority and number should be declared on the label.

- **Agriculture Marketing (AGMARK) Rules, 1937**
  Agricultural products such as nuts, ghee, honey, pulses, spices and condiments, vegetable oils etc. are covered under AGMARK for their quality parameters. The Agmark rules also specify the type of packages that can be used and labeling declarations that have to be given. It is voluntary for internal trade and compulsory for export of modified products.

- **Bureau of Indian Standards (BIS) Act, 1986 and BIS rules, 1987**
  The BIS has formulated specifications for packaging materials, packages and components. Also, it specifies the types of packaging materials that can be used for various types of food products. These specifications are voluntary for most of the foods, but are compulsory for certain items like food colours and packaged drinking water.

- **Food Safety and Standards Act, 2006 and Food Safety and Standards (Packaging and Labelling) Regulations, 2011**
  Under Food Safety and Standards Act, 2006, the regulations on packaging and labelling has come into force on/ after 5.8.2011 as Food Safety and Standards (Packaging and Labelling) Regulations, 2011, that overrides all existing rules and regulations related to food packaging and labelling.

UNIT :2

.Packaging Materials

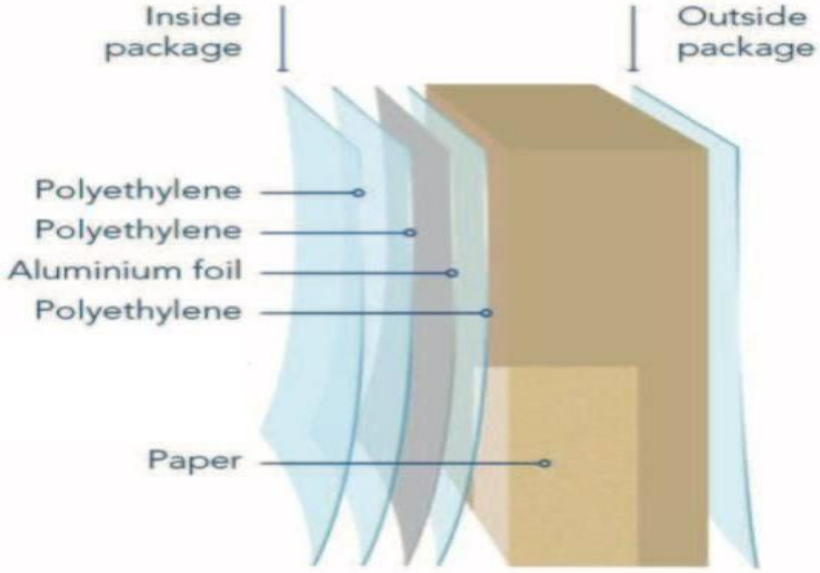
For packaging, a wide variety of materials are being used which may be grouped as follows.

- Plastics
- Paper and paper board
- Glass containers
- Earthenware and ceramics
- Metal containers
- Natural materials such as
  - Wood
  - Straw
  - Leaves
  - Jute and textiles

- Bamboo

Plastics

- Plastics are widely used for the manufacture of flexible packaging materials like films, semi rigid and rigid containers such as jars and bottles. The important plastic materials used in packaging are discussed below.



Low Density Poly Ethylene (LDPE)

The most widely used plastic for food packaging films.

- Relatively low cost
- Fairly tough (good mechanical strength properties such as tensile, burst, impact and tear strength)
- Ease of heat sealing and good seal strength
- Good water vapour barrier
- Good low temperature resistance.

Linear Low Density Poly Ethylene(LLDEP)

- This has an extremely high tensile strength and very high stretch with very good heat sealing characteristics. Used for heavy duty sacks and stretch wrap applications. It is used for incorporating into HDPE to reduce brittleness and increase tensile strength of carry bags

High Density Poly Ethylene (HDPE).

- HDPE gives a stiffer film than LDPE and has higher barrier properties to water vapour and gases by a factor of around 5. Because of extra stiffness and strength, HDPE can be used as a

very thin film,, it is water proof and hence used for butcher wrappings.

- .As it is tough, it is used for making super market carry bags. As HDPE does not soften at 100^{o}C, it may be used in the manufacture of boil-in-bag type packages.

Polypropylene (PP)

- It has higher softening point 140-150^{o}C than HDPE. It is a good water vapour barrier, a fairly good gas barrier and has good grease or oil resistance. However, it does not perform well at low temperature as it becomes brittle and its impact strength gets lowered
- It is widely used for packaging snack foods such as potato crisps and biscuits

Poly Vinyl chloride (PVC)

- It is hard, fairly brittle material but its properties can be modified by the addition of plasticizers – chemicals which when mixed with the polymer, soften it and render it plastic or flexible.
- Highly plasticized PVC is used as a cling film for over wrapping super market trays of fresh produce such as red meat, poultry fresh fruits and vegetable and cheese.

Polystyrene (PS)

- PS is a hard and rather brittle material, colourless and transparent unless pigmented. The addition synthetic butadiene or polybutadiene to polystyrene improve the impact strength and such material is referred as High Impact PolyStyrene (HIPS). Important properties of polystyrene are given below.

  - Fairly high water vapor permeability
  - Fairly high oxygen permeability
  - Softens at 85 to 95^{o}C.

Regenerated cellulose film

- Cellulose is obtained from wood pulp or cotton linters. It is soaked in caustic soda for about an hour and the recess alkali is pressed out. Residue is pressed and allowed to age for 2-3 days during which time it absorbs oxygen from air and reduces the chain length of cellulose. It is dissolved in carbon disulphide solution and then dispersed in dilute alkali.

Manufacture of plastic films,

- Plastics used in packaging are mainly thermoplastics which soften, when heated in contrast to thermo set plastics that do not soften. Conversion of

plastics into packaging usually relies on this thermoplastic property. Heat makes the plastic to become soft and in this high viscosity form, the soft plastic is made into the desired shape, which may be summarized as below.

Making of containers and bottles from plastics

Plastic containers and bottles are packs of 3 D type where the empty container has the same size and shape as the filled pack. Most of these packs are semi rigid rather than rigid but the demarcation is not sharply defined.

Most plastic containers and bottles are still single layers plastics in contrast to flexible packaging where multi layers packagings are widely used. However, the use of multilayer containers and bottles is likely to increase in future.

Extrusion

- Extrusion is used in most forms of plastic conversion and is important process in both in rigid and flexible packaging.
- An extruder, is a machine which has a single screw that is made to rotate inside a barrel. Solid resin usually in granule form is fed to the extruder through a hopper.
- The plastic is fed forward by the rotating screw and melts by the combination of heat from the heated barrel and by the friction created by the turning of the screw.

Thermoforming

- Separate processes of extrusion of sheets and thermoforming is generally more practical and is more usual. Thermo forming uses a combination of heat to soften a plastic sheet and a pressure difference to make the softened sheet to take up the required shape

Film blowing

- Blowing is one of the two methods used for making thin films. In this method, molten plastic is extruded by the screw extruder (described earlier) into a circular die (slit in the shape of a circle). As soon as the film comes out of the die as a tubing, it is blown into a bubble. As the bubble is hauled up, it is cooled and finally wound on reels as a lay flat tube.

Blow moulding

- Blow moulding enables a bottle to be made with a narrower neck than the main part of the body. There are many similarities between making glass bottles and making plastic bottles

Lamination

- Laminations are combination of various plies which gives material unique properties that are not given by a single material alone. In lamination process, adhesives are used.
- One plastic material is coated with an adhesive and subsequently adhered to another material. Laminates can be prepared by using only plastic

- films or plastic to paper, or aluminium foil to plastic or metalized plastic.
- For water based solvent based and solvent less laminating process, polyolefin films are surface treated on the laminating side although wet or molten adhesive is applied during lamination process.

Extrusion laminating

- It is done using an extrusion coating machine. The molten polymer falls between the two webs being laminated almost at that instant, the two webs are pressed together.

Protection of Fish packaging

- Protection and preservation of the product during transit, storage, display at the point of sale and carriage to and storage in the consumers home are essential functions of any package.
- In order to protect the product, we need to know the following product characteristics.

  - Mechanical strength of the product.
  - Whether the product undergoes undesirable moisture exchange with its surroundings.
  - Whether it supports microbial growth
  - Whether it is chemically reactive.

  Protecting means prevention of

  - Microbial growth
  - Oxidation or enzymatic rancidity
  - Colour change.

Preservation can be taken more widely to relate to prevention of any change in food as presented to the consumer. Thus loss of color or flavor, for whatever reason will be interpreted by the consumer as evidence of spoilage.

<u>Identification</u>:

Introduction:

The basic function of the package is to protect and preserve the contents during transit from the manufacturer to consumer. Protection is required against spillage, dirt, ingress and egress of moisture, insect infestation, contamination by foreign material, tempering, pilferage etc. Identification techniques for different packaging materials are given below.

<u>Packaging tests are as follows:</u>

1. Visual Test:

- Fold the film several times to make number of layers.
- Observe the Colour of the film. E.g. Clear, Hazy Watery, White, Yellowish etc.

2.Tear Test:

- Fold the film and Tear it on the fold.
- Try tearing the film from a straight edge.
- Nick the film.
-

3.Burning Test:

- Burn a film very carefully at the edge with help of a burner flame.
- Observe the edge of the film as it burns of the smoke .

4 Solubility Test:

- Cut the film into small pieces.
- If necessary, crush the sheet material to increase the rate of solubility.
- Dissolve this film in a glass beaker using appropriate solvents.
- Amount of the solvent should not be less than 10 times the volume of the solid material. If needed, 25 time volume may also be used.
-

5 Determination of density:

Weight a small amount of the material in a flask.

- If necessary, cut it into pieces.
- Add water up to the mark on the neck.
- Remove air bubble (if any) trapped with the film using vacuum.
- Weigh the flask containing water and film.

Weigh the same flask filled with only water at the same temperature.

- The difference in weights may be used in calculating the density of the given film.

.6 Melt Test:

- Light a match stick and let the stick to burn for few seconds.
- Extinguish it and make contact of the hot stick to the film.

7. Water Test:

- Place a drop of water on the flat surface of the film and observe.

8 Shrink Test:

- Hold the film I" away from the flame of a match or a burner and observe.

9 Drip Test:

- Roll the film into a tape like and allow to burn.
- Observe the burning and dripping of the film.

10 Flame hot wire Test:

- Heat a copper wire on flame and allow it to touch to the film.
- Put the wire again into the flame and observe.

Identification of various films

No.	Observation	Inference
1	**Melt Test:** • Match does not push through readily (film resists melting) • Hot end of the match readily pushes through the film • Film melts readily and does not resist penetration	• Plain Cellophane • NCC cellophane • PVDC coated cellophabe • PE coated cellophane • PVDC (Saran) • Cellulose acetate • Polystyrene • Nylon

2	**Water Test:** • Drop flatters, spreads and softens the film • Drop does not spread. Wetting and softening of the film occurs only when it is dipped in acetone and wiped off as compared to the original (undipped) part of the film.	• Plain transparent cellophane • Nitrocellulose coated cellophane
3	**Shrink Test:** • Film shrinks violently and rapidly to deep wrinkles • Little shrinkage is observed	• PVDC, Cellulose acetate • Polystyrene • Polyester, Nylon
4	**Drip Test:** • Film burns with drip like melting wax leaving molten drops • Some drip • No molten drip but edges tacky when cooled.	• Polyethylene (PE) • Poly Vinyl Chloride (PVC) • Rubber Hydrochloride, Pliofilm
5	**Flame Hot Wire Test:** • Green colour of the flame. • Negative test, film unaffected by accetone	• Vinyl or rubber type of material • Polyethylene coated cellophane

RESISTANCE OF PACKAGING MATERIALS

Introduction:

- The best package for any particular purpose is the one which would protect the contents against the hazards the package would undergo during its journey at the minimum cost.

- The simplest and the most efficient way of testing package is to carry out field trials with sufficient number of package under the actual conditions of usage.

- Evaluation of package performance or package testing is a means of shortening this process and of obtaining results in a shorter period with a reasonable degree of accuracy.

Mechanical Tests

Bursting Strength

- The popularity of bursting strength test depends not only on the ease with which the test is made but also on the combination of strength and the toughness, which it measures and which serves as a measure of the serviceability of paper in various applications.

- It has some disadvantage i.e. it depends in a complicated way on the machine direction, tensile strength, stretch and size of the burst area.

- A tester in which testing is done by hydraulic pressure communicated through the medium of glycerin or by compressed air to a pure gum rubber diaphragm in contact with the paper, shall be used. , shall be those necessary to effect correct vulcanized and resistance to premature aging at normal temperatures.

Tearing resistance

- The tearing resistance is usually greater in the cross direction than in the machine direction. Ballistic type of tear-tester such as the ‘Elmendorf’ is recommended.

- For determination of tearing resistance, accurately cut the piece with a template in such a way that two parallel slides from a centre tongue giving a double tear

Impact strength of glass bottles

- Impact strength in glass can be determined by two methods. First method is drop tester. In this method, the certain height at which glass is break determined. In second method the impact strength is determined by pendulum Whatever energy required to break the glass is becomes impact strength.

- silicates coating is done on bottles. When you treat with caustic soda, this coating is protecting other coating and the properties of glass remains as such for long time. P

Thermal shock

- For determination of thermal shock test requiring a basket for holding the bottles upright. Two water baths are also requiring. One contained hot water and other cold water. It may also have a device to control the desired temperature of the baths within +- 1^{o} C, otherwise the temperature has to be controlled manually using thermometers. Each water bath may also be provided with a stirrer to keep uniform temperature.

Climatic Tests

1 Salt Spray Test

- Salt spray test is used to evaluate the resistance of the package to corrosion by salt spray.

2 Sand and Dust Tests

- Sand and dust test is used to evaluate the resistance of a package to the penetration of sand and dust, to determine the erosive effects of blowing sand and dust.

4 Opacity

- Opacity of all kinds of paper and paper products is determined by measuring the apparent light reflectance. The apparatus shall be capable of measuring the apparent light reflectance.

- **<u>Development of protective packaging for Fishery products</u>**

Introduction

Protection of the product during transit, storage, display at the point of sale and carriage to and storage in the consumers home are essential functions of any package. In order to protect the product, we need to know the following product characteristics.

Role of packaging

- The way food products are packed depends greatly on the varied needs of the consumer. Where perishable products such as fish is concerned, convenience, protection as well as attractiveness accorded by the packaging materials used, play an important role in the actual sales of the product. Packaging of any product plays fourmajor functions as containment, protection, utility and communication.
- The most important function of packaging, however, is the protection it offers to the products. Among other functions, packaging should:

• protect the products against dirt, chemical (moisture, odor) and biological agents (insect, micro-organisms), adulteration, tempering, contamination, damage, etc.

• help ease the distribution and during product display on shelves, boxes, etc. • serve as a means of communication and provide

information on the products, whether as requirement or to attract consumers;
• help to add value to the product especially with high quality and attractive packaging;
• help product promotion to increase product range;
• help to minimize the cost of product;
• help to extend shelf-life of product.

- **Packaging requirement**
- The materials commonly used for packaging of fish and fish products are as follows:
  • Split bamboo baskets, plant leaves in mats, wood in boxes;
  • Paper or board in boxes, cartons;
  • Rigid materials like can;
  • Glass container like jars;
  • Plastics like bags, pouches, films, sheets, jars, boxes, etc.

Different types fish packaging

There are four common types to fish packaging as follows:

1. Bulk packaging for fresh fish
2. Wholesale packaging of fresh, frozen or other processed fish
3. Retail packaging of fresh/frozen or other processed fish products
4. Air freight packaging

1. Bulk packaging of fresh fish

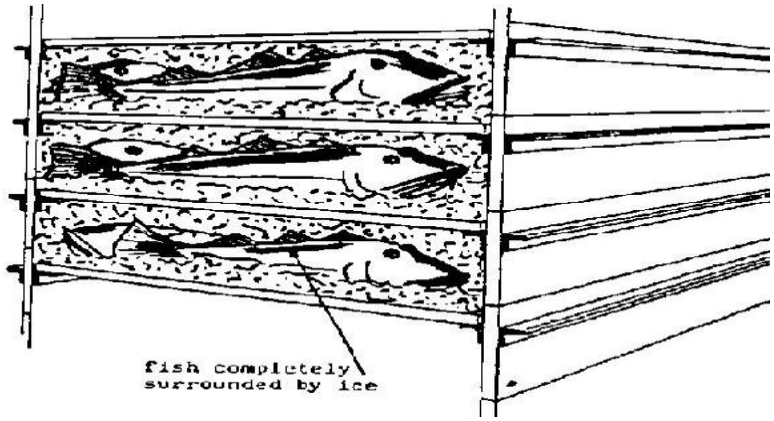
- After landing, fish are loaded to woven bamboo basket, wooden or plastic boxes and iced. Now a days, wooden and woven bamboo baskets are replaced by plastic boxes all over the world because they are more hygienic, lighter and strongerMaterial used for plastic boxes are low density polyethylene, high density polyethylene and polypropylene.
  An ideal fish box should be-
  i. of a suitable size to handle any type of fish comfortably;
  ii. easy to manage, carry and clean;
  iii. designed with proper insulation to maintain temperature if iced fish is loaded;

iv. designed to allow draining out of melted water if iced fish is loaded;
v. protect the fish from crushing, spoilage, environmental pollution and pilferage;
vi. easy to store and effective for transporting chilled fish; available at a reasonable cost.
For handling and transportation of artisanal catch in Bangladesh,

2. Wholesale packaging for fresh/frozen fish :

- The fresh or frozen fish which are not going for shipment or to the processing factories but to the wholesale market for retail distribution by caterers or retailers should be packagedwith due considerations.
- Traditional packaging materials for fresh and iced fish are wooden or woven bamboo boxes. However, above mentioned modified bamboo basket can also be used for local transportation.

Now a days, fibreboard boxes and corrugated board cartons waxed or coated with polyethylene are used for storage and transport of wet fish from port to fish monger, caterer or institution. The most common packaging of frozen fish is the



interlocking, printed, polycoated and corrugated fibreboard carton. Expanded polystyrene and corrugated polypropylene boxes are also used for fish and shellfish distribution. These boxes are non-returnable and capacity varies between 3-28 kg.

3.Retail packaging of fresh/frozen fish and fish products Packaging of fresh/chilled fish

In traditional fish markets, wet fish are sold with or without surrounded ice crystals. In modern shopping corner, fresh or chilled fish is packed using

styrofoam trays wrapped with cling film. Film is either of polythene or polypropylene.

Tray can also be produced by polyvinylidene chloride or polystyrene. This is one of the cheapest and most readily available packaging materials in the fish market (With proper packing and handling, this type of packaging can be quite attractive.

However, this type of packaging can not protect the product from – loss of moisture and aroma; drip from the fillet; contamination (micro-organism, odor from other products, etc.); mechanical and physical damage; oxidation, etc.

Packaging of frozen product

Frozen fish and fish products can be packaged by laminated plastic bag or pouch, clear plastic bag, etc. sealed and put inside carton boxes. There are three common types of plastic packaging materials available in the market. These are :

- Polystyrene
- Polyethylene
- Polypropylen

- should protect the products from moisture and aroma loss, oxidation and rancidity and other odors from permeating into the product;
- should not become brittle and torn during storage and displayatemperature below -18^{o} to -25^{o} C.

Some of the examples of commonly used packaging materials for frozen products are-

- Polystyrene trays over-wrapped with polyethylene/ polypropylene film;
- Polyethylene bag;
- Plastic bag inside carton box;
- Waxed paper box.

UNIT: 3

Methods of testing for packaging material for their physical properties:

Introduction:

- The best package for any particular purpose is the one which would protect the contents against the hazards the package would undergo during its journey at the minimum cost.

- The simplest and the most efficient way of testing package is to carry out field trials with sufficient number of package under the actual conditions of usage. Evaluation of package performance or package testing is a means of shortening this process and of obtaining results in a shorter period with a reasonable degree of accuracy.

Mechanical Tests:

Bursting Strength:

- The popularity of bursting strength test depends not only on the ease with which the test is made but also on the combination of strength and the toughness, which it measures and which serves as a measure of the serviceability of paper in various applications.

- It has some disadvantage i.e. it depends in a complicated way on the machine direction, tensile strength, stretch and size of the burst area. Bursting strength is measured by the pressure developed behind a circular rubber diaphragm when it is forced through the paper so as to burst it.

- A tester in which testing is done by hydraulic pressure communicated through the medium of glycerin or by compressed air to a pure gum rubber diaphragm in contact with the paper, shall be used.

- The diaphragm used in the equipment shall be such that it does not materially affect the bursting pressure and shall be between 0.35 mm and 0.45 m thick.

- The rubber sheet used shall be pure gum vulcanization containing not less than 95 % by volume of first quality smoked sheet rubber, the only ingredient in the mix, apart from rubber, shall be those necessary to effect correct vulcanized and resistance to premature aging at normal temperatures.

- The pressure required to bulge the diaphragm 5 mm above the top plane of the lower clamping surface of the rest instrument shall be not more than 0.07 kg/cm^2.

- For determination of bursting strength, first clamp the piece of packaging material firmly over the diaphragm without slippage during the test between two annular, planes, unpolished surface of 30 mm internal diameter. After clamping the test piece, run the machine so that the pressure increases at a uniform rate (0.75 kg/cm^2 per second) until the test piece burst. Now, with the help of pressure gauge the pressure in kilograms per square centimeter at which the test piece burst. Take two reading with each sample sheet, one with the wire-side upper most and the other with the top- side uppermost. For calculating the burst factor the formula is as follows:

Burst factor =Bursting strength (g/cm^2)/substance (g/m^2)

Tearing resistance

- The tearing resistance is usually greater in the cross direction than in the machine direction. Ballistic type of tear-tester such as the 'Elmendorf' is recommended. The machine is provided with two clamps, the one fixed and the other carried on a sector-shaped pendulum suspended from a column by means of a friction less bearing located near the apex of the load of pendulum recorded through a spring load friction pointer on the circumferential scale marked on pendulum.

- For determination of tearing resistance, accurately cut the piece with a template in such a way that two parallel slides from a centre tongue giving a double tear. At least one test piece in each direction shall be taken from each specimen.

- First holds outer tongues of the test piece in a fixed clamp and the centre tongue in the movable clamp. Release the pendulum and note the load necessary to continue to tear.

- The test may be made such that either the reading is not less than 25% and not more than 75% of the capacity of the instrument. The tearing resistance shall be tested separately for machine and cross direction.

- Record average, maximum and minimum of the reading in such direction separately and state the number of test piece used for each determination. Tear factor is used for comparing two papers with regards to their tearing strength and is calculated as follows:

Tear Factor = Tearing resistance/ substance

Impact strength of glass bottles

- Impact strength in glass can be determined by two methods. First method is drop tester. In this method, the certain height at which glass is break determined. In second method the impact strength is determined by pendulum. In this, keep glass bottle at platform and gives oscillation at which point glass break. Whatever energy required to break the glass is becomes impact strength

- During recycling of bottles; thermal shock resistance decreases, because of pitting of bottle, then application and use of caustic soda, acid, hot water etc. due to these severe processes; thermal shock resistance decreases. To avoid this problem; silicates coating is done on bottles.

- When you treat with caustic soda, this coating is protecting other coating and the properties of glass remains as such for long time. Pressure at which beverages bottles withstand is 15 kg / cm^2. By this experiment, one can determined the thermal shock resistance for glass bottles.

Thermal shock

- For determination of thermal shock test requiring a basket for holding the bottles upright. Two water baths are also requiring. One contained hot water and other cold water. It may also have a device to control the desired temperature of the baths within +- 1^o C, otherwise the temperature has to be controlled manually using thermometers. Each water bath may also be provided with a stirrer to keep uniform temperature.

- First adjust the cold water bath to a temperature of 30+-1^{o}C and the hot water bath at a temperature of 72+-2^{o}C. Now fill a basket fully or partially with the empty sample bottles. When the bath has attained the prescribed temperature, immerse quickly the basket containing the bottles in the hot water bath in such a manner that the bottles become completely filled with hot water.

- Allow the bottles to soak for 15 minutes. After this transfer the basket with the bottle filled with water to the cold water bath so that the bottles are immersed in water up to the neck, taking care that no cold water enter the bottles. Keep the bottles immersed for 2 minutes. Then remove the basket from cold bath. The process of transfer from the hot to the cold bath shall be completed in 15+-2 sec. Take every precaution to protect the apparatus from draughts. At last inspect each bottle for cracks or breaks.

Climatic Tests

Salt Spray Test

- Salt spray test is used to evaluate the resistance of the package to corrosion by salt spray. The package is placed for nearby 50 hours, to a wet, dense fog environment generated by the automation of a 20% water solution of sodium chloride. The solution shall maintain at a PH of 6.5 to 7.2, the temperature of the fog is maintained at 95^{o}F.

Sand and Dust Tests

- Sand and dust test is used to evaluate the resistance of a package to the penetration of sand and dust, to determine the erosive effects of blowing sand and dust. A standardize mixture of sand and dust of density 0.1 to 0.5 gm/cu.ft. is used to create an atmosphere for this. The temperature of this atmosphere is maintained at 77^{o} F for a period of 6 hours and then increased to 160^{o} F for another 6 hours.

Opacity

- Opacity of all kinds of paper and paper products is determined by measuring the apparent light reflectance. The apparatus shall be capable of measuring the apparent light reflectance. It may measure the value separately or give directly the ratio of the apparent reflectance.

- The values of apparent light reflectance are relative to the apparent reflectance from magnesium oxide taken as 100%. The standard white backing shall have an apparent reflectance of 91.5% and the standard black blacking shall have an apparent reflectance of not more than 0.5%.Completely diffused illumination from incandescent lamps at a colour temperature of 2400 to 2800 Kelvin shall be used. The direction of viewing shall be not more than 20o from the normal to the surface of the specimen. Observations shall be made visually or by equivalent means such as a photo- electric with a filter adjusting its sensitivity to that of the human eye.

- Place the test piece first over the standard white backing, then over the standard black backing and then measure the apparent reflectance of the light. The ratio of reflectance over black backing to that over white backing expressed as a percentage is the contrast ratio. Calculate the average contrast ratio from determination on both sides of each test piece.

Containers and their testing:

- Many types of containers, constructed from a variety of materials, are used for the transport of ice and fish - from simple baskets of woven reeds, bamboo, cane or grasses, to containers made from wood, metals and plastics. In order to reduce the melting of ice, insulation materials such as those discussed in Chapter 5 may be used in the construction of containers.

- Use of any particular type depends very much on the economic situation of the locale and fishery being pursued. In some tropical areas, the cost and availability of ice are limiting factors, rather than the cost of insulated containers.

- Besides the existing technological limitations in some tropical areas, there is scope for developments in the design and construction of locally made insulated containers, which should eventually make them more easily available and inexpensive enough for small-scale fishermen.

Insulated fish containers:

The main functions of an insulated fish container on board canoes and small fishing vessels are:

- to make handling easier (by reducing the handling frequency of individual fish) and protect the fish from the risk of physical damage;
- to maintain fish quality, by ensuring adequate chilling and low ice-meltage rates as a result of reduced heat infiltration through container walls;
- to improve fish-handling practices and so lead to better quality fish being landed, making longer fishing trips and better fish prices possible for fishermen.

The effectiveness of insulated containers in reducing ice melting is an important criterion in the evaluation and selection of such containers. It is more likely that the advantages that insulated containers offer will be fully appreciated by smallscale fishermen in tropical climates where ice meltage rates are much higher than in cold or temperate climates.

Design factors and construction aspects

The main general design features for insulated containers (both portable and fixed types) are as follows:

- They should be suitable for transportation on fishing vessels and road vehicles (which can be of different types and sizes). Therefore, portable containers should have special features, making them well suited for handling catches on board, as well as for storage and transport of fish on shore.
- They should be able to withstand relatively rough handling.
- They should have drains for ice melt water.
- They should be constructed of materials that allow easy and thorough cleaning.
- They should be of a suitable size for accommodating the range of fresh fish caught, so that they are not bent or distorted in any way.
- They should be of a suitable size for adequate manual handling or fork lifting, if these machines are available.
- Portable types should be suitable for secured stacking, so that the weight of the containers on top falls on the containers underneath and not on the fish inside the container.

Commercially manufactured insulated containers

- There is a wide range of insulated containers available, offering a variety of features according to different requirements of handling, size, insulation efficiency, modes of transportation, sturdiness, durability and construction materials. However, these insulated containers are generally an imported item in developing countries, which means that they are costly, especially when compared with non-insulated boxes and locally made traditional fish containers.
- Insulated container capacity or physical size has undoubtedly also been a limiting factor in introducing these units to some markets in developing countries' fisheries. Many such fisheries lack the infrastructure and equipment, such as cranes and fork-lift trucks, for the physical handling of large tubs when full of ice and fish. Most fish-landing sites at

artisanal level still rely on manual handling, which effectively places a limit on the size of items that can be used.

Locally made insulated containers

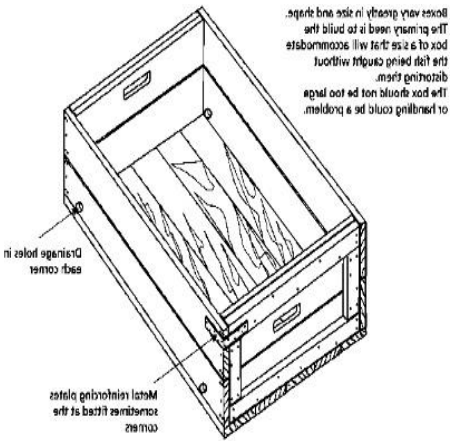
- A wide range of materials are used in the manufacture of insulated containers in developing countries, including wood, plywood, bamboo, metal sheets (galvanized iron and aluminium alloys), nipa, palm leaves, wood shavings and sawdust, dried straw and grass, coconut husks and rice husks.
- More recently, plastics such as polyurethane foam, expanded polystyrene, polyethylene sheets, PVC and FRPs have been used. Small-scale fishermen in developing countries have gradually become aware of the advantages of insulated containers and efforts have been made to design suitable containers making use of locally available materials.

The main advantages of these containers are that they:

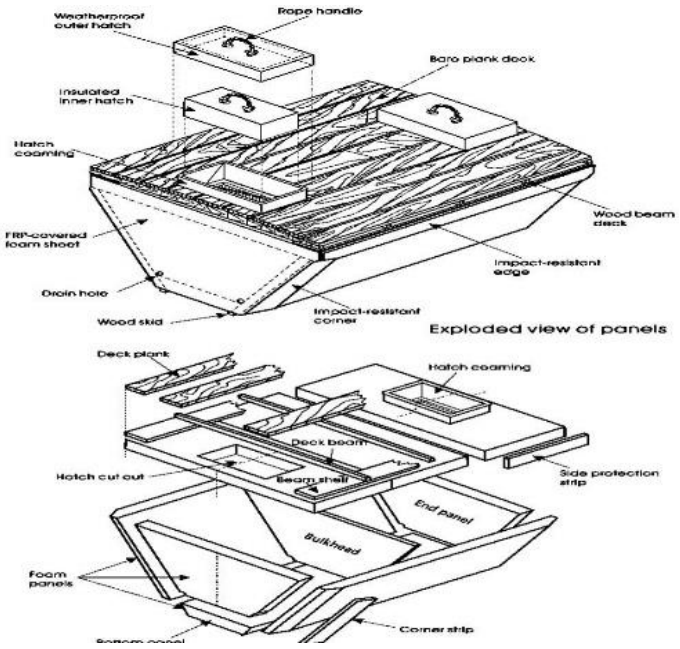
- are easy to handle;
- have good insulating properties;
- are relatively cheap;
- are readily available.

Their main disadvantages are that they:

- are difficult or impossible to clean properly;
- have a weak physical structure;
- do not nest when empty;
- have a relatively short useful life.



Uninsulated box



Insulated box

Fish baskets:

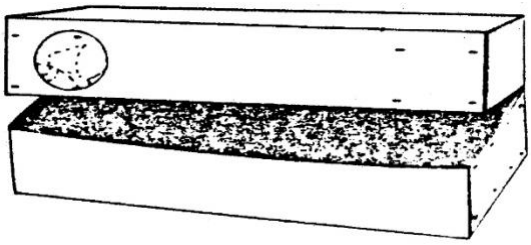
- Originally a container of plaited or woven material. Most often made of cane or some other strong plant fibre. This type is still commonly in use in most developing countries. In the industrialized fishing nations the traditional plant fibre has been replaced by plastic.
- It has been common to make the fish basket in sizes ranging from units which could take

around 10 kg up to those able to take 100 kgThe basket has gradually been losing ground to the fish box due to its unsuitable shape for storage (in fish holds, cold stores, etc.) and for mechanized handling, by fork lifts and similar systems.

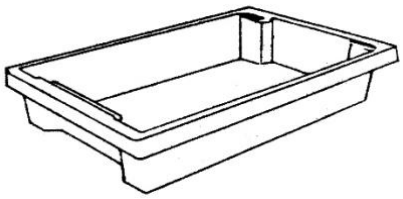
Fish boxes

Generally these are uninstalled containers with a capacity from 10 litres to around 100 litres. Each unit is designed to enable handling by 1 or 2 persons.

The fish box has its application on board fishing vessels, in warehousing, processing, transport and at the fish market.



Fibre board box



Polyethylene box

. Melting

Glass is melted in a furnace at temperatures of around 1350°C (2462°F) and is homogenized in the melting process, producing a bubble-free liquid. The molten glass is then allowed to flow through a temperature controlled channel (forehearth) to the forming machine, where it arrives via the

feeder at the correct temperature to suit the container to be produced. For general containers suitable for foods and carbonated beverages, this would be in the region of 1100°C (2012°F).

2.Container forming

In the feeder the molten glass is extruded through an orifice of known diameter at a predetermined rate and is cropped into a solid cylindrical shape. The cylinder of glass is known in the trade as a *gob* and is equivalent in weight to the container to be produced.

Metal container:

The total world market for metal containers is estimated at 410 billion units per annum. Of this, drink cans account for 320 billion and processed food cans account for 75 billion. The remainder is aerosol and general line cans. Drink cans may be divided into those for non-carbonated drinks (liquid coffee, tea, sports drinks etc.) and carbonated beverages (soft drinks and beer), many of which pass through a pasteurization process.

Plastic containers: The first plastics were derived from natural raw materials and, subsequently, in the first half of the 20th century, from coal, oil and natural gas. The most widely used plastic today, polyethylene, was invented in 1933 – it was used in packaging from the late 1940s onwards in the form of squeeze bottles, crates for fish replacing wooden boxes and film and extrusion coatings on paperboard for milk cartons.

Plastics are widely used for packaging materials and in the construction of food processing plant and equipment, because:

- they are flowable and mouldable under certain conditions, to make sheets, shapes and structures
- they are generally chemically inert, though not necessarily impermeable
- they are cost effective in meeting market needs
- they are lightweight
- they provide choices in respect of transparency, colour, heat sealing, heat resistance and barrier.

Gases such as oxygen, carbon dioxide and nitrogen together with water vapor and organic solvents permeate through plastics. The rate of permeation depends on:

type of plastic

- thickness and surface area
- method of processing
- concentration or partial pressure of the permeant molecule
- storage temperature.

Plastics are chosen for specific technical applications taking the specific needs, in packing, distribution and storage, and use of the product into consideration, as well as for marketing reasons, which can include considerations of environmental perception.

Surface treatments

After forming, surface treatment is applied to the container in two stages: hot end and cold end treatment, respectively.

1.Hot end treatment

- The purpose of hot end surface treatment is to prevent surface damage whilst the bottle is still hot and to help maintain the strength of the container.

- The most common coating material deposited is tin oxide, although derivatives of titanium are also used. This treatment tends to generate high friction surfaces; to overcome this problem, a lubricant is added

2. Cold end treatment

- The second surface treatment is applied once the container has been annealed. Annealing is a process which reduces the residual strain in the container that has been introduced in the forming process.

- The purpose of the cold end treatment is to create a lubricated surface that does not break down under the influence of pressure or water, and aids the flow of containers through a high speed filling line.

- Application is by aqueous spray or vapor, care being taken to prevent entry of the spray into the container, the most commonly used lubricants being derivatives of polyester waxes or polyethylene.

- The surface tension resulting from this treatment can be measured by using Dynes indicating pens. Labelling compatibility should be discussed with either the adhesive supplier or the adhesive label supplier depending on the type of label to be used.

3 Inspection and quality

- Quality assurance needs are defined and incorporated into the specification of the glass container at the design stage and by, consistency in manufacture, thereby meeting the needs of packing, distribution and use.

- Quality control, on the other hand, comprises the procedures, including on-line inspection, sampling and test methods used to control the process and assess conformity with the specification. The techniques used can broadly be defined as chemical, physical and visual.

Evaluation

Container Security is a critical part of a comprehensive security assessment. It is **the practice of protecting containerized applications from potential risk using a combination of security tools and** policies.The following tests used to evaluate the containes.

Adhesive bond strength testing:

- Delamination of flexible laminated packaging materials is a common cause of pack failure and print quality issues. Adhesive bond strength testing analyses the adhesive forces required to separate the laminated layers of flexible packaging materials.

Biotest

- Biotesting is a form of comparative container integrity testing used particularly during the development and introduction of new or modified forms of containers.
- are filled with a microbiological nutrient material and heat processed. The containers are then brought into contact with contaminated cooling water with a known microorganism. Samples are stored and checked for spoilage.

Burst test

- The burst strength of a flexible pack is a measure of its seal strength and determined by inflating the package with air at a specified rate until it bursts. The position and type (seal or material) of failure is recorded in addition to the burst pressure valucontaine.
- The test is used as a means of evaluating the likelihood of pack failure when exposed to pressure differentials, such as may be experienced in during retorting or air transport.

Coefficient of Friction (CoF)

- CoF tests are conducted on plastic films and other materials such as board to determine static and dynamic coefficients of friction - the force required to initiate and maintain motion between two material surfaces. CoF is a fundamental property of all materials which run on high speed printing and packaging lines and is routinely specified in for materials such as plastic films and fibreboard containers.
- Understanding and controlling CoF gives processors and packers the ability to optimise performance and avoid problems in forming, filling, transporting, and storing of packages.

Creep testing

- Creep testing is conducted in a similar way to burst testing. However, a burst test is a measure of pack/seal strength, while a creep test is a measure of seal strength and pack integrity.

- During a creep test the pack is inflated to a percentage of its known burst pressure and held for 30 ora nominated time 60 seconds for a pass or fail result (in the case of seal leakage). The seals can also be measured for "seal yield" - narrowing of the seals before and after testing as an indication of internal seal peeling.

Drop tests

- Drop tests can be conducted on packaging in various orientations and from a range of heights to determine its impact strength.

Dye penetration testing

- Dye penetration testing can detect leaks in packs down to approx 10 microns and are conducted over a period of 24 hours. These tests are especially effective for testing leaks in the seal area of the pack.

Internal pressure resistance

- Internal pressure resistancetesting is vital for containers that are intended for carbonated drinks or are otherwise subjected to changes in pressure during their intended use. This mechanical test determines whether the package meets applicable specifications and is fit for the intended use.

Tear resistance

- Tear resistance testing can be conducted on sheet and film materials to measure the force perpendicular to the plane of the sheet required to tear single or multiple plies through a specified distance after tear initiation.

Tensile and T-peel testing

- A tensile strength test is a mechanical test performed on packaging materials to determine the maximum load force that can be applied to a material before it ruptures or tears. In essence it is a 'pulling' test used to measure the strength of paper, board and plastics.

Packaging Evaluation on Meat products

Meats

1.Fresh Meat

- Most meat is offered to consumers in a freshly or recently cut form, with little further processing to suppress the normal microbiological flora present from the contamination received during the killing and breaking operations required to reduce carcass meat to

edible cuts. Reduced oxygen also leads to fresh meat color being the purple of myoglobin, a condition changed upon exposure to air which converts the natural meat pigment to bright cherry red oxymyoglobin characteristic of most fresh meat offered to and accepted by consumers.

- Reduced oxygen packaging is achieved through mechanical removal of air from the interiors of gas barrier multilayer flexible material pouches closed by heat scaling the end after filling.

2.Ground Meat

- About 40% of fresh beef is offered in ground form to enable the preparation of hamburger sandwiches and related foods.

- Ground beef was originally a byproduct, that is, the trimmings from reducing muscle to edible portion size. The demand for ground beef is so great that some muscle cuts are specifically ground to meet the demand. The most common packaging technique is pressure stuffing into chubs which are tubes of flexible gas barrier materials closed at each end by metal clips.

- At retail level the coarsely ground beef is finely ground to restore the desirable red color and to provide the consumer with the desired product.

- The retail cuts and portions are placed in expanded polystyrene (EPS) trays which are overwrapped with plasticized polyvinyl chloride (PVC) film.

- The tray materials are fat and moisture resistant only to the extent that many trays are internally lined with absorbent pads to absorb the purge from the meat as it ages and/or deteriorates in the retail packages. The PVC materials are not sealed but rather tacked so that the modest water vapor barrier structure does not permit loss of moisture during distribution.

3.Case-Ready Meat

- Case-ready retail packaging involves the cutting and packaging under hygienic conditions to reduce the probability of microbiological contamination.

- The package is usually in a gas barrier structure, typically gas/moisture barrier expanded polystyrene trays heat seal closed with polyester/gas barrier film.

- The internal gas is altered to a high oxygen/high carbon dioxide internal atmosphere. The high oxygen concentration fosters the retention of the consumer desired red color while the elevated carbon dioxide suppresses the growth of most spoilage microorganisms.

- for ease-ready beef and pork include the master bag system used widely for cut poultry in which retail cuts are placed in printed polyolefin film overwrapped EPS trays and the

trays are multipacked in gas barrier pouches whose internal atmospheres are carbon dioxide to retard the growth of aerobic spoilage microorganisms.

Packaging Evaluation of vegetables products

Fruits and vegetables products

Fruits and vegetables

- Alteration of the atmospheric environment in the form of modified or controlled atmosphere preservation and packaging have been used commercially to extend the refrigerated shelf life of fresh produce items such as apples, pears, strawberries, lettuce, and now fresh-cut vegetables.

- Controlled atmosphere has been largely confined to warehouse and transportation vehicles such as trucks and seaboard containers.

- In controlled atmosphere preservation, the oxygen, carbon dioxide, ethylene, and water vapor levels are under constant control to optimize refrigerated shelf life.Fresh-cut vegetables, especially lettuce, cabbage, and carrots have been a major product in the retail and the hotel/restaurant/ institutional market. Cleaning, trimming and size reduction lead to greater surface to volume of the produce and to the expression of fluids from the interior to increase the respiration and microbiological growth rate. Uncut produce packaging is really a multitude of materials, structures, and forms that range from the old and traditional, such as wood crates, to inexpensive, such as injection-molded polypropylene baskets, to polyethylene liners within waxed corrugated fiberboard cases.

Tomato Products

- The highly popular tomato-based sauces, pizza toppings, etc., must be treated as if they were low acid if they contain meat as so many do. For marketing purposes, tomato-based products for retail sale are more commonly packaged in glass jars with reclosable metal closures. The glass jars are often retorted after filling and hermetic sealing.

Juices and Juice Drinks

- Juices and analogous fruit beverages may be hot filled or aseptically packaged. Traditional packaging has been hot filling into steel cans and glass bottles and jars. Much fruit beverage is currently hot filled into heat-set polyester bottles capable of resisting temperatures of up to 80ºC without distortion. Hermetic sealing of the bottles provides microbiological barriers

Packaging Evaluation of Other Foods

1 Dry Foods

- Removing water from food products markedly reduces water activity and its subsequent biochemical activity, and thus also significantly reduces the potential for microbiological growth.

- Moisture can change physical and biological properties. Engineered dry products include beverage mixes such as blends of dry sugars, citric acid, color, flavor, etc.; and soup mixes, which include dehydrated meat stock plus noodles, vegetables, meats, etc., that become particulate-containing liquids on rehydration with hot water. Such products must be packaged in moisture-resistant structures to ensure against water vapor entry which can damage the contents.

2 Fats and Oils

- Fats and oils may be classified as those with and those without water. Cooking oils such as corn or canola oil and hydrogenated vegetable shortenings contain no water and so are stable at ambient temperatures if treated to preclude rancidity. Unsaturated lipids are susceptible to oxidative rancidity.

- Hydrogenated vegetable shortenings generally are packaged under nitrogen in spiral-wound composite paper-board cans to ensure against oxidative rancidity. Edible liquid oils are packaged in injection blow-molded polyester bottles usually under nitrogen. Fat-resistant packaging such as polyethylene-coated paperboard, aluminum foil/paper laminations and parchment paper wraps, and polypropylene tubs are used to package butter, margarine, and similar bread spreads.

3 Cereal Products

- Dry breakfast cereals generally are sufficiently low in water content to be susceptible to water vapor absorption and so require good moisture- as well as fat-barrier packaging. Breakfast cereals are usually packaged in coextruded polyolefin films fabricated into pouches or bags inserted into or contained within printed paperboard carton outer shells. Sweetened cereals may be packaged in aluminum foil, metalized plastic, or gas barrier plastic films or laminations to retard water vapor and flavor transmission.

5.Salty Snacks

- Snacks include dry cereal or potato products such as potato and corn and tortilla chips, and pretzels, and include roasted nuts, all of which except pretzels have low water and high fat contents. Snacks are usually packaged in flexible pouches made from oriented polypropylene or metallized oriented polypropylene to provide low moisture and gas transmission.

- Snack food producers depend on rapid and controlled product distribution to minimize fat oxidation. Many salty snacks are packaged under nitrogen both in pouches and in rigid containers such as spiral-wound paperboard composite cans to extend shelf life.

5 .Candy

- Chocolate, a mixture of fat and nonfat components such as sugar, is subject to slow flavor change. Ingredients such as nuts and caramel are susceptible to water content variation. Chocolates, which are generally shelf stable at ambient temperatures, are packaged in fat-resistant papers and moisture/fat barrier such as pearlized polypropylene

Package designs

What s packaging design

Your packaging is the material that contains your product. Packaging design is the process that allows your packaging to fulfil a wide range of functions. It has to be functional, holding your product, enabling it to be transported and stored. It needs to stand out from your competitors' packaging in some way, as well as appeal to customers in-store and online.

There are three types of packaging, all with different functions and design needs:

Primary packaging or sales packaging

- :Primary packaging is the term used to designate the layer of packaging in immediate contact withthe product; in other words, it is the first packaging layer in which the product is contained. Assuch, primary packaging is constructed both with the product itself and any existing secondarylayers of packaging in mind.
- For example, a beverage can, a paper envelope for a tea bag, an innerbag in a cereal box and an individual candy wrap in a pouch are primary packages, and their mainfunction is to contain and preserve the product. Beyond this packaging lies the product itself.Primary packages must be compatibe with the product
- Therefore it is said to be the packaging that wraps the product when being sold to the endconsumer. It contains the packaging that is in direct contact with the product and the otherpackaging components (e.g. cap and label) that are needed to complete the sales unit.

Secondary packaging or group packaging:

- Secondary packaging is intended to protect not only the product, but also the primary packaging,which often is the packaging most visible to the consumer in retail displays. The most commonexamples of secondary packaging include cardboard cartons, cardboard boxes andcardboard/plastic crates.It could be said to be the packaging used for gathering the sales units in order to allow for easyhandling practices in the sales environment.
- This process can be performed by grouping theproducts in order to sell them to the consumer (e.g. shrink film and corrugated cardboard box).The secondary package contains two or more primary packages and protects the primary packagesfrom damage during distribution and storage.
- Its main aim is branding display and logisticalpurposes as well as protecting and collating individual units during storage. Secondary packagingis often used by the beverage, food and cosmetic sectors for displaying primary packs on shelvestherefore it is often referred to as display packaging.

Tertiary packaging or transport packaging:

- Tertiary packaging is the type which is typically not seen by consumers since it is usually removedby retailers before products are displayed for sale. Examples of tertiary packaging might includebrown cardboard

boxes, wood pallets and shrink wrap.It is used to facilitate the handling/ transportation of a series of sales units or secondary packagingin order to prevent the physical damage that may occur during handling/transportation (e.g.corrugated cardboard box).

- The tertiary package typically contains a number of the primary or secondary packages. Tertiarypackaging is used for bulk handling warehouse storage and transport shipping therefore it is alsocalled as "distribution package".
- It facilitatesthe protection, handling and transportation of a seriesof sales units or secondary packaging in order to group everything into unit loads during transit.This type of packaging is rarely seen by the consumer..

- **PACKAGING DESIGN**

  (A) <u>Component Shape and Dimension</u>

  Standardizing both component shape and size should be the policy. There are many components that can be standardized such as ampules, vials, cartons, labels and leaflets. Rubber plugs and plastic bottles can be standardized with respect to shape and size, varying only in the material of construction. There will be a variety of sizes of components depending on the dosage, but again the same shape could be used but with different dimensions.
- **(B)<u>Packaging Validation Trials</u>**

  When the components have been identified for a particular product, the validation of packaging operation is required. This is to ensure that a consistent pack quality is obtained at the required packaging rate.
- **(C) <u>Material of Construction</u>**

  The material of construction requires careful consideration, particularly when the product is in contact with the container. It is necessary to ensure that the product does not deteriorate or does not become contaminated as a result of being in contact with the container, or that the product does not affect the integrity of the pack.
- **(D) <u>Component /Product Validation</u>**

  Once a formulation has been agreed, the pharmaceutical company has to perform compatibility studies between the product and container to ensure the product degradation does not occur during the product market life. The container has to be capable of protecting the product from environment.
- **1. <u>Sterile product validation</u>:-**

  a) ***Product and pack compatibility*****-** the components must be washed and sterilized through a validated procedure. The vials must be filled with the sterile product under sterile conditions and terminally sterilized if this is a part of the intended product operation. Components performance should be monitored during the compatibility trials to ensure that deterioration has not occurred.

  b) ***Seal integrity*****-** the seals of each vial should be examined before the experiment to ensure that there are no defectives, and then each vial should be inserted into a tray containing the challenge bacteria. The samples should be cycled through temperature and pressure changes expected on the market for several weeks. Careful cleaning of the vials and examination of contents for sterility will determine the seal quality.
- **2. <u>Nonsterile product validation</u>:-**

  a) *Water vapour permeability*- the water vapour permeability of the pack containing the product is required. This is necessary because although the bottles will comply with

the water vapour permeability test described in USP, permeation through the bottle wall will depend on wheather the product has a high or low affinity for the water. The test split into two parts to enable the maximum amount of information to be obtained and hence possibly eliminating the necessity to perform further time consuming experiments.

- Bottle wall permeation
- Bottle and cap permeation

- b) *Light transmission*- this test is to determine the effect of light passing through the bottle wall on the product stability and appearance. The bottle wall thickness can have a significant effect on the results obtained.
- c) *Product stability*- it is unlikely that a compatibility problem, particularly with the film coated tablet, will occur, although it is necessary to check up full life of the product. There is possibility that either the smell or taste of tablets will be affected.

Presentation of the product:

Presentation of the product by the package is achieved byGiving attractive appearance to the package or making the package "eye catching" through the use of colour, shape and design.

- Making the package as a source of information about the product
- Making the package to carry sales message.

Labelling:

Labeling on the package provides information on the food, durability (best use before the date), quantity, ingredients, nutritional facts, country of origin, and name of manufacturer. Several informations are presented on the label are as follows.

Name of the food:

A name prescribed by law or a customary name (A trade mark, brand name or fancy name may also be included, but not instead of the name of the food). Any special treatment the food has been subjected to must be included.

Minimum durability:

As determined by the manufacturer or processor, the duration for which the product will retain its quality both in terms of safety and spoilage must be given for foods.

With a shelf life of more than 6 months but less than 18 months and should be expressed as "Sell by" or "best before" date in terms of month and year. Shelf life upto 6 weeks, should include day and month (+ sign is an indication of period for which food will retain its properties under the storage conditions).

Quantity:

The quantity of the product inside the package should be given on the label. If the product is a mixture of solid and liquid, the gross weight and net weight should be mentioned. It is required to mention on the label because of the weights and measures act. This must be clearly legible, in a conspicuous place and all in the same field of vision.

Ingredients list:
Food with more than one ingredient must have them listed in descending weight order, with water included if it constitutes more than 5%of the finished total weight.

Name and address of Manufacture:
The address details of manufacturer of the product should be provided. The contact details should include telephone number, e-mail id and mail address. or packer or retailer must be shown.

Country of Origin:
Country of origin must be stated if the product is imported, or packed in the country after importing. This is not applicable to any EEC member country importing from other EEC country. At present, the pack is required to carry on e mark when it is to be exported to any EEC countries.

Charecter size:
There are number of requirements with regard to size of the characters in the food labeling regulations. Some regulations specify minimum character heights in relation to the size of the pack.
Food labeling regulations are extremely complex and the above is only an outline intended to indicate the range of items covered. There are a number of exemptions and variations and any one responsible for implementation should refer to the Regulations (laws) for detailed requirements.

Bar coding:

When a retailer operates point of sale scanning, they have a requirement for the pack to carry a bar code representing the European article number (EAN) or the Universal Product Code (UPC in the USA). The European article number consists of 13 digits.

50	12345	67890	0
Country	Manf. No.	Item No.	Check digit Code

Each type of pack is thus given a unique number which can be read electronically using a light pen or low intensity laser scanner linked to a computer. This system is used by the retailer for automatic checking of sales price (no need to price mark individual packs), the capture of sales information

and automatic recording through the computer. The customer receives an itemized bill receipt and should benefit by quicker movement through the check-out. Such a system places additional requirements on label design and accuracy of printing. The code must not distract the customer from the sales impact of pack design but needs to be suitably positioned for scanning. The code must be printed accurately without distortion and in a suitable colour to be scanned efficiently

Packaging to consideration:

Paperboard boxes

Paperboard is a paper-based material that is lightweight, yet strong. It can be easily cut and manipulated to create custom shapes and structures. These characteristics make it ideal to be used in personalized packaging. It is made by turning fibrous materials that come from wood or from recycled waste paper into pulp, and then bleaching it. Paperboard packaging comes in various grades, each suitable for different packaging requirements.

Corrugated boxes

Corrugated boxes simply refer to what is commonly known as: Cardboard. Corrugated boxes are the ones many probably consider as 'cardboard' as it produces the large shipping, shoe & storage boxes. What a lot of people do not realize is that corrugated boxes also come in different types depending on the durability and strength of the box

Plastic boxes

Plastic is used in a wide range of products, from spaceships to paper clips. A number of traditional materials, such as wood, leather, glass, ceramic, and so on, have already been replaced by plastic.

Plastic box packaging has many advantages in which they can be recycled, and generally they are much more durable than paperboard boxes. Airtight plastic packaging containers can help to preserve the quality of food and eliminate any contamination issues. Plastic packaging also does not break easily and can be stored with food under extreme conditions.

Rigid boxes

I'm sure you've always wondered the type of box they used to package iPhones or those luxury retail products such as Rolex, Tiffany & Co and Marc Jacobs. You have a sense that it's a type of cardboard but still wasn't sure because of its durable and premium appearance. This type of cardboard material is called a rigid box

Chipboard packaging

Chipboard packaging is used in industries such as electronic, medical, food, cosmetic, and beverage. A chipboard basically is a type of paperboard that is made out of reclaimed paper

stock. It can be easily cut, folded, and formed. It is a cost-effective packing option for your products.

Poly bags

A poly bag, also known as a pouch or a plastic bag, is manufactured out of flexible, thin, plastic film fabric. It is one of the common types of packaging and can carry a wide range of products including food items, flowers, waste, chemicals, magazines, and so on.

Poly bags are durable yet lightweight, reusable and flexible. Since poly bags are structurally simple to make, it can be fully customized in design, style & sizes but still remain cost-effective.

Foil sealed bags

Foil sealed bags can be seen typically in most coffee and tea packaging. Why? It keeps the products dense to maintain the flavor, protects it from bacteria coming in and helps increase shelf life. Apart from food, foil sealed bags are also used to package bedding and clothing products. The process involves removing the oxygen from the bag to keep the fabric tight and secure in order to prevent the growth of fungi and other bacteria. Nuts, cereals, smoked fish, cheese and cured meats are also packaged with foil sealed bags to prevent from spoilage.

Transportation:

Development in fish preservation and transportation has increased significantly the share of fish production that enters international trade. Fish is traded live, fresh, frozen, cured or canned. It is transported by sea, air or land. Live, fresh and frozen fish require special care in comparison with cured or canned fish.

Resistance of packaging

The objectives of packaging are to protect fishery products from dehydration, oxidation and contamination. One of the top concerns in the fish processing and packaging industry is spoilage. Fish quickly deteriorates, so steps must be taken immediately to extend shelf life.

Gas barrier

- Modified atmosphere packaging (MAP) for fish requires a high barrier to carbon dioxide (CO_2), oxygen (O_2) and nitrogen (N_2). The pre-determined gas mixture has to stay inside the package and remain the same. Therefore, packaging films or layers with a high gas barrier are applied. Packaging materials used for MAP are a combination of different substrates. The materials can be as simple as two-ply laminations or as sophisticated as multi-layer co-extrusions, incorporating ethylene/vinyl alcohol (EVAL) as a high barrier substrate2. As a coating, polyvinyl alcohol (PVAL) also provides excellent oxygen and aroma barrier properties. However, these properties are dependent on humidity; in other words, with higher humidity more water is absorbed. The water, which acts as a plasticiser, will then reduce its tensile strength, but increase its elongation and tear strength. PVAL is fully degradable and dissolves quickly3.

Water vapour barrier

- Impermeability to water vapour is important for fish packages as its quality is adversely altered by dehydration. Several plastics having good water vapour barriers like PVDC, coated oriented polypropylene (PP-O) and high density polyethylene (PE-HD) are used. Other plastics like polyamides (PA) and polystyrene (PS) have a poor water vapour barrier and yet some other plastics like EVAL can be adversely affected by moisture. Hence, in most packaging applications, the films must be laminated on both sides to protect it from contact with moisture.

Heat sealability

- A tight seal has to be formed between the tray and lidding material to prevent contamination and dehydration of fish. Since the fish packages are sold in supermarkets along with other food products, the strong fish odour should not be allowed to spread. Low density polyethylene (PE-LD), ethylene/vinyl acetate (EVAC) and polypropylene (PP) are widely used as a heat seal layer in laminates of fresh fish packaging.

Mechanical damage

- Fresh fish can be easily bruised. An expanded polystyrene (PS-E) tray is widely used to protect the sensitive product. To provide gas barrier and heat seal properties, PS-E is used in combination with EVAL and PE-LD to provide a suitable package. At times, a rigid PE-HD tray is also used. A sufficient head-space with puncture resistant films like polyamides completes the package.

Oil Resistance:

- For fatty fish, oil resistant films like PA, PVDC and unplasticised poly(vinyl chloride), PVC-U, may be considered. Poly(ethylene terephthalate), PET, and PP-O are also used as they provide an excellent oil barrier. PVAL is resistant to oil, grease and solvent. It is odourless and nontoxic.

Transparency

- For fresh food, the visibility of the product is important to the consumer. PET and PP films have superior optical clarity and, therefore, are applied for fish packaging over-wraps and as lidding materials. The polymers may also be blended with antifogging agents in order to reduce condensation on the lidding film.

Drip absorber:

- Fresh fish packaged under modified atmos – phere conditions may drip. In order to reduce bacterial growth and provide a clean package interior, absorbent pads are enclosed. Pads made of cellulose are placed under the fish or when an PS-E tray is used, are integrated as a layer.

Insulation

- is of particular importance in transport packaging of ice chilled fish. Expanded polystyrene trays and boxes are generally used as retail and transport packages respectively.

Moisture control:

- Loss of water during frozen storage results in a condition often referred to as freezer burn. The loss of water dries and toughens the food, and promotes oxidation. Freezer burn and oxidation are always accompanied by off-flavor, off-odor and off-color.Drying, salting and smoking reduces water content and makes a fish product suitable for consumption. Salting is a traditional method that's often combined with drying and smoking. It's also a low-cost way to preserve fish.

Low permeability.:

. Permeability is the rate at which packaging material permits vapors and gases to pass between the product and the surrounding atmosphere. There are large differences in the permeability of varied packaging materials and films.

Tight fit:.

- A tight-fitting package is essential to prevent moisture loss inside the freezer package. In a loose-fitting package, moisture evaporates from the fish and condenses as ice crystals on the inside surface of the package.
- If the product is warmed slightly during defrosting or when the freezer door is opened, moisture can move from the package surface back to the food surface. When the package cools again, the cycle is repeated. This can continue until a large quantity of water is removed from the food, causing severe dehydration.

Practial qualities

- **.** Packaging materials must also be strong, easy to apply and relatively inexpensive. See Table 1 for a comparison of packaging materials

Temperature control:

- Reducing the temperature to 32 degrees Fahrenheit slows down decomposition. Raw fish must be chilled in ice immediately after harvesting and be kept cool during the trip to the processing plant as well as throughout processing and distribution. Freezing is required to extend shelf life for a long time.

Controlled atmosphere packaging

- The only types of controlled atmosphere packagings currently used with raw meats are those in which an anaerobic atmosphere is maintained indefinitely. Controlled atmosphere packagings may be used for bulk product or items of irregular shape, such as whole lamb carcasses, or as master packs for retail-ready product. Controlled atmosphere packaging is not suitable for individual trays of retail-ready product because of the undesirable colour of anoxic meat, and because packaging materials that are impermeable to gases are mostly opaque.Fish may be vacuum-sealed to increase shelf life. Vacuum packaging deprives the fish product of oxygen, which prevents oxidation reactions and slows down spoilage.

Transportation and storage:

Storage:

When working with fish it is essential that proper handling and storage are used **to reduce the risk of food-borne illness and ensure a quality product**. You cannot see the harmful bacteria on the fish so you must handle it as if it is present.

Chilling and storage

Decreasing the temperature of the fish to about 0C slows down the microbiological, chemical and biochemical decomposition processes and extends fish stability. Thus when the raw material is cooled quickly, just after capture, and kept at low temperature during transport, processing and distribution, it meets the basic processing requirements. Its usefulness is extended and at the same time fish quality is maintained.

most common means of chilling is by the use of ice. Ice is available is several forms such as blocks, plates, tubes, shells, soft and flakes. In modern fish processing plants, especially the small ones, flake ice generators dominate as flake ice ensures major contact surface with fish hence higher cooling capacity, low production cost, relatively dry and will not stick together to form clumps when stored.

Fish spoil more quickly if

1. It has struggled for long in the net or inboard, than a fish, which is killed quickly
2. Its stomach is full while catching,
3. It is bruised while catching or handling

There are three methods of storing fish in ice on fishing vessels

Bulking:

The fish hold is a insulated chamber located at the near side of the Boat. It is divided into different compartments using wooden boards supported by an upright beam. A layer of ice at least 5 cm thick is spread over the bottom of a compartment followed by a layer of fish. Ice is then spread over the fish and around the edges so that the fish are not in direct contact with the sides of the board.

Further layers of fish and ice are added until a depth of about 45cm ice and fish is achieved, with a layer of 5 cm of ice at the top. A horizontal wooden board is now placed over the section. The wooden board must be supported by the stanchion structures, not by the fish and ice in the lower compartment. More fish and ice are added in the same way, again to a depth of 45cm. The operation is repeated until the compartment is full. Wooden boards and stanchions must be kept clean and out of direct contact with the fish.

Shelving*:*

1. The fish hold is divided into sections as it is for bulking but this time removable shelves spaced at about 23 cm are used for holding the fish. The lowest shelf is covered with a layer of at least 5 cm of ice. Fish are placed in rows on the ice and more ice is used to cover the fish to about 5 cm. Only one layer of fish is to be put on to each shelf. Shelves must be supported by stanchions, not by the fish and ice below.

Boxing:

Fish boxes come in a variety of sizes and materials. Ideally, a box should:

i. Be strong and robust.

ii. Be able to be stacked so that the weight of the top boxes are taken by the box below, not by the fish in the box below.

iii. Be able to nest to save on stowage space when empty.

iv. Be easily cleaned and, if necessary, sterilized.

v. Allow ice melt-water to flow away outside the box below and not through it on to fish in the lower box.

vi.Have good thermal insulation.

Dry fish storage:

There are different ways to store dried and dry fish for a long time at home. In a private home, the product can be stored in the basement or in the attic by properly preparing it. In a city apartment, carcasses can be stored in tin or glass jars, refrigerator, freezer or plywood boxes. With the correct setting and conservation, the fish will not lose its taste for 6-8 months.

Storage of Raw and Packaging Material:

- Fish/ Shellfish should be stored such that damage from over stacking or overfilling of boxes will be prevented and should be kept in shallow layers surrounded by sufficient finely divided ice or with a mixture of ice and water before processing.
- The temperature of the fish should be maintained between 0°C and +4°C in case of chilled and -18°C or below in case of frozen.
- Ingredients and packaging materials should also be stored appropriately in terms of temperature and humidity and protected and segregated to prevent cross contamination.
- A fish processing establishment shall store raw material and packaging materials in appropriate dry and ventilated areas for effective protection from dust, condensation, drains, waste and other sources of contamination during storage.
- Packaging material storage room should be closed from all sides to restrict entry of flies, rodents, birds, insects/pests etc.
- Storage of raw material/ ingredient, /packaging material shall be done as per FIFO (First in First Out) / FEFO (First Expire First Out) stock rotation system, as applicable.
- The food materials/ ingredient/ packaging material shall be stored on racks/ pallets such that they are stored off the floor on pallets and off the walls to ensure easy and adequate cleaning and prevent harboring of any insects, pests or rodents.
- The storage of raw, processed, semi processed, rejected, recalled or returned materials or products, shall be made separately and properly segregated. These areas shall packked for identification and shall be secured.
- All raw materials/food additives and ingredients shall be stored separately from printed packaging materials, sanitary, hardware and cleaning materials/chemicals

<u>Transportation:</u>

Transportation of chilled fish

- Fish is transported both through air and land. Land transportation of chilled fish is carried out in insulated or mechanically refrigerated vehicles with minimum inside temperature of 7^0C. Boxes for land transportation are made of wood, aluminum, high density polyethylene, expanded polystyrene or polyurethane.
- The ideal fish transpiration box should be light weight yet strong enough to withstand the combined weight of fish, ice and stacking and should have good insulating properties. Boxes are usually made of double bottom to collect the melt water.
- Air shipment of chilled fish requires a lightweight and protective container. Modern insulated containers are made of high-density polypropylene with polyurethane insulation. Instead of ice, pads of nonwoven fabric encapsulating synthetic absorbent powder are used for chilling of air shipped fish. These pads could be soaked in water and deep frozen for use.
- Plywood boxes insulated with 2.5cm thick foamed polystyrene slabs are found to be more usefull to transport fish over longer distances involving duration of 60-80hrs.

Transporting by air:

- Air cargo is responsible for transporting over 5% of the world annual catch and the increasing demand for fresh fish fuels a growing demand for air shipment of fish. However, successful air transport of fish and seafood requires special care in preparation and handling of the shipments, and excellent communication among the shipper, carrier and consignee.

- Also, it should be stressed that hubs often necessitate cargo transfers under tight schedules and the reliance on combination passenger-cargo, entry and exit in all markets can influence the timing of the delivery and the quality of the delivered products.
- But most importantly, the air shipment of improperly packaged fishery products is a safety hazard because of the potential damage, mainly by corrosion, to the interior and control mechanisms of the aircraft.
- Several companies spend yearly millions of U.S. dollars to repair damage that result from leaking seafood packages. Although ice is permitted to keep the fish cool, given it is sealed in plastic pouches, dry ice or gel packs are preferred by most airliners.

Transporting by land or sea:

- most challenging aspect of fish transportation by sea or by road is the maintenance of the cold chain, for fresh, chilled and frozen products and the optimisation of the packing and stowage density.
- Maintaining the cold chain requires the use of insulated containers or transport vehicles and adequate quantities of coolants or mechanical refrigeration. Continuous temperature monitors are used to provide evidence that the cold chain has not been broken during transportation.
- Excellent development in food packaging and handling allow rapid and efficient loading, transport and unloading of fish and fishery products by road or by sea. Also, transport of

fish by sea allows for the use of special containers that carry fish under vacuum, modified or controlled atmosphere, combined with refrigeration.

Live fish transportation:

Considerations for fish transport:

- transport must be done carefully in order to be successful. A poorly organized effort may easily result in death of fish. The following factors directly influence fish transport.

Tolerance to transport

- A famous saying in fish culture is that "fish are not potatoes". They need tender loving care if they are to remain strong and healthy. Tolerance of fish to transport is related to their ability to resist or adapt to stressful conditions. Their resistance also changes as they pass through various life stages. Larvae are very delicate as are brood fish which are ready to lay eggs. The table below indicates stress tolerance levels of some commonly cultured fish.

Presence of food in the intestines

- Fish survive transport better if they have no food in their intestines. For this reason, they are not fed for one to two full days prior to the time they will be transported.
- Brood stock are often conditioned for transport to spawning facilities by crowding them up in a seine net and releasing them. This procedure is done for two consecutive days before moving them from their pond to the hatchery for spawning. The fish stop eating and this helps them adapt to the stress of artificial spawning.

  Fish can also be harvested and held in net enclosures or tanks for 24 to 48 hours with clean, preferably gently running, water. The fish pass food out of their intestines and will be in good condition for transport. If the fish have disease or parasites they can also be treated easily in tanks prior to transport.

Age and size of fish

- A lower weight of small fish can be transported per unit volume of water than large fish. This guide classifies fish broadly into four main groups according to what life cycle stage they are in. Newly hatched fish are called larvae or sac fry. They are slow-moving and possess a yolk sac which provides them with at least a 24-hour food supply after hatching.

Methods used for transporting fish

- It is essential to maintain adequate oxygen in the water while transporting fish. The technique recommended for oxygenating water during fish transport is use of pure bottled oxygen. It may be bubbled continuously into an unsealed container during transport, or injected into a plastic bag containing water and fish which is then sealed air-tight for transport.

- When plastic bags are used, oxygen is added after water and fish. One-fourth of the bagusually contains water and fish and three-fourths contains oxygen.
- After adding oxygen the bag is sealed shut with a twisted rubber band, string or other material. As a precaution against leakage, the first plastic bag should be placed inside a second bag whenever possible.
- The sealed double bag of fish is then placed in a box, woven grass bag or other container for added protection and loaded onto a vehicle for transports.

UNIT- 4

Modified Atmosphere Packaging (MAP):

Modified Atmosphere Packaging

Modified Atmosphere Packaging (or MAP) is the practice of manipulating the atmosphere inside packaging containing perishable foods (for example, beef, pork, chicken, and fish). The goal of the process is to increase the shelf life of the product contained within.

MAP improves the shelf life and freshness of many foods. These include cheese, meats, fish, and other perishable food items. These foods are commonly packaged with oxygen, which is removed via MAP.

How Does Modified Atmosphere Packaging Work?

Oxygen produces lipid oxidation reactions. It also causes high respiration rates in fruit and vegetables. Increased respiration rates are to blame for shortened shelf life.

The presence of oxygen encourages the growth of aerobic spoilage. The potential formation of other unwanted microorganisms may also occur.

By reducing the amount of oxygen and replacing it with other gases, we can reduce or delay unwanted reactions. To change the atmosphere of a package, the oxygen contained within must be reduced or removed.

The MAP process lowers the volume of oxygen contained within the empty space of the packaging containing the product. It can also prevent the formation of water vapor. The oxygen inside of the package is often replaced with other gases.

> *"MAPAX gas mixtures usually consist of the normal atmospheric gases such as carbon dioxide (CO2), nitrogen (N2) and oxygen (O2). Microbial growth can also be inhibited to a certain extent with the help of other gases such as nitrous oxide (N2O), argon (Ar) and hydrogen (H2).*

Stabilizing the controlled atmosphere storage of the gases contained inside the package is possible by using active actions. These actions include gas flushing and compensated vacuuming. The process can also be achieved by utilizing "breathable" shrink wraps or packaging films.

Process of Modified Atmosphere Packaging

Modified atmosphere packaging allows natural and non-processed food to be packaged to extend the shelf life of the product. This increases the quality of the product's image, texture and the appeal of its nutrition.

The contained atmosphere within the package provides the product with extended availability. As MAP does not need chemicals to preserve the freshness of the product, it has greater appeal.

The processing and marketing of foods are enhanced due to modified atmosphere packaging. MAP provides the consumer with fresh and delicious foods. These foods often exceed the customer's expectations.

MAP Advantages :

- Longer shelf life
- Enhanced visual appeal
- Stays fresh longer
- No chemical preservatives
- Long-lasting flavor preservation
- Sustained nutritional content

Benefits of Modified Atmosphere Packaging For Retailers And Suppliers

Extending the shelf life of various products is appealing to consumers. MAP packaging gives processors of natural and non-processed foods an upper hand in their supply chain. Fresh food means less rotation of packages. This means much less waste. Excess human labor is reduced (especially when using collaborative robots).

Distribution territories expand, and a better variety of products are available to consumers. Manufacturers are allowed to take advantage of longer shelf life cycles. This means a reduction in production demands.

When it comes to the downsides of MAP, one of the primary concerns is cost. There are cheaper ways to package food. When health and freshness are not significant concerns, processed alternatives can save money.

The technologies of MAP are evolving. Healthier and fresher food products made possible by MAP will be able to compete in costs with their processed counterparts as new advancements are made in MAP technology.

MAP Disadvantages :

- More expensive
- Less consumer base
- Complicated to package
- A higher level of quality assurance required

Is Modified Atmosphere Packaging Safe?

As the saying goes, "safety first." MAP is not to be considered a fail-safe when it comes to food safety. While MAP allows for longer shelf life and can prevent certain types of spoilage, it is not guaranteed.

Some foods packaged with MAP may actually result in additional risk. MAP may allow for the formation of pathogenic organisms. There is a host of possible contamination issues with pathogens, including but not limited to *L. monocytogenes, Y. enterocolitica* and *A. hydrophila*. MAP packaged produce is particularly at risk.

Aseptic packaging:

Aseptic packaging is a packaging concept where product is packed under aseptic conditions.The history of aseptic packaging goes back to the early 20th century. when first aseptic filling plant was commercialised in the market by Dole which used superheated steam at 210ºC for sterilization. The most significant development in this field is the development of a commercially viable packaging plant for milk, i.e. the Tetra Pak system, following the development of UHT process for milk. The system remains till today the most widely used aseptic processing concept.

traditional method of sterilization involves filling the food into its containers which is then hermetically sealed before heat treatment in the retort. The continuous flow system combined with aseptic filling was developed from the retort system because increasing the temperatures in combination with shorter holding time has the same lethal effect on microorganisms while reducing the adverse effects of other possible chemical reactions on the food. Moreover in a continuous flow process, the product temperature can be raised and lowered more rapidly than in batch process. Hence the time distribution for several parts of the food system will be more even

The production of a commercially sterile product by continuous UHT processing requires a means of packing which will ensure continued product sterility with the attainment of expected shelf-life. Such a requirement is fulfilled by aseptic packing. Aseptic processing and packaging denotes the filling commercially sterilized and cooled product into pre-sterilized containers

under aseptic conditions and sealing in an atmosphere free of micro-organisms.

The basic operation in aseptic packaging consists of:

- Heating the product to sterilization temperatures (140-150°C for 0-few seconds).
- Maintaining the sterility of the products till they are cooled/packed.
- Filling into sterile containers and sealing aseptically.

The main characteristics of aseptic packing which are essential from basic functional point of view are as following.

- Low water-vapour transmission rate.
- Low gas transmission rates, especially to oxygen. This is important to preserve the colour, flavour and nutritional constituents in the products.
- Good physical or mechanical strength, sufficient to resist any physical damage during manufacture, handling and distribution.
- Good sealing characteristics to prevent entrance of external contaminants.
- Capability to fit into automatic fabricating and filling equipment.
- Resistance to withstand the temperatures encountered during filling of the product as well as during storage and distribution.
- Chemically resistant to the product packed and ability to withstand sterilisation packing material with gas, liquid radiation.
- Resistance to microbes, insects and other types of bio¬logical hazards.
- Compatibility with the milk packed. The constituents and additives etc. of the package material should be inert with low migration levels in accordance with the appropriate codes of practice and standards of the country.
- Economical in cost in comparison to the packaged product and readily available in the market.

Sterilant

The aseptic packaging machine ensures the sterilization of the container and provides a sterile environment for filling. The most commonly used sterilants, depending on the application, are hydrogen peroxide (H_2O_2) or a combination of H_2O_2 and peracetic acid.

- Use sterilants to sterilize the package that are safe and suitable for use in dairy processing facilities
- Follow the manufacturer's recommendation if dilution of the sterilant is required

During the sterilization of the packaging material by H_2O_2 or other sterilants, a residue of these sterilants may be left on the material and can subsequently contaminate the filled product.

- Rinse the treated aseptic packages with water to remove sterilant residues when necessary
    - Ensure the rinse water is sufficiently sterile (that is, commercially sterile) so that it does not result in loss of asepsis throughout the entire shelf-life of the product

- Perform residue testing at an appropriate frequency to ensure sterilant residues are at or below the level specified by the scheduled process

Depending on the type of packaging equipment, different means of applying the sterilants are used for example, spray, vapour, roller system, immersion bath, etc.

- Have the person responsible for the scheduled process (for example a process authority) validate that the sterilant can achieve commercial sterility

Packaging Materials used in Aseptic Packaging

1. 1st generation material: Paper board/plastic /foil/plastic laminates.

2. 2nd generation: plastic containers.

- Establish a program to ensure that the packaging materials received meet the criteria identified in the scheduled process
    - Include visual examination of the packaging material to identify damage and defects
- Store all packaging material in a clean and sanitary manner to minimize the risk of contamination and physically damaging the materials

Property sought in laminate for Aseptic packaging:

- The packaging material or container is sterilized prior to filling and sealing in a sterile environment. Both the packaging material and seal are of sufficient strength and function to prevent recontamination of the product during storage and transport.
- Various packaging materials are used for milk, from paper-based laminates or carton board, to bottles made from polyethylene or polypropylene. The common packing is typically a combination of polyethylene, paper and aluminium foil. The polyethylene forms a mono-layer protective coat on the outer surface of the carton, and a co-extruded double layer on the inner food-contact surface which aids in sealing. Between the polyethylene layers is a paper layer which provides strength, rigidity and printability and the aluminium foil layer serves as an oxygen barrier.

Controlled packaging

Cold chain/Temperature controlled packaging

chain packaging, also known as temperature-controlled packaging, refers to packaging and distribution methods specifically engineered to keep products at a constant temperature from

production through final distribution. While initially established to keep temperature-sensitive goods refrigerated or frozen in transit, temperature-controlled packaging solutions have expanded to encompass packaging that protects room temperature products from extreme external temperatures.

Applications

Temperature-controlled packaging ensures that products maintain a desired temperature consistent with relevant safety regulations and quality standards. Cold chain packaging is used in a wide range of industries, including:

Pharmaceutical

Many over-the-counter and prescription medications require temperature-controlled conditions to maintain optimal effectiveness. Many vaccines must be kept frozen or refrigerated within very specific temperature ranges to remain fully effective.

Food and Beverage

Fresh produce, dairy products, eggs, and frozen food are just a few examples of products that must be packaged and shipped in temperature-controlled packaging. Cold chain packaging solutions keep produce fresh, maintain frozen food at appropriate temperatures, and prevent sensitive products like candies and confections from melting in transit.

Chemicals

To prevent dangerous exothermic reactions, chemicals are often transported in refrigerated or temperature-controlled packaging. This prevents exposure to heat that may cause sparks, flames, or explosions.

Cosmetics and Personal Care

Many cosmetics and personal care products such as makeup, soap, and lotions must be contained in temperature-controlled packages. Exposure to heat or freezing temperatures outside the product's allowable range can result in product separation, breached seals, contamination, spills, and poor product quality.

Advantages of Cold Chain and Temperature-Controlled Packaging

Cold chain packaging offers a variety of benefits, including:

Product Quality

Using top-quality temperature-controlled packaging maintains consistent product quality from the manufacturing facility through distribution. This ensures greater customer satisfaction and reduces the potential for product loss, thereby increasing your overall profitability.

Consumer Satisfaction

With insulated packaging, you ensure that your customers receive high-quality products with a high degree of consistency and reliability. In today's digital age, this translates to return customers, good reviews, and greater customer satisfaction with your brand. What's more, you can pass your savings on to the customer to make your brand more competitive in the marketplace.

Distribution Standards

As customers become more conscious of product sourcing, there is an increased level of regulation and accountability for companies in every industry. By using temperature-controlled and cold chain packaging, you can stay ahead of the game. Keep your products at optimal temperatures to avoid product recalls and stay ahead of increasingly stringent distribution standards around the world.

Flexible packaging:

Flexible packaging is a means of packaging products through the use of non-rigid materials, which allow for more economical and customizable options. It is a relatively new method in the packaging market and has grown popular due to its high efficiency and cost-effective nature. This packaging method uses a variety of flexible materials, including foil, plastic, and paper, to create pouches, bags, and other pliable product containers. Flexible packages are particularly useful in industries that require versatile packaging, such as the food and beverage, personal care, and pharmaceutical industries.

Benefits of Flexible Packaging

At Star Label Products, we offer a wide range of flexible packaging options with numerous benefits, including:

Improved Production Efficiency

Flexible packaging uses less base material than traditional rigid packaging, and the easy formability of flexible materials improves production time and reduces energy consumption.

Environmentally Friendly

Flexible packaging requires less energy than rigid packaging. In addition, flexible packaging materials are frequently designed to be reusable and recyclable.

Innovative Package Design and Customization

Flexible packaging materials allow for more creative and visible packaging shapes. Coupled with our top-of-the-line printing and design services, this ensures conspicuous and striking packaging for superior marketing value.

Enhanced Product Life

Flexible packaging protects products from moisture, UV rays, mold, dust, and other environmental contaminants that can negatively affect the product, thereby maintaining its quality and extending its shelf life.

User-Friendly Packaging

Flexible packaging is less bulky and lighter than traditional options, so it is easier for customers to buy, transport, and store products.

Simplified Shipping and Handling

Shipping and handling costs are significantly reduced since this method is lighter and takes up less space than rigid packaging.

Different Types of Flexible Packaging

Flexible packaging comes in a variety of materials, shapes, and sizes, and is typically produced in either formed or unformed configurations. Formed products are pre-shaped with the option of filling and sealing yourself in-house, while unformed products typically come on a roll that is sent to co-packers for forming and filling. The materials used in flexible packaging are easy to manipulate and combine into innovative and customizable styles, such as:

- **Sample Pouches:** Sample pouches are small packets composed of film and/or foil that get heat-sealed. They are typically pre-formed for easy in-house filling and sealing
- **Printed Pouches:** Printed pouches are sample pouches on which the product and brand information is printed for marketing purposes
- **Sachets:** Sachets are flat packets made of layered packaging material. They are frequently used for single-use pharmaceutical and personal care products. These are great for trade shows where you want to distribute samples

- **Printed Roll Stock:** Printed roll stock consists of unformed pouch material with product information pre-printed on it. These rolls get sent to a co-packer to get formed, filled, and sealed

- **Stock Bags:** Stock bags are simple, blank formed bags or pouches. These can be used as blank bags/pouches or you can adhere a label to these in order to promote your brand

Industries Benefit From Flexible Packaging

Flexible packaging's versatility makes it an excellent option for many products and industries, including:

- **Food & Beverage:** Food pouches and sachets; stock and custom printed bags
- **Cosmetics:** Sample pouches for concealer, foundation, cleansers, and lotions; resealable packages for cotton pads and make-up remover wipes
- **Personal Care:** Single-use medicines; sample pouches for personal products
- **Household Cleaning Products:** Single-use detergent packets; storage for cleaning powders and detergents

Retort pouch:

Introduction

The retort pouch is a rectangular, flexible, laminated plastic, four-side hermetically sealed pouch in which food is thermally processed. It is a lightweight, high-quality, durable, convenient and shelf stabRetortable

Foods packed and processed in retort pouches are in successful commercial use for a wide variety of foodstuffs in several countries, particularly Japan. The materials from which retort pouches are made are either aluminum foil bearing/plastic laminates or foil-free plastic laminate films. Retortable pouches can be either preformed or in-line formed using form/fill/seal equipment. Common pouch structures are PET/nylon/foil/PP and PET/nylon/EVOH or PVDC/PP. Retortable pouches are used by hotels, restaurants, and other institutions.

Retortable pouches must be inert, heat sealable, dimensionally stable and heat resistant to at least 121°C for typical process times. They should have low oxygen and water vapor permeability, be physically strong and have good ageing properties.

Retail consumer products such as tuna, salmon, chicken patties, chipped beef, chili, and ground beef in retortable pouches have become available. Pouches are reverse printed in a wide range of graphics on the PET film before lamination, so that the print cannot come into contact

with the food. All laminates are required to meet very stringent requirements to ensure no undesirable substances can be extracted into the packaged food.**pouc**

Manufacturing of pouches

Pouches can either be formed from reels of laminated material either on in-line form/fill/seal machines in the packer's plant or they may be obtained as preformed individual pouches sealed on three sides, cut and notched. Forming consists of folding the laminate material in the middle, polyester (or PA) side out, heat sealing the bottom and side seals and cutting to present a completed pouch. Alternatively two webs can be joined, heat seal surfaces face to face, sealed, cut and separated. Hot bar sealing is the most common practice. Notches are made in the side seal at the top or bottom to facilitate opening by the consumer. Modern pouches have cut rounded corners which reduce the possibility of perforation caused by pouch to pouch contact. Rounded corner seals can also be incorporated.

The four-seal flat shape and thin cross section of the pouch is designed to take advantage of rapid heat penetration during sterilization and on reheating, prior to consumption, saving energy and providing convenience. The flat shape also enables ease of heat sealing and promotes high seal integrity. Fin seal design and certain gusset features permit the design of upright standing pouches although they create multiple seal junctions with increased possibility of seal defects. Several of these upstanding pouches are, however, available commercially. A wide range is possible in the size and capacity of pouches.

Filling and sealing

The premade pouches are filled vertically in-line. Vertical form/fill/seal machines can be used for liquid products. Another method employs a web of pouch material which is formed on a horizontal bed into several adjacent cavities. The cavities are filled whilst the seal areas are shielded. This method is especially useful for filling placeable products. Thereafter the filled cavities are simultaneously sealed from the top using a second web fed from the reel. The essential requirements for filling are:

- Pouch should be cleaned, fully opened to the filling station, solids are filled first followed by the liquid food at a second station
- Matching fill-nozzle design and filler proportioning to the product
- Non-drip nozzles are used for filling
- Shielding of the sealing surfaces
- Bottom to top filling
- Specification and control of weight consistent with the maximum pouch thickness requirement
- Product consistency in formulation, temperature and viscosity
- Deaeration prior to filling.

Sealing machines like fillers are constantly being refined and speed has improved from 30 to 60 pouches per minute to the current production rate of 120–150 pouches per minute. Sealers incorporate either one of two common satisfactory sealing methods namely hot bar and impulse sealing. Both methods create a fused seal whilst the pouch material is clamped between opposing

jaws, thereby welding the opposing seal surfaces by applying heat and pressure. Exact pouch-sealing conditions depend on the materials and machinery used.

Quality assurance

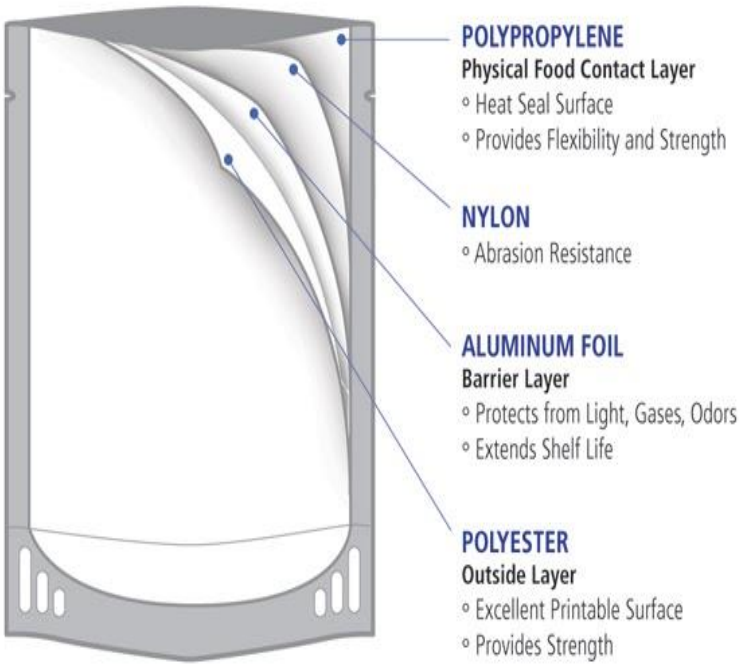
A successful pouch packaging quality system requires:

- Selection and continued monitoring of the most suitable laminate materials.
- Regular testing of formed pouches for seal strength, product resistance and freedom from taint.
- Careful selection, maintenance and control of filling, sealing, processing and handling machinery.
- Specifications for the control of product formulation, preparation (viscosity, aeration, fill temperature etc.) and filling (ingoing mass and absence of seal contamination).
- Post sealing inspection and testing of closure seals to confirm fusion, absence of defects and contamination.
- Control of critical parameters influencing processing lethality such as maximum pouch thickness and residual air content.
- Standardized retorting procedures applying only recommended process times and temperatures confirmed to achieve adequate lethality.
- Regular inspection and testing of retort equipment and controls to ensure uniform heat distribution.
- Visual inspection of all pouches to check sealing after processing.
- Handling only of dry pouches and packing into collective or individual outer packaging specially tested to provide adequate, subsequent, abuse resistance.
- It should be routine that all stocks are held 10–14 days prior to distribution and these should be free of blown spoilage on dispatch.
- Careful staff selection and training at all levels.

Shelf life

- Whilst shelf life is determined by many factors such as storage temperature and the barrier properties of the particular film used, in general, satisfactory shelf stability in excess of two years is easily obtained for a wide range of products in foil bearing pouches. US military rations tested over two years at 20°C showed no significant change in product quality ratings. Some products have been successfully stored for as long as seven years and found to be safe and edible.

- Foil-free laminates will demonstrate shelf stability commensurate with oxygen permeability of the particular laminate used and the sensitivity of the product. Commercial experience confirms, however, that product stability from four weeks to six months is obtainable. Nitrogen flushing of the outer container has been successful in extending the shelf life of product in foil-free pouches.



Advantages:

The retort pouch has several advantages.

It weighs less than a metal can. It is flexible, meaning that it can handle a lot of abuse when taken away from home or on military maneuvers. Because it is flat, it takes up little space, making it easier to carry in a backpack or pocket.

Combination and synergistic effects:

Introduction

Hurdle technology is a method of ensuring that pathogens in food products can be eliminated or controlled. This means the food products will be safe for consumption, and their shelf life will be extended Leistner in germany referred the combination preservation as hurdle technology.

Hurdle technology usually works by combining more than one approach. L. Lestner in germany referred the combination preservation as hurdle technology in 1980's. These approaches can be thought of as "hurdles" the pathogen has to overcome if it is to remain active in the food. The right combination of hurdles can ensure all pathogens are eliminated or rendered harmless in the final product. Hurdle technology has been defined as an intelligent combination of hurdles which secures the microbial

safety and stability as well as the organoleptic and nutritional quality and the economic viability of food products .

Common Hurdle Technology

- The most important hurdles generally used in food preservation are temperature(high or low), water activity (a_w), acidity (pH), redox potential (Eh), preservatives (e.g., nitrite , sorbate, sulfite), and competitive microorganisms (e.g., lactic acid bacteria).

- However, more than 60 potential hurdles for foods, which improve the stability and/or quality of the products, have been already described, and the list of possible hurdles for food preservation is by no means complete. Some hurdles (e.g., Millard reaction products) will influence the safety and the quality of foods, because they have antimicrobial properties and at the same time improve the flavour of the products.

- The same hurdles could have a positive or a negative effect on foods, depending on its intensity. For instance, chilling to an unsuitable low temperature is detrimental to some foods of plant origin (‘chilling injury’), whereas moderate chilling will be beneficial for their shelf life.

- Another example is the pH of fermented sausage which should be low enough to inhibit pathogenic bacteria , but not so low as to impair taste. If the intensity of a particular hurdles in a food is too small it should be strengthened, if it is detrimental to the food quality it should be lowered.

- By this adjustment, hurdles in foods can be kept in the optimal range, considering safety as well as quality, and thus the total quality of a food. For each stable and safe food a certain set of hurdles is inherent, which differs in quality and intensity depending on the particular product, but in any case the hurdles must keep the ‘normal’ population of microorganisms in this food under control. The microorganisms present (‘at the start’) in a food should not be able to overcome (‘leap over’) the hurdles present during the storage of a product; otherwise the food will spoil or even cause food poisoning .

- Various factors like the microbial load determines the type and amount of hurdles required.

- · If only few microorganisms are present at the start, than a few or low hurdles are sufficient for the stability of the product

- · If microbes present are sub lethally injured, they lack vitality & are easier to inhibit by few hurdles
- · Food rich in nutrients and vitamins will enhance the growth of microorganisms (booster or trampoline effect), thus the number & intensity of hurdles should be increased
- · Water content is an essential component of food, if an increased water activity is compensated by other hurdles (pH, Eh etc.), the food becomes more economical
- · If energy preservation is the goal, than energy consuming hurdles such as refrigeration are replaced by other hurdles that do not demand energy but still ensures a stable and safe food

1 Basic aspects of hurdle technology

Homeostasis

- Strong tendency of organisms to maintain their internal environment stable and balanced so that homeostasis is in balanced condition. If homeostasis is disturbed by preservative factors (hurdles) in foods, they will remain in lag phase or even die before their homeostasis is re-established. Repair of disturbed homeostasis demands much energy, thus restriction of energy supply inhibits repair mechanism and leads to synergistic effect of preservative factors. Energy restrictions are caused by anaerobic conditions, low a_w, low pH and low redox potential.

Metabolic exhaustion

- It leads to auto sterilization of foods. Counts of variety of bacteria, yeasts and molds that survive the mild heat treatment decrease quite fast in the products during unrefrigerated storage because the hurdles applied do not allow growth. Microorganisms in hurdle technology foods try every possible repair mechanism for their homeostasis. By doing this, they completely use up their energy and die, that leads to auto sterilization of foods.

Stress reactions

- Bacteria become more resistant or even more virulent under stress – heat shock proteins. Protective stress shock proteins are induced by heat, pH, Aw, ethanol, starvation etc. Activation of shock protein genes would be more difficult if different stresses are received at the same time.

Multi target preservation

- A Synergistic effect could be achieved if hurdles in a food hit, at the same time, different targets (e.g., cell membrane, DNA, enzyme system, RNA) within the microbial cell and thus disturb the homeostasis of the microorganisms. Repair of homeostasis as well as the activation of stress shock proteins would become more difficult. Nisin, damages the cell membrane, in combination with Lysozyme and citrate, which then easily penetrate the cell and disturb the homeostasis with different targets.

Example for application of hurdle technology

- The hurdle technology approach is used for non fermented foods like Italian pasta. In this reduced aw, mild heating are principle hurdles with modified atmosphere in packaging and chilling during storage are the hurdles. Other food items preserved by the hurdle \ technology are foods, dairy products, fish, meat and cereals for shelf stable food preparations.

UNIT-5

Labelling and Printing of packaging Material:

Introduction:

Label is the first point of contact between the consumer and the producer. It allows the consumers to know what exactly they are buying in terms of calories, proteins, fats etc. and thus enables them to make a 'health conscious selection'.

It informs the consumers regarding weight of the product, best before date, storage conditions and cooking recipe if any. It allows consumers to compare food products by Value for Money. A label is a piece of paper, polymer, cloth, metal, or other material affixed to a container or article, on which is printed a legend, information concerning the product, addresses, etc. A label may also be printed directly on the container or article.

Labels have many uses: product identification, name tags, advertising, warnings, and other communication. Special types of labels called digital labels (printed through a digital printing) can also have special constructions such as RFID tags, security printing, and sandwich process labels.

Purpose of Labels:

Information about Packaged Foods: It requires that all packaged foods list the name and address of the food's manufacturer, the weight or count of the food and nutrition facts for the food. The NLEA applies to all foods except for meat, poultry, eggs, prepared food or foods that are sold in bulk.

Nutrition value of product: The Nutrition Facts Label is the label with the most information for consumers. The first line of this label lists the serving size. The nutritional information that follows is based on this specific serving size. The next line lists the total calories, and the amount of calories that are from fat. The following lines contain the food's total fat content (including a breakout of saturated and Trans fats), cholesterol and sodium. Carbohydrates, fiber, sugars, vitamins and minerals are listed next. The percent of the daily value for each nutrient, based on a 2,000 calorie diet, is listed on the right side of the label. The footnote on the bottom of the label has the FDA's recommended dietary guidelines. If the food label is very small, this footnote is abbreviated.

Decoration: When food product is choicely labeled in bright and attractive colors, it attracts consumers to buy. It acts as a silent shelf salesman. The color and design should be in symmetry with product color and the level should have some relationship to the size and shape of the package and container.

Warning: Food labels also having warning and instructions about the food product. Labels educate consumers about allergens, preparation methods and storage conditions for products.

Identification: Identification of the product is the main role of the labels as the consumer must be able to identify. Name & address of the manufacturer, packer and / or seller and brand name also identify by the labels.

Types of Labels:

Paper labels may be classified into four main categories:

1. Plain paper labels
2. Pre-gummed paper labels
3. Thermoplastic labels
4. Pressure sensitive paper labels

Plain paper labels: Plain paper labels are cheaper than other same quality of labels. Any type of the plain paper label can be printed by standard printing machine and by normal printing methods. These labels can be applied by simple hand application, semi automatic to fully automatic procedure.

Pre gummed paper labels: Pre- gummed paper labels are prepared from dextrin and gum Arabic coated papers and then calendared, flattened or non-curled by a special process. The advantage over plain paper is that they require only to be moistened with water for ready use as a postage stamp.

Thermoplastic labels: Thermoplastic labels are prepared from paper coated with a synthetic resin which melts and becomes tacky on the application of heat. There are two varieties a) instant tack and b) delayed action. In thermoplastic labels printing inks are used for the printing purpose. In these types of levels liquid phase or solvent does not activate the adhesive and should be heat resistant.

Pressure sensitive labels: Pressure sensitive labels may be considered as the most advanced form of labelling and is a process where the label is in a stage of permanent activation and does not require heat, moisture or gum in order to make it adhere to a surface. One can use finger pressure for sticking of the label on the surface. Paper sensitive label consists of a label paper coated with permanent tacky adhesive.

Swing labels: A tag may be described as a marking device that is attached to a container or product by some means other than adhesive- strings, ribbons, wire, holes and various types of slots and slits. High class food products, particularly those styled and designed as presentation and gift packages or units.

Some of the common terms for labels

Back label	Used on back of containers.
Band label	Wraps around container or product, does not cover the entire surface.
Can label	Used on tin cylindrical containers.
Die cut label	Label of irregular shape cut with a die.
Embossed label	Labels which have three dimensional effects
End label	Essentially a spot label applied to end of box or wrapped package

Neck label	Used for neck of bottle
Over-all wrap	Covers the entire surface of a container top, bottom and sides
Spot label	Label which covers only a small portion of the container
Tag	special purpose label, Affixed to product or container by string wire etc.
Wrap around label	Wrap all around the container, does not cover top or bottom

Printing:

Introduction:

Printing is a process in which text and images are reproduced, typically with ink on paper using a printing press made from letters, photographs and drawing. It is often carried out as a large-scale industrial process, and is an essential part of publishing and transaction printing. The basic systems of printing are: - 1) the original, (2) the plate, (3) printing ink, (4) a printing medium such as paper and (5) a printing machine. Printing can be classified into two parts:

1) Direct Printing: In this type of printing, printed material comes in direct contact with the plate so that the ink is directly applied to the printing medium.

2) Indirect Printing: In this printing, the ink is first applied to the blanket cylinder from the plate and then printing medium comes in contact with the **lithograph**

Printing Technologies

Numbers of printing are in trend for printing purposes of packaging materials. Which are?

Lithography

Lithography is a method in which printing is applied on a smooth surface. Lithography is a printing process that uses chemical processes to create an image. is a form of planographic printing, meaning that the surface is flat, in contrast to relief printing or intaglio printing. For instance, the positive part of an image would be a hydrophobic chemical, while the negative image would be water.

Thus, when the plate come in contact with a compatible ink and water mixture, the ink will adhere to the positive image and the water will clean the negative image. This allows for a relatively flat print plate which allows for much longer runs than the older physical methods of imaging (e.g., embossing or engraving).

Colour printing

Chromolithography is a method for making multi-colour prints. This type of colour printing stemmed from the process of lithography, and it includes all types of lithography that are printed in colour. Lithographers sought to find a way to print on flat surfaces with the use of chemicals instead of relief or intaglio printing.

Chromolithographs are mainly used today as fine art instead of advertisements, and they are hard to find owing to poor methods of preservation and also because a cheaper form of printing replaced it. Many chromolithographs have deteriorated because of the acidic frames surrounding them.

Screen printing

Screen printing has its origins in simple stenciling, most notably of the Japanese form (katazome), used who cut banana leaves and inserted ink through the design holes on textiles, mostly for clothing. This was taken up in France.

Flexography

- Flexographic printing is widely used in western countries. Flexography (also called "surface printing"), often abbreviated to "flexo", is a method of printing most commonly used for packaging (labels, tape, bags, boxes, banners, and so on).A flexo print is achieved by creating a mirrored master of the required image as a 3D relief in a rubber or polymer material. A measured amount of ink is deposited upon the surface of the printing plate.

- The print surface then rotates, contacting the print material which transfers the ink. Ink is picked up by a cavitated anilox roll and transferred to the printing plate. The ink is then transferred to the film. Because the costs of producing the plates are relatively low, flexographic printing is cost effective, especially for short runs.

- Its printing quality is inferior to that of modern printing techniques such as offset printing and gravure printing. Now a day this printing technology is utilized for printing on polyethylene bags, corrugated boxes and carton after using the photosensitive resins of improved printing quality.

Digital press

- Digital printing is the reproduction of digital images on a physical surface, such as common or photographic paper or paperboard-cover stock, film, cloth, plastic, vinyl, magnets, labels etc. it is now possible to create artwork on a computer and transfer the image directly to the packaging film. A design is created on a computer; it may be an individual design or replicated to give several hundreds of impressions.

It can be differentiated from litho, flexography, gravure or letterpress printing in many ways, some of which are;

1. Every impression made onto the paper can be different, as opposed to making several hundred or thousand impressions of the same image from one set of printing plates, as in traditional methods
2. The Ink or Toner does not absorb into the substrate, as does conventional ink, but forms a layer on the surface and may be fused to the substrate by using an inline fuser fluid with heat process(toner) or UV curing process(ink).
3. It generally requires less waste in terms of chemicals used and paper wasted in set up or make ready.
4. It is excellent for rapid prototyping, or small print runs which means that it is more accessible to a wider range of designers and more cost effective.

Frescography

Frescography is a method for reproduction/creation of murals using digital printing methods. The frescography is based on digitally cut-out motifs which are stored in a database. CAM software programs then allow entering the measurements of a wall or ceiling to create a mural design with low resolution motifs. Since architectural elements such as beams, windows or doors can be integrated, the design will result in an accurately and tailor-fit wall mural. Once a design is finished, the low resolution motifs are converted into the original high resolution images and are printed on canvas by Wide-format printers. The canvas then can be applied to the wall in a wall-paperhanging like procedure and will then look like on-site created mural.

3D printing

Three-dimensional printing is a method of converting a virtual 3D model into a physical object. 3D printing is a category of rapid prototyping technology. 3D printers typically work by 'printing' successive layers on top of the previous to build up a three dimensional object. 3D printers are generally faster, more affordable and easier to use than other additive fabrication technologies.

Modern printing technologies

1 Offset printing

Offset printing is widely used for printing on folding cartons in the packaging field. Offset printing is a widely used printing technique where the inked image is transferred (or "offset") from a plate to a rubber blanket, then to the printing surface. When used in combination with the lithographic process, which is based on the repulsion of oil and water, the offset technique employs a flat image carrier on which the image to be printed obtains ink from ink rollers, while the non-printing area attracts a film of water, keeping the non-printing areas ink-free.

Offset printing has the following advantages:

1) Plate making time is short in this printing technology.

2) Plate making cost is less than that of gravure printing.

3) It is suitable for multicolor printing.

4) In offset printing large sized plates are easily made.

Labelling requirements:

like to say, “Don’t a book by its cover.” There’s one problem — most of them are lying. They judge not only books but products of all sorts based on their packaging. In fact, at least a third of product purchase decision-making is based on packaging. That’s why it’s so important to get your product labeling right.Getting it right includes three key factors: cultural fit, accurate translation (where necessary), and compliance with local regulations.

A successful product label is more than just text. It’s like a mini-advertisement for your product. And like any advertisement, if you don’t take the local culture into account, your sales may suffer for it.

Accurate Translation:

The where customers look to find key information about their potential purchase. Depending on the product, labels can list ingredients and materials, instructions, safety information, and more.

Product names and branding elements can be altered from the original to ensure cultural fit. But there’s no such flexibility when it comes to the information customers need to make purchasing decisions or keep themselves safe. Accurate translation of information like this is non-negotiable.

Compliance With Regulations

Regulatory compliance includes accurate translation, where required. But there's more to it than that. Labeling regulations also govern the type of information you present on the label, the way it's presented, and sometimes even the size of the font used.

Regulation to meet product labeling requirements for your target geographic region won't just make your product less appealing to customers; it also exposes your business to legal liability and compliance risks. Since regulations vary between countries (and sometimes even between states), the potential for costly errors increases as your business expands to other regions.

This overview of retail product labeling requirements will help you understand more about what's involved.

Retail Labels for Food

Generally speaking, labels for food products must advise consumers of the product ingredients (including potential allergens), the "best before" or "use by" date, country of origin, and nutrition information. The address of the manufacturer or distributor is also required.

International labelling requirements

United States Food Labeling Requirements

In the United States, the Food and Drug Administration (FDA) regulates most food labels. However, meat, poultry, and eggs are under the jurisdiction of the United States Department of Agriculture, while the Department of the Treasury's Bureau of Alcohol and Tobacco Tax and Trade governs alcohol sales, including labeling.

States can also impose their own labeling requirements. And if you're planning to sell your food product in other countries, the requirements get even more complex.

Canadian Food Labeling Requirements

In Canada, food labeling requirements are outlined by the Food and Drugs Act and Regulations and the Safe Food for Canadians Act and Regulations. Mandatory information has to be provided in both French and English, with some exceptions for specialty foods, local foods, and test market foods.

Net quantity symbols must appear in English and French as well, and use locally appropriate units of measurement. "Best before" and "packaged on" dates must be formatted as Year/Month/Date.

Mexican Food Labeling Requirements

Mexican food labels must comply with the Mexican Official Standard NOM-051. As you'd expect, this includes standard information like ingredients, allergens, country of origin, etc. Everything must be in Spanish using appropriate date formats and units of measurement.

But there's more…Mexican food label laws now mandate specific warnings to help curb poor nutrition and obesity. Foods high in saturated fat, trans fats, sugar, sodium, or calories must carry black octagon-shaped warning labels. Products with caffeine or added sweeteners must have warning labels to indicate that they are not for children. And they cannot use child-friendly branding elements like cartoon characters, pets, celebrities, or athletes.

Say Adios to Lucky the Leprechaun, Tony the Tiger, and Count Chocula — they are no longer a part of this nutritious breakfast!

EU Requirements

If you're exporting to the EU, you'll need to comply with the Food Information Directive, which took effect in 2014. Information including but not limited to country of origin, ingredients, allergens, and nutrition must be available in "a language easily understood by the consumers of the Member States where a food is marketed."

Organic Food Labels

In the United States, organic food must be certified to contain at least 95% organic ingredients, with no synthetic growth hormones, antibiotics, pesticides, biotechnology, synthetic ingredients, or irradiation.

Products certified as organic in the United States can use the Canada Organic logo under an equivalency agreement. However, there is not yet an organic equivalency agreement between the US and Mexico. For now, to market products as organic in Mexico requires certification under Mexican organic standards.

Labelling legislation:

Introduction:

Most of the packaging related regulatory initiatives are concerned to the Product quality, Public Health and Hygiene, Safety, Export Promotion, Transportation and Consumer protection.

The international markets are governed by various packaging rules and regulations that make it mandatory for an exporting country to abide by them.

The Legal Metrology (Packaged Commodities) Rules, 2011

These rules may be called “The legal metrology (packaged commodities) Rules, 2011. These shall come into force from 1st March 2011. The commodities specified in the second schedule shall be packed for sale, distribution or delivery in such standard quantities is specified in that schedule.

Declaration to be made on every package
1. Thename and address of the manufacturer

2. The common generic names of the commodity contained in the package

3. The net quantity in terms of standard unit of weight or measure of the commodity

4. The month and year in which the commodities is manufactured

5. The retail sale price of the package

6. Such other matter as are specified in these rules

Package of Food to Carry a Label

(1)Every package of food shall carry a label and unless otherwise provided in these rules, there shall be specified on every label:
(a) The name, trade name or description of food contained in the package;
(b) The names of ingredients used in the product in descending order of their composition by weight or volume as the case may be;

Provided that in the case of artificial flavouring substances, the label may not declare the chemical names of the flavours, but in the case of natural flavouring substances or nature-identical flavouring substances, the common name of flavours shall be mentioned on the label. Provided also that whenever Gelatine is used as an ingredient, a declaration to this effect shall be made on the label by inserting the word "Gelatine-Animal Origin."

In case of packages of confectionery weighing 20 gm or less, which are also exempted from the declaration of ingredients, will be exempted from the declaration of "Animal Origin" even if it contains Gelatine provided that such declaration shall be given on the multi- piece package in such a manner that the same is readable even without opening the package.

(2) The maximum permissible error specified as percentage shall be rounded off to the nearest one-tenth of a g or ml, for a declared quantities less than or equal to 1000 g or ml and to the next whole g or ml for declared quantities above 1000 g or ml.

Provided also that when any article of food contains whole or part of any animal including birds, fresh water or

marine animals or eggs or product of any animal origin, but not including milk or milk products, as ingredient

FSSAI standards:

Government agencies all around the globe have stringent policies in place for food labelling and food packaging designs. In India, the FSSAI (Food Safety and Standards Authority of India) is the authority that mandates the food labelling norms. Whenever there is a launch of a new food product or the packaging gets renewed, the producer needs to adhere to FSSAI guidelines on the labelling of food products.

1. Name of the Food

A label should clearly display the product's name and the font prescribed in the food labelling FSSAI rules.

2. The List of Ingredients

The label must mention the elements used in making the final food product. The manufacturer should mention all the ingredients of the product fairly and should not keep the end customers in the dark about any ingredients used.

3. Nutritional Information

FSSAI labelling rules mandate the mention of the details related to the calories of the food product on the label. It should mention calories received from trans fat, saturated fat, sodium, cholesterol dietary fibre, carbohydrates, protein, sugar, iron, calcium, vitamin A, and vitamin C contained in the product.

4. Declaration Regarding Non-vegetarian or Vegetarian

Some parts of India consider non-vegetarian food unholy and against the relevant religious practices. Therefore, FSSAI label rules dictate to every manufacturer to mention on the label whether the food product has any non-vegetarian ingredients in it. The label must have a small dot at the corner to represent if the product is vegetarian or non-vegetarian. A red-coloured dot represents non-vegetarian food and a green-coloured dot represents vegetarian food.

5. Declaration Regarding Food Additives Used

Additives are substances added to a food product to enhance its appearance and/or taste and to preserve its flavour. The producer must make a declaration on the label regarding the additives used in the product.

6. Name and Complete Address of the Manufacturer

At a prominent place on the label, there should be a clear mention of the manufacturer's name, complete address, and place of manufacturing.

7. Customer Care Details

The contact details of the customer support centre must be on the label
8. Quantity

The net quantity or packaged weight of the food product must find a prominent mention on the label
9. Retail Sale Price

The maximum retail price at which the product is on sale should be there.

11. Batch/Code/Lot Number

These numbers provide authenticity about the manufacturer of the product and hence there should be a

mention of it on the label.

Labelling for irradiated food

Irradiation of Food:

Irradiation does not make foods radioactive, compromise nutritional quality, or noticeably change the taste, texture, or appearance of food. In fact, any changes made by irradiation are so minimal that it is not easy to tell if a food has been irradiated.

Food irradiation (the application of ionizing radiation to food) is a technology that improves the safety and extends the shelf life of foods by reducing or eliminating microorganisms and insects. Like pasteurizing milk and canning fruits and vegetables, irradiation can make food safer for the consumer. The Food and Drug Administration (FDA) is responsible for regulating the sources of radiation that are used to irradiate food. The FDA approves a source of radiation for use on foods only after it has determined that irradiating the food is safe.

The FDA has approved a variety of foods for irradiation in the United States including:

- Beef and Pork
- Crustaceans (e.g., lobster, shrimp, and crab)
- Fresh Fruits and Vegetables
- Lettuce and Spinach
- Poultry
- Seeds for Sprouting (e.g., for alfalfa sprouts)
- Shell Eggs
- Shellfish - Molluscan
  (e.g., oysters, clams, mussels, and scallops)
- Spices and Seasonings

Labelling:

Like other forms of processing, irradiation can affect the characteristics of food. Consumer choice mandates that irradiated food be adequately labeled and under the general labeling requirements, it is necessary that the food processor inform the consumer that food has been irradiated. Labeling of

irradiated foods however, is undergoing reevaluation in the US. If whole foods have been irradiated, FDA requires that the label bear the radura symbol and the phrase "treated with radiation" or "treated by irradiation.

" Yet, if irradiated ingredients are added to foods that have not been irradiated, no special labeling is required on retail packages. Special labeling is required for foods not yet in the retail market that may undergo further processing in order to ensure that foods are not irradiated multiple times. In this regulation, FDA advises that other truthful statements, such as the reason for irradiating the food, may be included [(13)].

Because the words "radiation" and "irradiation" may have negative connotations, the labeling requirement has been viewed as an obstacle to consumer acceptance. Many in the food industry believe that an alternative wording, e.g. "electronically pasteurized," would be helpful. In 1997, Congress attempted to resolve this issues in two ways.

First, it mandated that the FDA could not require print size on a label statement to be larger than that required for ingredients and second, it directed the FDA to reconsider the label requirement and to seek public comment on possible changes.

The FDA had not in fact mandated a type size but did require a statement that would be "prominent and conspicuous." In response to this congressional directive, the FDA published an Advance Notice of Proposed Rulemaking (ANPR) in 1999 seeking public comment on the labeling of irradiated food, particularly on whether the current label may be misleading by implying a warning and invited suggestions of alternative labeling that would inform consumers without improperly alarming them. Thousands of comments were received, with a large number compiled into a categorical database for further examination by the CFSAN's Office of Nutritional Products, Labeling, and Dietary Supplements. This leading office for labeling policy has not yet determined whether there will be a change in labeling requirements.

Labelling for Organic food

What are organic foods

Organic foods are products of holistic agricultural practices focusing on bio-diversity, soil health, chemical free inputs etc. with an environmentally and socially responsible approach that have been produced in accordance with organic production standards.

Need for standards for organic foods

People are wary to purchase organic food due to lack of confidence about its genuineness. The problem of fraud and mis-labelling occurs when a Food Business Operator (FBO) marks a product as organic while it contains non-organic ingredients or where the organic production standards are not adhered to in the production process. Therefore, it becomes important to check if the food labelled as "organic" is genuinely organic.

The National Organic Program (NOP) is the federal regulatory framework governing organically produced crops and livestock. The U.S. Department of Agriculture (USDA) oversees the program and enforces the NOP regulations and standards. They regulate use of the term "organic" on food labels.

The USDA requirements for products that are labeled with the term "organic" are separate from the laws that the FDA enforces. Food products that are ordinarily under the FDA's jurisdiction and labeled with organic claims must comply with both USDA NOP regulations for the organic claim and FDA regulations for food labeling and safety.

Labelling for GM (Genetically Modified)food:

enetically modified foods, also known as genetically engineered foods, or bioengineered foods are foods produced from organisms that have had changes introduced into their DNA using the methods of genetic engineering

GM foods and ingredients (including food additives and processing aids) that contain novel DNA or novel protein must be labelled with the words 'genetically modified'. This labelling statement is also required for GM foods that have an altered characteristic (e.g. altered nutritional profile) when compared to a counterpart non-GM food (e.g. soy beans with increased oleic acid content).

GM listed on the label

You will find the statement 'genetically modified' on the label either next to the name of the food (e.g. 'genetically modified soy beans**'), or in association with the specific GM ingredient in the ingredient list (e.g. '**soy flour (genetically modified)**'). If the food is unpackaged, then the information must accompany or be displayed with the food.**

Food from animals that have eaten GM feed

Animals that are fed with feed produced using gene technology are not themselves genetically modified. Food products such as meat, milk or eggs that come from an animal which has been fed GM feed are not regarded as GM foods and are not required to be labelled.

Requirements for implementing labeling policies
Standards, testing, certification, and enforcement:

Before any labeling rules can be implemented, governments would have to set up standards and services to conduct testing of the presence of GM ingredients; certification; and ensure that the quality standards are clear and achievable.

While it is easy to detect GM ingredients in products where the GM ingredient is the main ingredient (like tofu or popcorn), it would not be so easy to detect them in processed products like oils, sugars and starches, which no longer contain any novel DNA or proteins.

On another note, much of the food that is bought and consumed in developing countries is not packaged and consequently not labeled. Examples are soybean milk from a street vendor or fresh fruits and vegetables from the market.

Another issue that regulators have to grapple with is the wording: ideally a label should not prejudice the consumer for or against the product.

There is also the issue of whether the label would be useful or educational. To a homemaker who has heard little about the debate on GM food, a label that reads, "Made from genetically modified soybean" or "Grown from seed obtained through modern plant biotechnology" may create more confusion.

Labelling for vegetarian and Non vegetarian food:

Vegetarian mark and non-vegetarian mark

Effective region	India
Effective since	2001
Product category	Packaged food products
Legal status	Mandatory
Mandatory since	2001


vegetarian food


non-vegetarian food

Packaged food products sold in India are required to be labelled with a mandatory mark in order to be distinguished between vegetarian and non-vegetarian. The symbol is in effect following the *Food safety and standards (packaging and labelling) act of 2006*, and got a mandatory status after the framing of the respective regulations (*Food safety and standards (packaging and labelling) regulation* in 2011. According to the law, vegetarian food should be identified by a green symbol and non-vegetarian food with a brown symbol.

Only veg and non-veg

In the present scheme there are no distinguishing marks for egg and milk products, other than the broad vegetarian and non-vegetarian classifications. As per the present specifications, egg-products would be considered as non-vegetarian, while milk and milk-products are vegetarian and are marked with the green symbol. But there is a common misconception that the brown dot denotes egg-products and that meat-products are distinguished by a red dot. But there is in fact no such provision in the approved standard.

The mark

The law specifies the mark in quite enough detail. An excerpt (the opening sentence) of the specification of the mark in the law:

> The symbol shall consist of a green colour filled circle, having a diameter not less than the minimum size specified in the table below, inside the square with green outline having size double the diameter of the circle, as indicated below ....
>
> —Food safety and standards (packaging and labelling) regulations of India, 2011, Rule 4.

The mark is either a green dot or a brown one enclosed in a square of the same colour. The law specifies other requirements too, like wanting the mark to be placed near the brand logo, in an easily noticeable position

Labelling <u>designs:</u>

Labelling:

Labeling on the package provides information on the food, durability (best use before the date), quantity, ingredients, nutritional facts, country of origin, and name of manufacturer. Several informations are presented on the label are as follows.

Name of the food:

A name prescribed by law or a customary name (A trade mark, brand name or fancy name may also be included, but not instead of the name of the food). Any special treatment the food has been subjected to must be included.

Minimum durability:

As determined by the manufacturer or processor, the duration for which the product will retain its quality both in terms of safety and spoilage must be given for foods.

With a shelf life of more than 6 months but less than 18 months and should be expressed as "Sell by" or "best before" date in terms of month and year. Shelf life upto 6 weeks, should include day and month (+ sign is an indication of period for which food will retain its properties under the storage conditions).

Quantity:

The quantity of the product inside the package should be given on the label. If the product is a mixture of solid and liquid, the gross weight and net weight should be mentioned. It is required to mention on the label because of the weights and measures act. This must be clearly legible, in a conspicuous place and all in the same field of vision.

Ingredients list:

Food with more than one ingredient must have them listed in descending weight order, with water included if it constitutes more than 5%of the finished total weight.

Name and address of Manufacture:

address details of manufacturer of the product should be provided. The contact details should include telephone number, e-mail id and mail address. or packer or retailer must be shown.

Country of Origin:

of origin must be stated if the product is imported, or packed in the country after importing. This is not applicable to any EEC member country importing from other EEC country. At present, the pack is required to carry on e mark when it is to be exported to any EEC countries.

Charecter size:

There are number of requirements with regard to size of the characters in the food labeling regulations. Some regulations specify minimum character heights in relation to the size of the

pack.
Food labeling regulations are extremely complex and the above is only an outline intended to indicate the range of items covered. There are a number of exemptions and variations and any one responsible for implementation should refer to the Regulations (laws) for detailed requirements.

Bar coding:

When a retailer operates point of sale scanning, they have a requirement for the pack to carry a bar code representing the European article number (EAN) or the Universal Product Code (UPC in the USA). The European article number consists of 13 digits.

50	12345	67890	0
Country	Manf. No.	Item No.	Check digit Code

Each type of pack is thus given a unique number which can be read electronically using a light pen or low intensity laser scanner linked to a computer.

This system is used by the retailer for automatic checking of sales price (no need to price mark individual packs), the capture of sales information and automatic recording through the computer.

The customer receives an itemized bill receipt and should benefit by quicker movement through the check-out. Such a system places additional requirements on label design and accuracy of printing.

The code must not distract the customer from the sales impact of pack design but needs to be suitably positioned for scanning. The code must be printed accurately without distortion and in a suitable colour to be scanned efficiently.

Nutrition labels on the front of packaging

ToMany supermarkets and food manufacturers now also highlight the energy, fat, saturated fat, sugars and salt content on the front of the packaging, alongside the reference intake for each of these.

This is very useful when you want to compare different food and drink products at a glance.

Front-of-pack labels usually give a quick guide to:

- energy (calories)
- fat content
- saturated fat content
- sugars content
- salt content

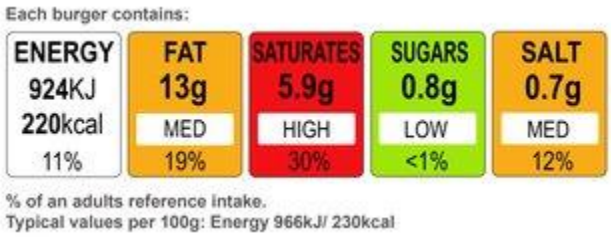
These labels provide information on the number of grams of fat, saturated fat, sugars and salt, and the amount of energy (in kJ and kcal) in a serving or portion of the food or drink. It may also provide the amount of kJ and kcal per 100g or per 100ml.

But be aware that the manufacturer's idea of a portion may be different from yours.

Some front-of-pack nutrition labels also provide information about reference intakes.

Colour:

Red, amber and green colour coding



Credit:

NHSD/Annabel King

Some front-of-pack nutrition labels use red, amber and green colour coding.

Colour-coded nutritional information tells you at a glance if the food has high, medium or low amounts of fat, saturated fat, sugars and salt:

- red means high
- amber means medium
- green means low