UNIT 8 PACKAGING SYSTEMS AND MACHINERY

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8.0 OBJECTIVES

After studying this Unit, you should be able to:

- understand about the factors influencing for longer shelf-life of cereals, pulses and oil seeds
- know the various packaging system involved to processed food products especially cereals, pulses and oil seeds
- learn about different important packaging machinery used for packaging of this group of products
- discuss about important packaging laws and regulations involved to processed food products.

8.1 INTRODUCTION

Over a period of time, remarkable changes have been observed in the Indian packaging scenario. The changes have occurred due to effect of multiple activities like growth of Indian economy and to increase of purchasing power of consumer, the upward trend of consumerism resulting into the demand of availability of commodities in packaged form and the improvement of distribution network.

In addition, the constant growth of export market has also created a high demand for the development of newer alternative packaging materials, high accuracy based packaging machinery and innovative packaging system to enhance the shelf life of agro based products. These development have not only made it possible to compete with international brands but also help to get a position in the shelf of super markets.

The increase of consumer’s awareness towards health and safety risk due to increased level of literacy and the legal requirements of overseas countries have also created a great demand to formulate various packaging laws and regulations. In order to meet these requirements, a number of packaging laws have been framed to protect the customers from fraud, health and safety risk, trade description and environmental issues etc.
But there is always scope for further improvement of packaging technologies in terms of packaging machineries and systems by way of achieving the desired shelf-life of cereals, pulses and oilseed based processed food products so that Indian food processor would be capable to compete with International market.

8.2. FACTORS INFLUENCING THE SELECTION OF SUITABLE PACKAGING MATERIALS FOR LONGER SHELF-LIFE OF CEREALS, PULSES AND EDIBLE OIL

The important factors responsible for the selection of suitable packaging materials are as follows:

- Physical nature of products.
- Critical features towards spoilage during handling, storage and distribution.
- Its sensitiveness towards environmental conditions.
- The length of desired shelf-life.
- The size and capacity of packages.
- Market Conditions.
- Distribution network.
- Consumer needs and
- Labelling requirement as per existing packaging laws.

Out of the abovesaid factors, the most important point in the critical factors of individual products. In case of cereal, pulses and edible oil, the following points are generally considered:

i) Presence of moisture content in products
ii) Required barrier properties of packaging materials against moisture, gases and light.
iii) Resistance towards the growth of insects.
iv) Chances of appearance of bacteria.

Most of the cereal based products like rice, atta, maida, suji etc. are hygroscopic in nature. When the products are exposed to atmosphere, they have a tendency to absorb moisture from environment resulting into lumpy formation, appearance of insects and emission of odd odour. Similarly, malt based beer is sensitive to light. In presence of sunlight of the environment, the products undergo photo oxidation resulting into the changes of colour and taste of beer.

Soyabean milk is very sensitive to environmental condition like temperature and humidity. In the presence of these elements, the products deteriorate due to appearance of bacteria resulting into spoilage of milk. And hence, the shelf-life of milk will be for limited period of time.

But the processed food products like namkeen, traditional snack food, assorted mixture etc. are very much prone to atmospheric spoilage. The fat content available in the product get a tendency to react with the atmospheric oxygen caused to have hydraulic as well as oxidative rancidity resulting into formation of organic compounds like peroxides, ketones, aldehydes, free fatty acids and glycerols. Due to this fact, high fat based processed food products are prone to get rancidity and
then, the products turn into bitter in taste and thus become unacceptable to the consumer.

**8.3 PACKAGING SYSTEM FOR ENHANCEMENT OF SHELF-LIFE**

The constant research work of packaging technology has enabled to develop innovative packaging system by which the shelf-life of processed food products could be increased to a large extent. However, the important systems related to cereals, pulses and edible oils are discussed below:

**Vacuum, Gas and Inert Packages**

Vacuum packaging is very common and simplified method of modifying the internal gaseous atmosphere of packages. Fat based products are packed into the packages made of plastic laminate with higher oxygen barrier properties. Air is evacuated and then heat sealed so that products will not get exposed into atmospheric oxygen and thus prevent the rancidity of fatty foods. Under good vacuum condition, the oxygen level is reduced to less than 1% due to high oxygen barrier properties of plastic film and the entry of oxygen is also restricted due to heat seal of package. And then, the shelf-life of products is enhanced to the desired level.

Gas packaging can be achieved in two fundamental ways. These are the replacement of air with a gas or mixture mechanically or by generating the atmosphere within the package either passively as in the case of fruits and vegetables or actively by using suitable atmosphere such as oxygen absorbents.

There are two different techniques of mechanical air replacement in a package:

**Gas Flush Process**

The gas flush process is usually performed on a form-fill-seal machine. Gas is injected into the package to replace the air. This dilutes the air in the head space surrounding the food product. When most of the air has been replaced, the package is sealed. Typical residual oxygen levels in gas flushed packs are 2-5%. That means the gas flush technique is not suitable for packaging of oxygen sensitive foods. The great advantages of gas flush process is the speed as it is a continuous operation.

**Compensated Vacuum**

This process first applies a vacuum to remove the air from inside of a thermoformed container holding the food and then introduces the desired gas or gas mixture. Machines designed to perform this operation are of the chamber variety. Since, this is a two stage process, the speed of operation of the equipment is slower then the gas flushing techniques. However, the efficiency of the process with respect to residual air levels is much superior.

**Aseptic Packaging**

Aseptic packaging can be defined as a procedure consisting of sterilization of the packaging materials or containers, filling of a commercially sterile product in a sterile environment and producing containers which are hermetically sealed so that recontamination or reinfection is prevented. Due to this, a product become shelf stable at ambient condition. This term ‘aseptic’ is desired from the Greek word ‘Septics’ and implies the absence or exclusion of any unwanted organisms from the product, package or other specific areas and the term ‘hermetic’ is used to indicate suitable mechanical properties to prevent the entrance of micro organisms or gas or vapour into the containers.
Aseptic processes comply with the following:

a) Sterilization of product before filling.
b) Sterilization of packaging materials or containers before filling operation
c) Filling the product into the sterile package by maintaining the aseptic condition.

a) Sterilization of Product

The product sterilization is carried out by the process or on-line sterilization which is popularly known as Ultra High Temperature (UHT) or High Temperature Short Time (HTST) depending upon the product treatment. Normally, the sterilization temperature is maintained at 133°C - 135°C for 3 to 5 seconds under HTST method. However, there may be slight variation in temperature and duration depending upon the type of product.

b) Sterilization of Packaging Materials & Equipments

Different kinds of sterilizing agents like heat, irradiation, chemical treatment or combinations of all are applied to sterilize the packaging materials and equipments. The packaging materials used is a multilayered paper based laminate containing aluminium foil as a barrier against the entry of oxygen gas. The food contact surface is usually polyethylene. The details are given in figure 1 & 2.
Heat
The product supply lines of the equipment and fillers are commonly sterilized by moist heat in the form of saturated steam under pressure. ‘Dry heat’ in the form of superheated steam is normally used to sterilize the equipment. Moist heat and dry heat are used to sterilize the equipment by maintaining the temperature range of 121 °C to 129 °C and 176 °C to 232 °C respectively.

Hydrogen Peroxide
Hydrogen peroxide with a concentration level of 30 to 50 % is used as a sterilant for packaging material followed by hot air (60 °C to 125 °C) to dissipate residual hydrogen peroxide.

Radiation
A dose of approximately 1.5 mega radius (MGRAD) gamma radiation is commonly used to decontaminate containers for acid and acidified foods.

c) Filling the product under Aseptic Condition
Once the product has been brought to the sterilization temperature, it flows into holding tube. The tube provides the required residual time at sterilization temperature. The sterilized product is accumulated in an aseptic surge tank prior to packaging. The product is pumped into the surge tank and is removed by maintaining a positive pressure in the tank with sterile air or other sterile gas. In India, this packaging system has been introduced by Tetrapack Company, Sweden. The most commonly system followed by Tetrapack is called Tetra Classic Aseptic System (TCA). TCA is illustrated with the following schematic diagram (Fig. 3).

![Fig. 3: Principle of Making Classic Aseptic Package](image)

The Tetrapack Company offers the following different types of packages (Fig. 4):

- Soyabean based milk are stored in aseptic packs to increase the longer shelf-life.

Canning System
The canning of processed food products in tinplate containers were developed in the early nineteenth century as a revolutionary method of preserving foods and since then, it has given unblemished service, developing and adapting to the needs of the time so that today, it remains as a modern innovative method as it was nearly two centuries ago. This system is mostly employed to the fruits and vegetables,
meat, fish etc. But now a days, attempts have also been taken to use this system for canned rice, edible oil and malt based infant food.

Canning is defined as a system by which the products are packed in metal containers, sealed by creating a headspace at top of the can and then processed by means of suitable temperature and pressure to make hermetically sealed containers. Normally, tinplate containers of having 3 pieces are used for canning process. However, tin free steel is also used for fabrication of general line cans for packaging of edible oil, dry food products like infant foods and biscuits.

In case of edible oil, the edible oils are produced by crushing the oilseeds and then subjected to solvent extraction process for filtration. The filtered oil is then filled in either 3-piece can of having one litre capacity or 15 ltr. rectangular tin plate container in order to make air tight and thus increase the shelf-life of products.

But the cereal based infant foods are packed in tinplate containers made of 3 pieces after replacing the air with inert gas like nitrogen and then closed by means of proper seaming and thus to make it air tight container to enhance the shelf-life of product.

Retort Pouch Packaging

The term ‘Retort Pack’ is used to describe a flexible or semirigid packages in which cereal based food products like rice is packed, sealed and sterilized at temperature greater than 100°C. This system is developed as an alternate method to canning process. Retort packages are available in the form of flexible pouches of either co-extruded or laminated form of polyester (PET), polypropylene (PP) with aluminium foil. The most important feature is that the packaging materials used should be heat resistant so that pouches filled with ready to eat product are enabled to process in retort at temperature of around 121°C.

Typical Structure of Retort Pouch

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer Layer</td>
<td>16 Micron Polyester (PET)</td>
</tr>
<tr>
<td>Middle Layer</td>
<td>9 MICRON Aluminium Foil (AL)</td>
</tr>
<tr>
<td>Inner Layer</td>
<td>60 MICRON Cast Polypropylene (CPP)</td>
</tr>
</tbody>
</table>

Check Your Progress 1

Note: a) Use the spaces given below for your answers.

b) Check your answers with those given at the end of the Unit.
1. What are the important factors to be considered for the selection of suitable Packaging materials?

2. Mention four important critical features of cereals, pulses and edible oil.

3. How do you explain vacuum and gas packaging.

4. Define Aseptic Packaging?

5. What are the steps to be followed in Aseptic Packaging?

6. How do you sterilize packaging materials?

7. Mention the different types of Aseptic Packages introduced by Tetrapak.

8. What do you mean by ‘Canning’ System?
8.4 PACKAGING MACHINERY FOR VALUE ADDED PRODUCTS

Form-Fill-Seal Equipment

Form-fill and seal equipment have become very popular for the last two decades. This equipment is extensively used for the packaging of dry food products like rice, atta, besan, suji, dal, assorted mixture, namkeen, popcorn, puffed rice, edible oil, etc.

This particular packaging equipment is suitable for flexible packaging materials as well as semi-rigid packaging materials. This machine operates with either one or two webs of films which are transported vertically and as well as horizontally. There are two types of Form-fill-seal machinery available. These have got extensive application for the packaging of cereals, pulses and edible oil.

a) 'Vertical' Form-fill-Seal machine
b) Horizontal Form-fill-Seal machine

a) Vertical Form-Fill-Seal Machine

This particular machine performs different operations like film formation, back seal production and making top and bottom seal simultaneously. This film is fed from a roll and the operations are as follows:

i) Form-fill Tube

In this process, the flat film passes over the shoulder to perform a round tube shape with sides overlapping each other. In some cases, machine uses a metal tube to maintain the shape. The back seal could be formed either as LAP, FOLD OVER or FIN seal to make the basic shape of flexible pouches.

ii) Heat seal along back

Once the tubular shape has been formed, the overlapping edges of the flexible packaging materials are sealed. This is normally done with the help of a pair of heated jaws which come together and press the overlap edges of film to make the back or center seal. In most of the cases, the impulse seal is used for certain film types while other methods such as hot air on high frequency are also used. This machine creates the longitudinal seal that is generally centered on the back of the pouch formed at the front of the forming tube.
iii) Cross Seal Formation

Once the tube is formed with back or center seal, cross sealing and filling takes place. The bottom of the pouch is then sealed with the help of heating element in the horizontal jaws and then the seal is cut at the middle and allow to drop the filled package freely with its own weight. In this case, the horizontal seal where one part act as top seal of the bottom pouch and the other part will be the bottom seal of the subsequent pouch and thus the operation continues.

Vertical form-fill seal machines are particularly suited for materials that drop freely on its own weight. These are fed by fillers that are normally positioned at the top of the machine.

b) Horizontal Form-Fill-Seal Machine

This type of machine has also got extensive use for the packaging of processed food products. In this machine, the flexible film is moved horizontally through the machine which form or folds it into a simple ‘V’ shape. Once ‘V’ shape is formed, proportional heat control dies will make the side seals and the pouches are separated. This machine also have the control device either electromechanical, electronic or micro processor based.

Applications

a) Vertical form-fill-machine - Rice, atta, suji, namkeen, edible oil, assorted mixture, graded dal etc.

b) Horizontal form fill machine – Sugar, macroni, spaghetti, paste, etc.

Machinery for Vacuum Packaging and Gas Flushing

In India, the machinery used for vacuum packaging and gas flushing are of two types i.e. Nozzle vacuumising and chamber vacuumising.

a) Nozzle Vacuumising

This type of equipment ranges from manual to automatic units.

In this machine, the open end of the bag containing the product is placed over a nozzle and vacuum draws are from inside the bag. With this method, it is difficult to consistently produce packages with higher than 5 inch mercury vacuum since the packaging materials begins to collapse and block air removal as soon as negative pressure develops. After vacuumising, a metal clip is applied to the end of the bag between the end of the nozzle and the product.

Fig. 5: The Sealer
The Sealer
Sealer is an extremely versatile sealing machine. This compact machine has got the ability to seal plastics or complex laminated materials. It is ideally suited for 300 mm length bags. It is also capable of removing air and flushing with neutral gas such as nitrogen. The air is evacuated through vacuum and the neutral gas is flushed and simultaneously sealed. Auto system controls the amount of gas required in the bag according to the predetermined volume of the bag.

The Flusher
This particular type of equipment is suitable for transparent film and laminate. This equipment covers the following aspects:
- Suitable for longer shelf-life required food products.
- For vacuum sealing prior to sterilization.
- It is very simple and efficient design.

Chamber Vacuumising
This machine provides finished packages with much higher internal vacuum level. The bagged product is placed in the chamber with the neck of the bag protruding through an orifice into the package vacuumising chamber. The chamber lid closes and the vacuum is pumped down so that external pressure of the bag is lower than the inside resulting into bellowing off of the bag with the product. A high vacuum is turned onto the package vacuuming chamber. The details are given in figures 5 & 6.

Cartoning Machine
The cartoning machine is very much suitable for folding cartons used for the packaging of soyabean grits, corn flakes, etc.

In a semi automatic cartoning machine, the products are placed in the carton manually. The machine feeds the carton from the magazine, forms it, then closes the ends after the product has been loaded. But in the fully automatic machine, the products are put into carton automatically.
Sophisticated electronic control systems are designed into many cartoners to
- Provide faster change over
- Achieve higher reliability of components
- Make more production data available for decision concerning line efficiencies, causes of down line and rejected packages.

There are two types of cartoning machines
a) Intermittent motion
b) Continuous motion

The speed of intermittent motion machine is 60 cartons/min whereas continuous motion machine can pack 120 to 220 cartons/min. The machines are illustrated figures 7 & 8.

![Image of Horizontal Continuous Motion Cartoning Machine](image1)

**Fig. 7: Horizontal Continuous Motion Cartoning Machine**

In this machine, the products are fed into the carton either manually or automatically. Then the folding cartons are picked up from the stack pneumatically. Followed by this operation, the cartons are erected and opened. The products are fed into the cartons and then closed automatically. An important safety device is provided in the machine that the machine stops automatically without any carton.

This machine is very useful for the packaging of milk food, biscuits, cereal based extruded products etc. into folding carton.

![Image of Product Infeed](image2)

**Fig. 8: Product Infeed**
The consumer packages of cereal and pulses based products and edible oil have to provide variable information either by printing or coding or marking on the surfaces to meet the legal requirement. In fact, this aspects are related to labeling and marking. Labelling is a process of providing the information to the customer about the product inside the package. And marking is considered to be a means of identification of products through symbols either by coding or stamping or printing on the surface of the packages.

Coding and marking equipments are used to satisfy the legal requirement by way of printing the information on the packages. Coding and marking can be used for a wide range of specific applications on food items which include product reference by name or code, batch number or lot reference, date or time code, net content and maximum retail prices. Coding can take place on the primary packaging like cans, bottles, plastic containers, flexible packaging or directly on product surfaces and in secondary packaging, directly on the cases.

The equipments developed for printing these information are based on mainly two aspects i.e. contact printing and non-contact printing.

A) Contact Printing Equipments

Contact printing methods seems to be cheap and can allow for logos and coloured inks to be used. There are different types of contact printing equipments like

i) Wet Ink and Rubber Stereos

The equipments used for hot foil overprinting (the transfer of codes) and hot blocking (the transfer of logos) are mainly mechanical based technologies which have been well established in processed food industry.

ii) Embossing

The equipment itself has got an inbuilt embossing station which makes the impression on the packages mostly hard surfaces like cartons and thus producing the readable marking.

iii) Roller Coding

In this equipment, the image is applied in ink by using rubber or synthetic stereos. This method is low cost and well proven. The equipment is capable of printing logos and bar codes.

iv) Other Equipments

There are many other equipments like pad printing, tampon printing, silk screen printing and engraving used for printing the information on the surfaces of the packages.

B) Non-Contact Printing

Non-contact printing is done either by using ink-jet printing or laser coding.

i) Ink-jet Printing

Ink-jet printing for variable marking exists in two forms i.e. drop-on-demand ink printing and continuous ink-jet printing.

Drop-on-demand Ink Printing

The technology involves to firing tiny, quick drying ink droplets at a surface which
may be several centimeters away through a matrix of small ink dispenser jets. The printer can produce alpha-numeric characters on a 7 X 5 matrix of dots and logos and bar codes. Print speed can be reasonably high upto 100 characters per second and the characters height range from 8 mm to 50 mm. This equipment is often used for the outer cases in food industry.

![Fig. 9: Latest Ink Jet Printer](image)

**Continuous Ink-jet Printing**

This equipment is used to get the fastest marking output. The equipment is capable of over 3000 characters per second. The fundamental principle of operation is the deflection of electrostatically charged droplets leave the print head and fly through the air to the product and the uncharged drops are recirculated in the printer to be reused.

**ii) Laser Coding**

![Fig. 10: The New Laser Coder](image)

This kind of equipment is capable of printing the permanent marks on the packages. The equipment is also capable to run at high speed. The most commonly used for printing the codes on the surfaces of card, glass and plastic materials (Figure – 10). However, the only disadvantage of this equipment is higher capital cost and less flexibility with regard to substrates that can be coded.

**Check Your Progress 2**

Note: a) Use the spaces given below for your answers. 
   b) Check your answers with those given at the end of this Unit.

1. What are the types of FF machine used in packaging industry?
2. How many types of seals are made in flexible pouches by FFS machine?

3. What are the advantages of electronic control systems of Cartoning Machine?

4. Mention the important coding printing machine used in packaging industry.

5. Give two examples for each type of FFS machine for their application. Under PFA Rules.

6. What are the types of cartooning machines available?

7. Tick mark the following (True / False)
   a) You require two separate packaging machines for vacuumisation and gas flushing. (True / False)
   b) The full form of FFS means Fast Forward System (True / False)
   c) Horizontal FFS machines are made on electromechanical, electronic or microprocessor techniques (True / False)
   d) Labelling is a means of providing information about product and marking is a system of identification of packages (True / False)
   e) Continuous ink-jet printing machine is used to get the fastest marketing output (True / False)
8.5 PACKAGING LAWS AND REGULATIONS

The great advancement of food technology has caused to produce large number of processed food products. This has been resultant into the demand for the development of alternate packaging materials, forms, systems and machinery to enhance the shelf-life of processed food products and also to meet the export requirements.

The continuous increase in percentage of literacy has made it possible to increase the awareness of the consumers in terms of consciousness towards product quality, public health and hygiene, consumer protection. Due to all these aspects, the entire packaging scenario has changed to a large extent.

In order to meet the requirement of consumer as well as export market, a number of guidelines of packaging have been formulated. Subsequently, these guidelines have been framed in the form of either legislation/law and regulations. In fact, there is no separate classified legislation of packaging. But a number of laws and regulations are coupled with product as well as packaging. All these laws are formed based on the sale of goods, trade description, transport, weights and measures, food safety and environmental issues.

The main objectives of packaging laws and regulations are as follows:

- To protect the consumer from fraud.
- To avoid human health and safety risk
- To protect the environment

A) Compulsory Laws

These laws are mainly concerned with the minimum specified standards on the products especially food, pharmaceutical and cosmetic items. Based on these laws, the informations are required to be printed on the unit packs or consumer packages for retail market as well as on bulk or transport packages for distribution.

Similarly, there are number of markings which are required to be printed or coded or marked on the unit packs as well as bulk packages to identify the products.

The most important compulsory packaging laws are discussed below:


This law is applicable to all kinds of Commodity products including foodstuff. Under this law, the commodities are classified as Class ‘A’ and Class ‘B’. The net weight or volume of products in packaged form which does not exceed to 25 gms or 25 cc are covered under Class ‘A’ and the rest are in Class ‘B’. As per this law, the following declarations are to be printed on the retail packages.

- Common / generic name of the product
- Net quantity (weight or volume)
- Name and address of the manufacturers/packers
- Maximum retail price.......... Inclusive of all taxes
- Batch No./Lot No.
- Month and year of manufacturing or prepacking. For example, best before

These Rules are basically intended to protect consumer's health and safety. As per rules, the packages are to be labeled with following declaration like Product name, ingredients, name and address of manufacturer, net quantity, batch number, month and year of packing, vegetarian and non-vegetarian marking. Otherwise, these packages are termed as misbranded.

c) Essential Commodities Act, 1954 which includes

- Fruit Product Order, 1955 (FPO) – mainly concerned to fruit and vegetable products including synthetic beverages, syrups, sherbets and vinegar.
- Solvent extracted oils, deoiled meal and Edible Oil Control Order, 1967 and Vegetable Products Control Order. 1976.
- Meat Products Control Order, 1973
- Milk and Milk Product Order, 1992


e) German Ordnance on the Avoidance of Packaging Waste, 1991 – mainly dealing with the recyclability of packaging materials to meet the requirement of environmental issues.

B) Laws Related to Transport Packages

The important laws applicable to transport packages are as follows:

i) Pictorial marking – different kinds of symbols are printed on the packages to indicate the nature and type of products.

   - This law is dealing with the carriage of dangerous goods for export by sea.

   - This law is applicable to the carriage of dangerous goods for export by air.

   - This law is considered to be the guidelines for regulatory wood packaging materials in international trade. Under this law, all the wooden packaging materials like wooden box, wooden crate wooden pallet, wooden barrel etc. are required to be treated to avoid the growth and appearance of pests prior to export.

C) Voluntary Laws or Standards

Under these laws or standards, there are different logos with respect to different voluntary organizations are required to be printed on the outer surfaces of packages. The organizations are as follows:

- Bureau of Indian Standards (BIS)
- Directorate of Marking & Inspection (AGMARK)
- Agricultural and Processed Food Products Export Development Authority (APEDA)
- Marine Products Export Development Authority (MPEDA)
- Spices Board
- Tea Board
Basic Principles-I

- Coffee Board
- Cardamom Board
- EAN India (Bar Coding)
- Environmental Protection Act, 1986.
- Consumer Protection Act, 1988

The logos of above said organizations are printed as 'Marking' on the Unit packages only. These markings on the packages will indicate about the quality of products inside the packages as the product as well as packaging are produced by following the laid down standard specifications of the respective organizations.

Check Your Progress 3

Note: a) Use the spaces given below for your answers.
   b) Check your answers with those given at the end of this Unit.

1. What are the objectives of packaging laws and regulations?

2. Mention the important compulsory laws for food products.

3. Indicate the different organizations considered to be voluntary standards under Packaging laws.

4. Write down the important declarations to be made on packages under PC rules.

5. Write down the important information required to be printed on package Under PFA Rules.

6. What are the full form of IMDG, ICAO and ISPM?
7. Complete the following sentences:
   a) German Ordinance on the avoidance of packaging waste, 1991 mainly to meet the requirement of ..........................................
   b) Fruit Product Order, ............................................. mainly concerned to ............................................. and ................................. products.
   c) The net weight or volume of products in packages form which does not exceed to .......................... or .......................... under Class .......................... ..........................
   d) Bar Coding system is dealt by ..........................
   e) Packages without declarations are termed as ..........................

8.6 LET US SUM UP

In this Unit, you have learn about the important factors responsible for the selection of suitable packaging materials for the packaging of cereals, pulses based processed food products and edible oil. In addition, the various packaging systems for the enhancement of shelf-life of processed food products have also been discussed.

You have also got an opportunity to know about the important packaging machines used for the packaging of processed food products. The packaging laws and regulations are the key aspects for domestic as well as export market of processed food products. The details about the packaging laws and regulations have also been covered in this Unit.

8.7 KEY WORDS

<table>
<thead>
<tr>
<th>Vocabulary</th>
<th>Description</th>
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<tbody>
<tr>
<td>Vacuum Condition</td>
<td>Exclusion or evacuation of air from a sealed packages.</td>
</tr>
<tr>
<td>Inert Gas</td>
<td>Gases like nitrogen, carbondioxide which does not take part in oxidation chemical reaction.</td>
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<tr>
<td>Residual Oxygen</td>
<td>The amount of oxygen gas is left over in the package after evacuation of air.</td>
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<tr>
<td>Head Space</td>
<td>The upper most part above the product level of a sealed package.</td>
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<tr>
<td>Hermetic Seal</td>
<td>Complete air tight closure so that the entry of outside agencies responsible for spoilage of food product is closed.</td>
</tr>
<tr>
<td>Three Piece Can</td>
<td>Metal container is made of body and two ends.</td>
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<tr>
<td>Microorganism</td>
<td>The living tiny organisms like bacteria, yeast and mould Which cannot be seen in naked eye.</td>
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<tr>
<td>Over Printing</td>
<td>The process by which the transfer of codes on hot foil is done.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
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<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>Ean India</td>
<td>European Article Numbering Organisation in India, dealing with bar coding systems on packages.</td>
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<tr>
<td>FFS Machine</td>
<td>Form-fill and Seal machine where all the three operations are done in single packaging machine.</td>
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<tr>
<td>Photo Oxidation</td>
<td>The chemical reaction occurs in presence of oxygen presence in the environment and ultra violet rays emits from sunlight.</td>
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<tr>
<td>Rancidity</td>
<td>A chemical reaction occurs in fatty foods where the fat molecules are either oxidized in presence of atmospheric oxygen or hydrolysed in presence of moisture content exists in food products.</td>
</tr>
<tr>
<td>Thermoformed Container</td>
<td>The container made of thermoplastic materials where the materials are soften by means of heat and then soften materials are allowed to get the shape of mould by means of vacuum, followed by cooling to make the container</td>
</tr>
<tr>
<td>Embossing</td>
<td>A process by which the letter or text are protuberant above the plain surface of packaging materials or packages.</td>
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<tr>
<td>Laser</td>
<td>A device of generating intense beam of highly coherent monochromatic radiation of light in one direction.</td>
</tr>
<tr>
<td>Lap Seal</td>
<td>One web is overlapped on another web and then heat sealed.</td>
</tr>
<tr>
<td>Fin Seal</td>
<td>Two webs are joined together and get sealed in such a way that the edges of both the webs look like fins.</td>
</tr>
<tr>
<td>Report</td>
<td>A vessel is capable of heating the product by controlling steam flow, steam pressure, air pressure, water temperature, water level and holding time.</td>
</tr>
<tr>
<td>Shelf Life</td>
<td>The time between the production and packaging of product and the point at which the product first becomes unacceptable for consumption under defined environmental conditions.</td>
</tr>
<tr>
<td>Sterilization</td>
<td>A process by which the complete killing or removal of microorganisms are held.</td>
</tr>
<tr>
<td>Pasteurisation</td>
<td>A method by which the microorganisms are removed or killed partially.</td>
</tr>
</tbody>
</table>
8.9 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

Your answers should include the following:

1. • Physical nature of products.
   • Sensitiveness towards environmental conditions.
   • Size and capacity of packages.
   • Length of desired shelf life.
   • Market condition.
   • Distribution network.
   • Consumer needs.
   • Labelling requirement.

2. • Presence of moisture content in products.
   • Required barrier properties of packaging materials
   • Resistance towards the growth of insects.
   • Chances of appearance of bacteria

3. • Vacuum packaging is the replacement of air from the package and thus the packages are tightly attached to the product.
   • Gas packaging is the flushing of inert gas or mixture of gas into the package by replacing of air from the package.

4. • A system consist of sterilization of product
   • Sterilization of packaging materials
   • Sterile environment on which the products are filled into the packages

5. • Sterilization of product before filling.
   • Sterilization of packaging materials before filling operation.
   • Filling the product into the sterile packages maintaining the aseptic condition.

6. • Heat process
   • Hydrogen peroxide.
   • Radiation.
7. • Tetra brick Aseptic.
   • Tetra Classic Aseptic.
   • Tetra Fino Aseptic
   • Tetra Wedge Aseptic.
8. • A system on which the products are packed in metal container.
   • Hermetically sealed by creating a head space or vacuum at top of the container.
   • Heated to process the product by using suitable temperature & Pressure under specific time.
9. • A packaging system on which the products are packed in flexible Pouches.
   • Heat sealed by creating head space above the product level.
   • Heat treatment in a retort under specified temperature, pressure and time.
   • An alternate method of canning.
10. • 16 micron polyester (as outer layer)
     • 9 micron aluminium foil (as middle layer)
     • 60 micron cast polypropylene (as inner layer)

Check Your Progress 2

Your answer should include the following:

1. • Vertical form fill seal machine.
   • Horizontal form fill seal machine
2. • Lap seal.
   • Fin seal or Fold over seal.
3. • Provide faster changeover
   • Achieve higher reliability of components.
   • Make more production data available for decision concerning line efficiencies.
4. • Contact printing equipments like wet ink and rubber stereos, embossing and roller coding.
   • Non-contact printing equipments like ink-jet printing and Laser coding.
5. • Vertical form-fill-seal machine - Rice, Atta.
   • Horizontal form-fill seal machine - Sugar, macroni.
6. • Intermittent motion.
   • Continuous motion.
7. a) False b) False c) True d) True e) True

Check Your Progress 3

Your answer should include the following:

1. • To protect the consumer from fraud.
   • To avoid human health and safety risk.
   • To protect the environment
   - Agricultural and Processed Food Products Export Development Authority.
   - Directorate of Marketing and Inspection
   - Marine Products Export Development Authority.
   - Spices Board
   - Cardamom Board
   - Coffee Board
   - EAN India (Bar coding)

4. Common/generic name of the product.
   - Net quantity (weight/volume)
   - Name and Address of the manufacturers
   - Maximum retail price
   - Batch No/Lot No.
   - Month and year of manufacturing
   - Best before (in food) and expiry date (for pharmaceutical products)

5. Name and address of manufacturers.
   - Product name
   - Ingredients.
   - Net quantity
   - Batch number
   - Vegetarian or Non-vegetarian.
   - Month and year of packing.

   - International Council of Aviation Organisation.
   - International standards for Phytosanitary Measures.

7. a) Environmental issues
   b) 1955, Fruits, vegetables
   c) 25 gms. 25 cc A
   d) EAN India
   e) Misbranded.