
UNIT 13 PACKAGING MATERIALS

Structure

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13.0 OBJECTIVES

After reading this unit, you should be able to:

- describe the manufacturing processes of different packaging materials used for processed food products;
- explain the properties of packaging materials;
- discuss the advantages and disadvantages of packaging materials;
- state the application of packaging materials for different processed food products; and
- define the quality control measures of packaging materials.

13.1 INTRODUCTION

In our country, the packaging technology was not given due importance for long time but recently, the approach has been slightly changed. However, the concept of value addition to the product by means of new types of packaging materials and forms are yet to be recognised by the major quarters of population. Even today, many quarters of community consider that packaging materials always add cost to the product and thus these has been given a low priority. But with the increase standard in living and per capita income, the Indian consumers have moved to new sophistication era resulting in their demand of packaged commodities. The demand of packaging materials also have, therefore, shown a steep rise, particularly in the last three decades.

In fact, the packaging in the country appeared in the 1950's, became noticeable in the 1960's, grew in dimensions in the 1970's and with the advent of the 1980's the industry showed a tremendous progress which is continuing and likely to grow many fold in future. The poor rate of growth in the past had been attributed to lack of awareness, lack of education and skill as well as inadequate support. The other reasons could be the lack of serious attempts on standardisation of packaging materials and systems.

In the wake of industrial growth a number of industries manufacturing and marketing different range of product groups have been setup. Different kind of packages introduced over a period of time have replaced the conventional packs successfully. At the same time, industry strived its best to keep packs

with the growing demand and also to cater the export requirement. Moreover, in the WTO era, it has become imperative for the Indian industry to upgrade these technologies to innovate alternate packaging materials at affordable cost to become globally competitive.

Wood, probably the oldest form of packaging medium, still dominates its use in the specific area of packaging like heavy engineering and electronics products and defence articles. But the introduction of fibre board materials like corrugated fibre board box and solid board box have completely replaced wood for the packaging of most of light engineering, automobile, textiles, etc. Today, these materials are considered to be most economical and eco-friendly.

Jute is another type of natural packaging material available in the country and has got extensive application in food grain packaging. This old age system continuing to expand with the new technologies in the combined form and has got newer applications.

Glass is a traditional packaging material. Despite its inherent characteristics like fragility, it is still in use in packaging of processed products due to its reusability.

The indigenous production of tin plates have reduced the import of these materials substantially. But the growth of these materials have been slow due to their expensiveness as compared to other packaging materials like plastics.

Plastics have entered in the packaging scene only from the mid fifty's and early 1960's. These particularly referred to low-density polyethylene and PVC. Subsequently, high-density polyethylene, polypropylene and polyester were introduced. Although, the thermosets were used earlier for caps and closures, but these are being replaced by thermoplastics. In our country, a great revolution has occurred due to the introduction of plastic carry bags in the late 70's and early 80's. Further to this, plastics by virtue of versatility have captured the market in a big way. Meanwhile, the concept of consumerisation has also played a great role in the usage of more plastics for packaging of rice, atta, maida, salt, etc. In addition, plastics packaging materials have entered in the applications of newer systems like blister and skin packaging for processed food, pharmaceuticals, shrink packaging for unitisation, strip packaging for medicine and thermoformed containers for ready to serve food products. With the same pace of development, plastics multilayered collapsible tube has also been introduced in the Indian market for the packaging of toiletries, cosmetics and processed food also.

Aluminium is used as sheets, slugs for collapsible and rigid tubes for packaging pharmaceutical ointments and for foil for making flexible laminates to pack processed food products.

The constant increase in consumer demand has forced to introduce newer packaging system for extending shelf life of food products like fruit juices. One of the most important system, like aseptic packaging system, had been introduced in our country during the early 1970's. Though, there had been certain initial inertia of consumer to purchase these packages due to prohibitive cost but slowly, its advantages were realized. Now, this system has been well accepted and more and more liquid and paste food products are being packed.

In short, packaging is a need based technology. The need of consumer forced to develop newer packaging materials as an alternate media and thus, a wide variety of packaging materials have been invented. But there is always a thrust

to develop newer packaging materials at lower price so that more variety of products could be made available in packaged form. The consumption of packaging materials will increase substantially in the years to come.



Check Your Progress Exercise 1

Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. Write down in chronological order of appearance of packaging materials in the country.

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2. Please tick mark (✓) the correct answer.

- a) Which of the packaging material is considered to be the oldest one?

- i) Plastics
- ii) Wooden container
- ii) Paper

- b) Which of the packaging material have really gone ahead as compared to others?

- i) Aluminium container
- ii) Plastics
- iii) Glass

- c) The most important natural packaging material available in the country is

- i) Tin container
- ii) Glass
- iii) Jute

13.2 GLASS CONTAINERS

Glass, the oldest packaging material, is used as container for over 3000 years. The first glass container was made in Egypt in 1500 B.C. During the first golden age, the Romans produced some exquisite glass ware including containers. This very ancient packaging material has withstood the challenges and competition with many types of packaging materials and the same is being continued till date. With the fast development of science and technology all over the world, newer types of packaging materials like metal, plastic, etc., have been developed resulting into stiff competition with the application of glass containers in packaging. Hence, the use of glass containers have been reduced to a great extent. Despite of having certain inherent characteristics

like fragility, tare weight, the glass containers have made an established application in packaging to certain specific areas like carbonated and alcoholic beverages, perfumes, etc. This is mainly due to its certain unique properties which have made it to take a lead over other packaging materials.

I. Properties

a) *Chemically inert*

It has no inherent property of action which enables the packaging of products without any danger of reaction or spoilage.

b) *Non-permeable*

Glass does not allow gases, odours, vapours and liquids to pass through its walls.

c) *Transparent*

You can see the packaged product.

d) *Mouldable*

Glass containers can be moulded easily in any shape or size ranging from a tiny vial to a 18 gallon carboy.

e) *Strength*

The ultimate strength of glass is equal to that of the strongest sheet.

g) *Light weight*

Glass is as light as aluminium roughly $\frac{1}{3}^{\text{rd}}$ the weight of steel or of a density $2 \frac{1}{2}$ times that of water. Progressively, the weight of a given capacity glass container is being reduced by suitable change in design and uniform distribution of glass for increasing the strength of the container.

h) *Unlimited supply*

Glass container can enter to an unlimited market because of its basic raw materials – sand, lime stone and soda ash which are available in plenty. Arsenic, selenium and cobalt oxides are used to make clear glass. Carbon and sulphides are added to make brown (amber) coloured glass. Boron addition provides strength to glass.

II. Advantages

- a) This packaging material is used for all types of products like liquid, powder, paste, granules, etc.
- b) Glass has got high and low temperature resistance. The processed food products like tomato ketchup is filled hot and can be refrigerated too.
- c) Glass containers do not contaminate the contents with crystals or fibres as found in packages made of metals or alloys.
- d) Climatic variations do not affect the glass container or the product packed in it.
- e) Due to see through property of glass containers, the colour, appearance and consistency of the product can be easily detected.

- f) Containers can be made in any size, shape and capacity depending on the requirement.
- g) The glass container does not taint, pollute or affect the quality of product packed in it.
- h) The closures made of metal, plastic, cork or rubber, depending up on the requirement, can be chosen.
- i) Glass containers are impermeable to moisture and gases.
- j) Glass containers may be coloured (like brown, green, blue) to protect the product from sum light.

III.Applications

Glass containers have wide applications in the packaging of pharmaceuticals, dairy, liquor, breweries, food, soft drinks, cosmetics, chemicals, inks and other industries. More specially, glass containers are used to pack jams, jellies, squashes, pickles and other preserves. In addition, containers are also used for processed meat and fish products, tea, coffee, spices, baby food, cheese, ghee and vegetable products.



Check Your Progress Exercise 2

Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. What are the constituents of glass?

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2. How do you explain the important properties of glass containers?

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3. Mention the important advantages of glass packaging.

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13.3 METAL CANS

Metal cans could be made either from aluminium, tin plate or tin free steel. But the tin plate containers and aluminium containers have got extensive application in packaging. The most popular form of metal containers is tin plate container which has been used in food packaging for the last five decades. Most probably, this packaging material could be considered to be oldest one, next to glass containers, for food packaging industries.

There are two types of tin plate containers namely:

- a) Open top container
- b) General line container

a) Open top container

This range of containers is a standard variety from which a customer selects the size suitable for its requirement. These are also called as open top sanitary (OTS) cans and are essentially round in shape. A standard open top can is supplied by can making company with bottom seamed to the body and the top ends are supplied as loose. The processed food manufacturer fill the content into the tin can and then seam with the top lid by using a machine called seamer and then the filled tin cans are subjected to heat process. This can is also called as 3-piece can. Open top sanitary cans are widely used for processed food and beverages. One of the recent developments in open top market is the advent of easy open end. This is specially designed and accurately made to components of the can, which is made either of tin plate or aluminium. It is fitted with a “ring pull tab” whenever the customers pull the ring, it gets tear and open the top lid without much efforts. This development has definitely helped the consumer to get away from the traditional method of opening the can with the help of a ‘can opener’, which requires more time in opening the periphery of the top. Recently DWI can or “Drawn and Wall Iron” can has been developed. These cans are called two piece cans as the cylindrical body and bottom become single piece and lids are separate. These cans score more over conventional 3-piece cans in terms of savings of considerable amount of materials without sacrificing the speed of the machine. But these cans are confined to the applications of pressurised beer and beverages.

b) General line container

General line containers range from tiny containers like pharmaceutical ointment to 15lts capacity containers for vanaspati or biscuits and 20 litre drum for paints and varnishes. A large number of tailor made sizes of containers are added into this category. These containers are round as well as un-round (known as irregular) and are filled with various kinds of fitments made from tinplate, aluminium and plastics. These containers do not have much application for processed foods, rather bakery products, hydrogenated oils and confectionery items are packed in them.

Application

Tin plate containers have got extensive application in packaging of different products like:

- i) Beer and beverages
- ii) Processed food
- iii) Lubricants
- iv) Tooth powder/ Talcom powder/ Creams
- v) Confectionery
- vi) Edible oils
- vii) Coffee, baby food and chocolate
- viii) Aerosols
- ix) Paints
- x) Insecticides and pesticides
- xi) Thermos flask
- xii) Battery cells



Check Your Progress Exercise 3

Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. What are the different types of metal cans?

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2. How do you differentiate between OTS and DWI cans?

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3. What are the main applications of OTS cans?

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4. Give three examples of application for general line can.

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5. Mention five important advantages of metal cans for processed food products.

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13.4 ALUMINIUM FOIL

Over the years, aluminium foil has been established as the best flexible packaging material in terms of barrier properties against moisture, gases, light, aroma, etc., as compared to any other material. No other flexible material can match the characteristics of aluminium because foil retains all metallic properties of aluminium.

Aluminium foil is a continuous web/sheet of aluminium metal rolled to thickness/gauges ranging from 0.005 to 0.2 mm. It is produced from commercial purity aluminium having aluminium content of not less than 98 per cent. Foil in hard or soft temper (i.e., annealed), is available with bright or with one side dull/ matt surface. It is available in plain, coloured, coated, lubricated and embossed forms.

I. Properties

The important properties are as follows:

- i) **Impermeability:** Foil of 0.025 mm thickness is impermeable to moisture vapour and gas transmission.
- ii) **Non toxic:** Due to inertness in nature, the foils are completely non-toxic.
- iii) **Stable:** It does not get brittle at low temperature.
- iv) **Light and heat barriers:** It acts as a barrier against light and heat.

- v) *Tasteless and odourless*: It neither absorbs any odour from food nor releases any off odour to the food.
- vi) *Tagger*: It is pilfer proof diaphragm for tin containers.
- vii) *Retort pouch*: Foil is used as middle layer in the three layered flexible laminate helps to withstand temperature and pressure in the retort for extending shelf life of ready to eat products.

Advantages

- i) Tearing properties facilitates to use the Web as sealing surface in the blister pack.
- ii) Impermeable in nature – extensively used for lamination.

II. Applications

- i) *Decorative label*: Foil of 0.009 mm thickness can be laminated to paper for flexible label.
- ii) *Confectionery*: 0.009 mm thick foil wax backed by paper like glassine, greaseproof or poster is used to pack chocolates, toffee, etc.
- iii) *Biscuit wrappers*: Base laminate of 0.009 mm thick foil and 30 gsm poster paper printed in multicolour and wax coated are used as biscuit wrappers.
- iv) *Milk products*: Cheese wrappers are composed of 0.012 mm foil coated by heat sealable, anti corrosive coatings.
- v) *Multilayer laminates*: Packaging of instant coffee, Pan masala, snack foods, and also for aseptic pouch.
- vi) *Stand up pouches*: These are used for packing ready to serve (RTS) beverages.
- vii) *Tea chest lining*: Bulk packaging of tea is done.
- viii) *Milk strip*: It is used for capping milk bottles.

13.5 PLASTIC MATERIALS

A plastic material is one which is a solid at ordinary temperatures and allows appreciable and permanent change of form without losing its coherence on the application of pressure and heat.

This quality in synthetic or natural materials containing an organic or inorganic compound of high molecular weight is an essential ingredient. The materials are usually solid in finished form but at some stage during manufacture or processing finished articles can be moulded or shaped by flow. The substances of high molecular weight are synthesized from simple chemical components either by condensation or polymerization reactions, yielding products called synthetic resins. The term ‘plastic’ covers a broader group of materials than the term ‘resin’. Usually, heat and pressure together are used to mould or shape the plastic.

Plastic materials are perhaps the most versatile group of materials used in packaging. The use of plastic is fast growing in India due to easy availability of resins. Plastics are light in weight, very strong, hygienic and non-conductive. They do not rust, rot or react with most chemicals.

The development of plastics has resulted into its application in many ways despite its appearance in the market much later as compared to other packaging materials.

The plastic resins are generally categorised as thermoset or thermoplastic resin. Thermoset resins are those materials which can be heated and set to a definite shape but unable to change into another shape by application of heat. The products like electrical switch and other liner materials made of bakelites are covered under this category. Whereas the thermoplastic materials are flexible in nature. These materials can be changed into different types of plastic films with the help of heat application and further, these could be melted and convert into resin form. For example, different types of plastic films used in packaging may be converted into recycled plastic resin materials with the application of heat.

In the current scenario, about one third of all thermoplastic materials manufactured are used in packaging. The plastic materials used for packaging include the polyolefins, principally polyethylene, and polypropylene, poly vinyl chloride (PVC), polystyrene(PS) and polyethylene terephthalate (PET). Out of these about two thirds are used for packaging of food and beverages. Plastics offer distinct advantage over other packaging materials due to its important characteristics like light weight, good mechanical strength, flexibility and recyclability. These materials have excellent barrier properties towards moisture and gases and thus have got wide application in the packaging of food products.

Some of the important thermoplastic materials which have got extensive application in packaging are normally classified into different group based on the polymerisation process and molecular structure like

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| a) Polyolefins | – | Polyethylene and Polypropylene (PP) |
| b) Polyvinyl group | – | Polyvinyl Chloride (PVC) |
| c) Condensation polymer | – | Polyester (PET), Nylon-6 or Polyamide (PA) |
| d) Styrene polymers | – | Polystyrene (PS) and Expanded polystyrene (EPS) |
| e) Carbonate group | – | Polycarbonate (PC) |

a) Polyolefins groups

Depending upon the molecular weight and density, the polyolefins group materials are available in different forms. The important properties of these materials are given below:

i) Low density polyethylene (LDPE) film

- Density ranges from 0.910 – 0.925 gms/cc
- Average molecular weight is 3×10^5
- Resistance to heat (82 – 100°C)
- Translucent type of clarity
- Water absorption is 0.015%
- Permeability to gas is 1.0 cc/m²/ 24hrs at 27°C and 1 atmospheric pressure
- Good tensile strength properties and high percentage of elongation.
- Good dart impact resistance

- Resistant to weak acids and alkalies
- Good barrier to moisture vapour

ii) *Linear low density polyethylene (LLDPE)*

- High film tensile strength properties as compared to LDPE
- High percentage of elongation as compared LDPE
- High tear strength properties
- Better stress crack resistance and low temperature brittleness
- Improved stiffness properties
- Excellent puncture resistance
- Excellent heat seal properties

iii) *Medium density polyethylene (MDPE) film*

- Density varies from 0.926 – 0.940 gm/cc
- Average molecular weight is 2×10^5
- Resistance to heat (105 – 121°C)
- Translucent type of clarity
- Percentage of water absorption is 0.01
- Permeability to gas is 1.33 cc/m²/24 hrs at 27° and 1 atmospheric pressure
- Very resistant to weak acids, alkalies, etc.
- Effect of sunlight is yellow.

iv) *High density polyethylene (HDPE) film*

- Density varies from 0.941 – 0.965 gm/cc
- Average molecular weight is 1.25×10^5
- Resistance to heat is 121°C
- Opaque in nature
- High barrier to moisture vapour
- Permeability to gas is less as compared to other polyethylene films
- Effect of sunlight is yellow

v) *High molecular high density polyethylene film (HMHDPE)*

- High mechanical strength in both directions
- Pleasant white translucence in clarity
- High tear resistance properties.
- Does not impart any taste or odour
- Suitable for food contact application.
- Less elongation as compared to other polyethylene film.
- Excellent moisture barrier properties

vi) *Polypropylene (PP) film*

- High tensile strength
- High chemical resistance and high temperature performance than HDPE
- Very low permeability to moisture vapour and gas compared to polyethylene
- High transparency
- Chemical inertness
- High softening point

b) *Polyvinyl chloride (PVC)*

- It is hard, brittle and transparent material

- Low GTR
- Moderate WVTR and good resistance to fat and oil
- Glass like clarity
- Good mechanical strength
- Retention of flavour
- Excellent printability
- Lower weight/ volume ratio
- Resistant to chemicals

c) Condensation polymer

i) *Polyester film (PET) film*

- It has got excellent gloss
- Very low moisture and gas permeability.
- High mechanical strength
- Resistant to tear, puncture, burst and flex crack
- Dimensionally stable over a wide range of temp. from 70°C to + 130°C
- Excellent machinability
- Excellent printability
- Light in weight
- Free from all kinds of additives
- Good surface properties for metallization

ii) *Polyamide or Nylon-6 film*

- High mechanical strength
- High elongation capability
- Excellent resistance to cutting, perforation, abrasion and bursting
- High chemical resistance to oils and fats
- Outstanding impermeability to gases and vapours
- Easy printability
- Easy metallising
- Economical
- Could be biaxially oriented

d) Styrene polymers

i) *Polystyrene (PS)*

Polystyrene is not flexible in nature unlike LDPE and PP and is mostly used as rigid containers in the field of packaging. The important features or properties of this polymer are as follows:

- Crystal clarity of containers
- Availability in attractive light or dark colours
- Lustrous finish
- Rigidity and dimensional stability
- Resistant to chemicals
- Easy processing
- Good barrier to moisture.
- Ability to take post moulding decorations like hot stamp foiling, screen printing, inlay foil moulding, etc.

ii) *Expanded polystyrene (EPS)*

Expanded polystyrene (EPS) is neither flexible nor rigid in nature rather the material is cushioning in nature. Normally, the material is called 'thermocole' which has extensive application in the packaging of electronic and light engineering products. In addition, it is also used for the packaging of sea foods. These materials are manufactured in the following forms, i.e., rigid sheets, flexible sheets, granules, cushion moulded and general purpose moulding.



Check Your Progress Exercise 4

Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. What is aluminium foil?

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2. Write the five important properties of aluminium foil.

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3. Indicate four important application of aluminium foil in food packaging.

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4. How do you define plastic material?

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5. What are important groups of polymeric materials used in packaging?

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6. Indicate True or False for the following:

- i) Polypropylene films are more transparent than polyethylene films.
- ii) Polyester films have got more gloss as compared to other plastic films.
- iii) The moisture barrier properties of polyethylene is better than nylon film.
- iv) Polyester film has got better oxygen barrier properties than polyethylene.
- v) Expanded polystyrene has got good cushioning property as compared to polystyrene.

13.6 PLASTIC CONTAINERS

Plastic containers are manufactured with the help of different processes and are available in different forms like bottle, drums, carboys, jars, etc. These have wide application in packaging of processed food products.

The plastic containers are manufactured by means of different processes like:

- a) Blow moulding process
- b) Extrusion blow moulding process
- c) Stretch blow moulding process
- d) Injection blow moulding process
- e) Coextrusion blow moulding process

13.7 COLLAPSIBLE CONTAINERS

The collapsible containers are mainly available in the form of tube for packaging application. The collapsible tubes are either made from multilayer plastics or aluminium. The aluminium collapsible tubes have been used for long time for the packaging of pharmaceutical products. Now a days, number of products like tooth paste, ayurvedic medicines, cosmetics, stationery, gum, etc., are being packed in collapsible plastic tubes. Due to this innovation, consumers have got alternative packaging materials for the packaging of same products. But it would be necessary for you to understand in detail about both the packaging materials and also applications.

I. Alluminium collapsible tube

The collapsible tube is manufactured by means of extrusion process. However, after extrusion of aluminium slug stampings, tubes remain hard and do not collapse. Tubes are then subjected to annealing process after trimming and threading operation. The annealing is done to impart softness and turning away of greases and other minor extraneous impurities at high temperature. The dimensional accuracy beginning with the slugs punched out from extruded/rolled strips right through the manufacturing process should have a high accuracy with near 'nil' tolerance. Extrusion at a very high pressure, 40 tonnes horizontal or vertical, 'blows' the slug into tube.

After the annealing is over, the tubes are given an enamel coating which is dried for about six minutes in a zig zag conveyor type oven. Then the tubes are printed. Once the tube is ready, it is subjected to capping operation.

Advantages

- i) Temper proof:*** Cannot be refilled or reused.
- ii) Protective:*** Contents remain well protected and free from contamination.
- iii) Elegant:*** Attractive, possess a bright surface and lend themselves to trouble free printing.
- iv) Non-toxic and hygienic:*** Non toxic, non-absorbant and hygienic. Impart no taste, flavour, odour or colour to contents.
- v) Light weight:*** Reduces transport and handling cost.
- vi) Complete collapsibility:*** Highly ductile and ensures complete collapsibility.
- vii) Easy availability:*** Increased production of aluminium has resulted in easy availability of raw material.
- viii) Economical:*** Unbreakable and easy to use and carry.

Applications

- a) Industrial products:*** Adhesives, artist's colour, paints, duplicating inks, lubricants and rubber solutions are packed.
- b) Cosmetics and toiletries:*** Cosmetic creams, shampoos, deodorant depilatories, hair cream, hair dyes, shaving cream and tooth paste, are packed.
- c) Food products:*** Chutney, condensed milk, honey, mustard cream, tomato ketchup, etc., are packed.
- d) House hold items:*** Cream detergents, insecticides and rodenticides, shoe polish, mosquito repellent creams, etc., are packed.
- e) Pharmaceuticals:*** Antiseptic cream, pharmaceutical creams, ointments, vaginal jellies, veterinary creams, etc., are packed.

II. Multilayer collapsible plastic tube (Lamitube)

The multilayer collapsible plastic tube, commonly known as 'Lamitube', has been introduced in the Indian market recently and now it has taken a lead in many areas by overtaking the aluminium collapsible tube.

The tubes are produced by extruding a continuous tube by a single or more extruders and then cutting into its required length. The tube shoulder is compression moulded and then welded to the tube in line operation. The tubes are then printed separately in multicoulor graphic. As the tube is seamless and printed individually, the printing is continuous all around the tube. A lacquer coat is given further to protect the surface and provide necessary surface finish.

Applications

- Mainly used for different types of cosmetic products like lotions, cream, spray or liquids.
- In toiletry products like tooth paste, shaving cream, etc.
- Available for industrial products like greases, varnishes and creams used for automobile industry.

13.8 COMPOSITE CONTAINERS

A composite container is a canister or a container made from more than constituent material, generally consisting of paper, boards and kraft papers with metal or plastic ends. It is also called as Combican. A laminated composite container is a container made from kraft papers and boards, laminated with polyethylene or aluminium and heat sealed with the membrane to make it completely leakproof. Because of this unique heat sealing property, the aroma retention capacity of the container increases and permeability of moisture vapour decreases

Applications

- i) Food products like custard powder, masala powder, etc.
- ii) Detergents and detergent powders.
- iii) Pharmaceutical products like tablets.
- iv) Pesticides.

I. New Developments

Leak proof composite containers are the new addition where the inner layers are made in such a manner that double seaming of the cans become possible to pack liquid product.

The new developed composite can becomes suitable for the packaging of fruit juice, fruit pulp, preservatives, lube oil, motor oil, tooth powder, talcom powder, etc.

Advantages

- i) Acts as an alternate packaging material to tin plate container.
- ii) This is disposable packaging and can be used for filling of goods with shelf life of 1-2 years.
- iii) Composite container is environment friendly.
- iv) The stability of the can for a volume upto one litre is as good as tin or glass containers.
- v) Seaming or sealing can be effected on the same line as tin plate containers.

Check Your Progress Exercise 5



Note: a) Use the space below for your answer.
b) Compare your answers with those given at the end of the unit.

1. What are the important processes involved for the manufacturing of plastic containers?

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2. Write five important properties of plastic containers.

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3. What are the important types of collapsible containers?

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4. Mention five important advantages of aluminium collapsible tube.

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5. Explain the important applications of 'Lamitube'.

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6. What do you mean by Composite can?

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7. How many methods are available to manufacture composite cans?

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8. What is the new development in Composite containers?

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9. Write three important applications of Composite can.

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13.9 LET US SUM UP

Packaging is considered to be a need based technology. Depending on the requirement of consumer, the development of packaging is also being occurred. On the one hand, continuous development of food technologies resulted into production of new types of products requiring innovate variety of packaging materials and packages to provide effective barrier properties and adequate strength for longer shelf life. On the other hand, the consumers are demanding for lighter, cheaper, durable and attractive packaging materials or packages. This has compelled to develop variety of packaging materials which could be either rigid, semi rigid or flexible in nature. The packaging materials converted directly into package form to pack the processed food products are termed as primary packaging materials. In addition, certain packaging materials like adhesive, printing ink, etc., are called as ancillary packaging materials.

The packaging materials like glass containers, metal containers, plastic containers, composite containers and collapsible containers used prominently for the packaging of processed food products have been discussed in this chapter. The manufacturing process, types of containers, their properties, application in packaging and important quality measures with respect to each materials have also been described in detail.

There has been tremendous use of flexible plastic packaging materials for the packaging of processed food products in the form of consumer packages. These materials are being preferred by the consumer mainly due to thinner, cheaper and lighter in weight.

Though, there has been lot of criticism by the environmental scientist about the application of flexible plastic materials, but there is a constant growth of consumption of these materials. Due to this fact, the properties of these materials have been covered in this chapter.

You have also learnt about another important packaging material the aluminium foil. Its being flexible in nature and has high barrier properties against moisture, gases, light, aroma, etc., this particular material is extensively used as substrate in the flexible laminate to meet the customers requirement. In short, all the important packaging materials, manufacturing processes, properties and applications have been discussed in this chapter.

13.10 KEY WORDS

WTO	:	World Trade Organisation
Annealing	:	Regulated way of cooling of an article to eliminate internal stress and thus breakage.

Throat	:	The channel of the furnace through which the molten glasses are passed away.
Ring pull top	:	A newly designed lid of the can where the lid gets opened up through tearing by pulling the ring.
Dead fold characteristic	:	It is the characteristic of soft annealed aluminium foil. While the foil is folded, it remains in folded condition and does not come back.
Grease proof	:	It is the resistance of aluminium foil by which there will not be any seepage of oil or grease on the other side.
GTR	:	Gas Transmission Rate. It is an important property of plastic film.
WVTR	:	Water Vapour Transmission Rate. It is another important property of plastic film.
EVAL	:	Ethylene Vinyl Alcohol. It is another polymer.
LCC	:	Leak proof Composite Container. Enables to make double seaming so that liquid products can be packed.
UV curing	:	The drying of printed surface under ultra violet light which improves scuffproofness property.
Tensile strength	:	The strength or force by which the polymeric material breaks while under tension.
Parasite	:	The thermoplastic material when extruded in the form of pipe under blow moulding process is called as parasites.
Billets	:	Billets are the rectangular blocks of cast metal, used for the manufacturing of aluminium foil.

13.11 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

Your answers should include the following points:

1. i) Wood is the oldest packaging material appeared in the beginning of 1950 for the packaging of heavy engineering and electronic products.
- ii) Jute fibre is considered to be the second appearance as natural packaging material. The material has got tremendous application in packaging of food grains.

iii) Glass containers have appeared in the market as packaging material especially for the packaging of pharmaceuticals, alcoholic beverages, etc.

- Plastics materials have entered in big way during the period of mid fifties and early 1960's. Initially, polyethylene and PVC have shown the application in packaging.
- In the late 1970's and early 1980's, plastic carry bags have been introduced in the Indian market. Subsequently, these materials have taken a lead over other materials for the packaging application.

2. a) Wooden containers
- b) Plastics
- c) Jute

Check Your Progress Exercise 2

Your answers should include the following points:

1.
 - The main constituents are sand, lime stone and soda ash.
 - Other ingredients like arsenic, selenium and cobaloxides are added to make clear glasses.
 - Boron is added to make it stronger.
 - Carbon and sulphides are added to make amber (brown) coloured glass.
2.
 - Inertness, non permeable, transparent, mouldable
 - Impact strength, light weight and unlimited supply
3.
 - Used for all types of product packaging
 - High temperature resistance
 - Can be made in any size, shape and capacity
 - Impermeable to moisture and gases
 - Can be made in different colour depending upon the requirement

Check Your Progress Exercise 3

Your answers should include the following points:

1.
 - General line can
 - OTS can
2.
 - Open top sanitary (OTS) cans are three piece cans where as Drawn and Wall Iron (DWI) cans are tow piece cans.
 - Open top sanitary cans are mainly used for processed food but the other one is confined to the application of pressurised beer and beverages.
3.
 - Processed food
 - Edible oil
 - Coffee, baby food and chocolate
 - Paints, insecticides and pesticides

4. • Hydrogenated fat or vanaspati
 - Bakery products
 - Confectionery items
5. • Can be fabricated readily
 - Imperable to light, gases and moisture
 - Non-toxic
 - Amenable to heat sterilization
 - Amenable to printing

Check Your Progress Exercise 4

Your answers should include the following points:

1. A continuous sheet of aluminium metal rolled to thickness ranging from 0.005 to 0.2 mm.
2. Impermable, non toxic, light and heat barriers, tearability, moisture and gas barrier.
3. • Lidding foil, biscuit wrapper.
 - Decorative label, tagger and an important substrate of flexible laminate
4. • A plastic material is a solid at ordinary temperature and allows appreciable and permanent change of form without losing its coelurence on the application of pressure and heat.
5. • Polyolefin group
 - Polyvinyl group
 - Condusation polymer
 - Styrene polymers
 - Carbonate group
6. i) True ii) True iii) True
 iv)True v) True

Check Your Progress Exercise 5

Your answers should include the following points:

1. • Injection blow moulding
 - Co-extrusion blow moulding
 - Extrusion blow moulding
 - Stretch blow moulding
2. • Can be made in any size, shape and capacity
 - Good impact resistance
 - Low permeability to gases and moisture vapour
 - Customer friendly due to innovative opening device
 - Smooth finish surface enhance eye appeal
3. • Aluminium collapsible tube
 - Lami tube
4. • Tamperproof

- Non-toxic and hygienic
 - Elegant
 - Economical
 - Light weight
5.
 - Cosmetic products
 - Toiletries products
 - Industrial products like greases
 6. A can made of dissimilar material where the body is made from paper and the ends are made either from plastic or metal.
 7.
 - Convolute
 - Spiral winding
 - Lap seal method
 8. Leak proof composite can which could be used for packaging of liquid products like fruit juice, tube oil etc.
 9.
 - Detergent powder
 - Pesticides
 - Pharmaceuticals products

13.12 SOME USEFUL BOOKS

1. Packaging Technology Education Volumes (Part 1) (2001) Indian Institute of Packaging, E-2, M.I.D.C. Area, Chakala, Andheri (East), Mumbai.
2. Brody Aaron, L. and Marsh Kenneth, S. (1986) The Wiley Encyclopaedia of Packaging Technology.
3. Plastics in Packaging (1986) Indian Institute of Packaging, E-2, M.I.D.C. Area, Chakala, Andheri (East), Mumbai.
4. Bikales Borbert, M. (1971) Moulding of Plastics – Wiley Interscience, a division of John Wiley & Sons Inc, New York.