UNIT 9 PACKAGING MATERIALS

Structure

9.0 OBJECTIVES

After reading this unit, you will be able to:

- identify the major packaging materials used for packing fish and fishery products;
- explain the different types of synthetic packaging material; and
- differentiate between synthetic and natural packaging material.

9.1 INTRODUCTION

In the earlier units, you have learnt about fishery products of commerce wherein you could get an idea of traditional methods of curing fish and shell fish as well as modern processing methods of fish such as freezing, pasteurization, cook-freeze, canning and pouching. Whatever method the fish is processed, if it has to be properly stored without spoilage till it reaches the consumer, it should be packaged well using appropriate material. Another need of packaging is that the packaging should please the consumer and lead him to buy the product. Packaging is an integral part of fish product development. This unit informs you about the different types of packaging materials used for packing fish and fishery products. The properties of packaging materials vary depending on the product to be packed and the purpose. All types of packaging material cannot be used for food. While selecting packaging material for foods it should be seen that the material should not cause any adverse effect to the food. These requirements restrict the use of many materials for packing food products. The unit gives you a brief description of the major packaging materials used in food packaging.

Packaging materials can be broadly divided into synthetic and natural. They may be also classified based on their structure or flexibility into flexible, rigid and semi rigid containers. Flexible films can take the shape of the product, which is packed into it. Rigid containers like glass bottles and cans have a fixed dimension and cannot change their shape. Semi rigid containers like thermoformed trays can change their shape to a certain extent.

9.2 WHAT IS SYNTHETIC PACKAGING MATERIAL?

Do you know what synthetic packaging material is? Come let us know about it, and also understand the different types of synthetic packaging materials. Synthetic packaging materials (Fig. 9.1) are man-made artificial materials which have a good shelf-life, strength needed to allow handling, are flexible and are of different types as given below:

Fig. 9.1: Synthetic Plastic Film

Various types of synthetic plastic films are available such as:

i) Low Density Polyethylene (LDPE)

Polyethylene (polythene, PE) is the material consumed in the largest quantity by the packaging industry (Fig.9.2). LDPE is the single largest polymer used in food packaging. It is a polymer of ethylene, which is a hydrocarbon gas which is a by-product of petroleum refining. LDPE is a macromolecule of ethylene with very high degree of branching. It is having density ranging from 0.916-0.925 g/cm^3. LDPE is tough, translucent, has good tensile strength, impact resistance, water vapour impermeability, heat sealability, chemical inertness and low cost of production.

Fig. 9.2: Block frozen products-polythene pack

ii) High Density Polythene (HDPE)

You should understand that HDPE possesses a much more linear structure than LDPE. HDPE resins are produced by low-pressure process. The density of the material is around 0.95 g/cm^3. It is stronger, thicker, less flexible and more brittle than low-density polythene and has lower permeability to gases and moisture. It has a higher softening temperature (121°C) and can therefore be heat sterilized. HDPE (Fig. 9.3) has higher tensile and bursting strengths but impact and tear strengths are lower than LDPE. High molecular weight, high-density polythene (HM-HDPE) has very good mechanical strength; less creep and better environmental stress and crack resistance property.

Fig. 9.3: Bulk packaging of dried fish – HDPE woven gusseted sack

iii) Linear Low Density Polythene (LLDPE)

Linear low-density polythene is low-density polythene produced by a low-pressure process. The term linear is used to imply the absence of long chain branches allowing the molecules to pack closer together to give a very tough resin. It is virtually free of long chain branches but does contain numerous short side chains. The linearity provides strength, while the branching provides toughness. Generally, the advantages of LLDPE over LDPE are improved chemical resistance and improved performance at both low and high temperatures. LLDPE shows improved puncture resistance and tear strength. The superior properties of LLDPE have led to its use in new applications for polyethylene as well as the replacement of LDPE and HDPE in some areas.

iv) Polypropylene (PP)

Polypropylene is produced by the polymerisation of propylene. It is stronger, rigid and lighter than polyethylene.

Orientation can be in one direction (unbalanced) or in two directions equally (balanced). The resulting film is characterized by good low temperature durability, high stiffness and excellent moisture vapour transmission rate. One drawback of Oriented PP is its low tensile strength.

Kraft paper is used for the manufacture of corrugated fibre board (CFB). Corrugated fibre board boxes are used as a shipping container for the export of frozen shrimp and the cartons should be given adequate water proofing treatment on both sides. This is done by lining with polypropylene (Fig. 9.4).

Fig. 9.4: Corrugated polypropylene box developed by CIFT for carrying fish on board

You should comprehend that practically all these materials have been in use for packaging different products providing satisfactory services. However, plastics that have a relatively recent origin, while offering several advantages over other packaging materials, have been presenting several problems as well for food products. Some of the chemical adjuvants used in the manufacture of plastic materials may be toxic in nature and may get transferred to the food when the package is in contact with the food material. However, plastics have the advantage that most of them possess excellent physical properties such as strength and toughness. They are light in weight and flexible, and also resistant to cracking. A wide range of polymers are now available for conversion into diverse type of plastic packaging materials. However, the requirements with a particular food may not be met with a simple material, as it may not possess all the desired properties. In such cases copolymers or laminates consisting of two or more layers of different polymers having different properties can be used.

v) Polystyrene

Polystyrene is manufactured from ethylene and benzene. While a reasonably good barrier to gases, it is a poor barrier to water vapour. New applications of polystyrene involve co-extrusion with barrier resins such as EVOH and poly vinylidene chloride copolymer to produce thermoformed, wide mouthed containers for shelf stable food products and multi layer blow moulded bottles. Used as a breathing film for packaging fresh produce. Since, it is crystal clear and sparkling, it is used in blister packs and display cover. These materials have low heat sealability and often tend to stick to the jaws of heat sealer. Both impulse and adhesive sealing are satisfactory.

vi) Polyester

Polyester can be produced by reacting ethylene glycol with terephthalic acid. Polyester film's outstanding properties as a food packaging material are its great tensile strength, low gas permeability, excellent chemical resistance, lightweight, elasticity and stability over a wide range of temperature (-60° to 220°C). The latter property has led to the use of PET for boil in the bag products which are frozen before use (Fig. 9.5) and as over bags where they are able to withstand cooking temperatures without decomposing. A fast growing application for polyester is ovenable trays for frozen food and prepared meals. They are preferable to foil trays for these applications because of their ability to be micro waved without the necessity for an outer board carton.

Fig. 9.5: IQF shrimps in Polyester/polythene pouches

vii) Polyamides (Nylon)

Polyamides are condensation products of diacids and diamine. The first polyamide produced was nylon-6, made from adipic acid and hexamethylene diamine. Various grades of nylons are available. Nylon-6 is easy to handle and is abrasion-resistant. Nylon-11 and nylon-12 have superior barrier properties against oxygen and water and have lower heat seal temperatures. However, nylon-6, has a high melting point and hence, it is difficult to heat seal. Nylons are strong, tough, highly crystalline materials with high melting and softening points. High abrasion resistance and low gas permeability are other characteristic properties.

In general, nylons are highly permeable to water vapour. Their permeability to oxygen and other gases is quite low when the films are dry.

viii) Polyvinyl Chloride (PVC)

You will be surprised to know that this monomer is made by the addition of reaction between Acetylene and Hydrochloric acid. It must be plasticised to obtain the required flexibility and durability. Unplasticized PVC as a rigid sheet material is thermoformed to produce a wide range of inserts from chocolate boxes to biscuit trays. Unplasticized PVC bottles have better clarity, oil resistance and barrier properties than those made from polyethylene. They have made extensive penetration into the market for a wide range of foods including fruit juices and edible oils.

ix) Ionomers

You must understand that these are essentially LDPE, wherein ionic forces due to carboxyl ions containing metallic ions such as sodium or zinc are incorporated. Compared to LDPE, ionomers are more resistant to oils and fats, superior in transparency, toughness, abrasion resistance and coating adhesion. They are specially used in skin packaging, meat packaging and in combination with polyamide for packaging oils and fats. Ionomers are particularly useful in composite structures to provide an inner layer with good heat sealability.

x) Copolymers

The polymers mentioned above are all made from a single monomer each, and are known as homopolymers. In some cases, polymers are prepared by the additive reaction of more than one monomer or by condensation of different monomers. These products are known as copolymers. The important copolymers in food packaging applications are ethylene vinyl acetate, vinyl chloride copolymers and polyester copolymers.

xi) Ethylene Vinyl Acetate (EVA)

EVA copolymers are made by the co-polymerization of LDPE with vinyl acetate. They contain up to 20% vinyl acetate and hence are similar to LDPE in impact strength and elasticity is higher than LDPE. It has greater resistance to environmental stress cracking; its permeability to moisture vapour and to gases is higher. They are thermally unstable at high temperatures, but are very stable at lower temperatures and have wide heat seal range.

? 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 is meant by synthetic packaging material?

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2) Name the different types of synthetic packaging materials?

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3) How LDPE is different from HDPE?

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4) How is polyester produced and what are the merits of polyester?

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5) What are the merits of Nylon?

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9.3 RETORT POUCHES

Retort pouches are made mainly of synthetic materials, as you will understand from the description below:

You will be happy to know that retortable pouches, as the name implies, pouches capable of retorting, are latest development in the canning industry. The retort pouch

(Fig. 9.6) is a rectangular type of package usually made of a three-layer lamination. Some manufactures give additional layer for better barrier properties. It is usually made up of an outer polyester, middle aluminium foil and inner polypropylene layer. The outer laminate, which is polyester, provides atmospheric barrier properties as well as mechanical strength. The aluminium ply provides protection from gas, light and moisture and ensures a better shelf life. The inner polypropylene layer provides the best heat-sealing medium. Table 9.1 gives the properties of different materials used for retort pouch manufacture.

Fig. 9.6: Fish Curry in three layered (Polyester/Aluminium foil/Cast polypropylene) Retort pouch

Table 9.1: Properties of Material Used for Retort Pouch Manufacture

Layers	Materials	Advantages	Disadvantages
Outer layer	Polyester	Good heat resistance and heat sealing property.	Probability of having pin holes high.
	Biaxially Oriented nylon	High strength	Shrinks during heat processing.
	Non oriented nylon	High strength and very good heat resistance.	Difficulty in quality printing.
	Biaxially oriented polypropylene	High strength and sealing.	Develops shrinkage during heat processing; has the tendency to curl.
Middle layer	Aluminium foil	High barrier.	Pin holes, has opaque colour, poor heat sealing quality.
	Polyester	High strength, heat resistant.	Pin holes.
	Nylon	High strength and impact resistance.	Expensive.
Inner layer	High density polythene	Good impact resistance, high sealing property; cheap.	Poor heat resistance, translucent.
	Non-oriented polypropylene	Transparent, good heat resistance.	Poor impact resistance.
	Co-polymer of polypropylene and polyethyleneseal	Good impact resistance, heat resistance, easy to seal.	Expensive.

The salient features making the retort pouch attractive than the other containers are the following:

1) The retort pouch can be produced in any shape and size.

2) It has a high surface to volume ratio and a thin cross-section.

3) Rapid heat penetration is possible compared to conventional metal cans. Heating is uniform.

4) There is 30 to 40% reduction in processing time.

5) The retort pouch offers savings in terms of weight and space. Compared to an empty can of the same volume, an empty retort pouch occupies 85% smaller space and weighs 84% less.

6) Retort pouches can be easily opened by consumers.

7) The packets can be very easily reheated, prior to eating, by immersing in hot water.

In spite of the above merits, the retort pouches have certain inherent disadvantages.

1) *Less physical strength:* Pouch and pouch seals are more vulnerable to damage than a can. They are easily damaged by sharp edges and this requires an over wrap for individual pouches.

2) *Slow process line speed:* The outputs from retort pouch lines are low (30-120 pack/minutes) compared with canning line (200-400 cans/minute).

3) *Higher packaging costs:* Along with an outer carton the packaging cost goes higher than metal can.

4) *Higher production costs:* Higher packaging costs along with low production makes the cost of production high.

In India, the raw materials required for pouch manufacture are available at cheap rate. Hence, the pouches are manufactured and supplied at a lower rate than metal cans.

? 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 the unit.

1) What do Retortable pouches mean?

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2) What are the different materials used in retort pouch manufacture?

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3) Define the features, which make the retort pouch attractive than other containers?

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4) What are the disadvantages of retort pouches?

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9.4 GLASS CONTAINERS

You might have studied earlier that glass is a mixture of silicates formed by heat and fusion with cooling to prevent crystallization. It is an amorphous, transparent or translucent super cooled liquid.

Glass bottles present a number of problems. The major problem encountered is the breakage problem; another problem is their limitation at high temperature sterilization. Glass bottles sterilized in boiling water and temperatures above 70°C are risky. Heat processing of vacuum-sealed glass containers requires superimposed pressure during cooling to hold lids in place. These short comings limit the use of glass containers to certain semi preserved items like salted fish, pickled products, jams, jellies, fruit juices etc.

You know that glass containers have been used for many centuries and still are one of the most important in food packaging. Due to its special properties, glass has its unique place in food packaging. It is strong, rigid and chemically inert. It does not appreciably deteriorate with age and is an excellent barrier to solids, liquids and gases, and gives excellent protection against odour and flavour contamination. The transparency of glass provides product visibility. Glass can also be moulded to variety of shapes and sizes. But, it has disadvantages like fragility, photo oxidation, heavier in weight etc. Glass containers include bottles, jars, tumblers and jugs.

9.5 METAL CANS

Metal cans were first developed in the early 19th century. The tin plate metal containers used in early days called “canisters” from which the term ‘can’ is believed to have derived. Each container has certain exclusive uses; in the course of development we can see that one container is invading other fields. The selection of one container over the others is usually decided on the basis of process and product, cost of production etc.

9.5.1 Tin Cans

Most frequently used container for packing food is tin plate can. The tin can is made of about 98% steel and 2% tin coating on either side. The base steel used for making cans is referred as CMQ or can making quality steel. Corrosion behaviour, strength and durability of the tin plate depend upon the chemical composition of the steel base. The active elements are principally copper and phosphorous.

Depending upon the degree of workability, strength and corrosion resistance required in the case of tin plates, four types of steel are specified. They are L type, MR type, MC and type M. First three are produced by cold reduction process. Type M is similar to type MC in composition but produced by hot reduction process.

You will be surprised to know that tinned food or foods packed in tin coated cans gradually lose their natural colour. A lacquer coating on the inner side of the can prevent this. This lacquer coating protects the steel and tin and prevents direct contact with the food material. The can body protects the contents against the entry of micro-organisms, insects, air, light and moisture. They are light in weight and can be handled with ease. A very important advantage is that they can be sterilized at high temperature and pressure.

9.5.2 Aluminium Cans

It was noticed that the organoleptic qualities of foods packed in tin containers gradually decreased when they are kept for longer periods. This led to the introduction of another important container, the aluminium alloy can. Aluminium containers were used for packing meat and fish products as early as 1918. These are now being used extensively in European countries because of the availability of the raw material and less cost for its production due to plenty of electricity in those countries. Various types of aluminium and its alloys are used for packaging. The aluminium in grade of 1000 is called pure (99-99.7%) and these are used for foil and slug for impact extruded cans. The alloys in grade 3000 are used mainly as sheet for deep drawn cans and craned cans. Manganese is added to increase the strength. The best promising alternative to tin plate has been considered as aluminium modified by alloying with manganese and magnesium.

Aluminium possesses good corrosion resistance. They offer good resistance to external atmospheric corrosion. Aluminium containers are easy to fabricate. It is possible to set up a can manufacturing unit for a good canning factory. Machinery for such units is simple and highly profitable. Cans are produced in a wide variety of sizes and shapes with attractive appearance. They are light in weight.

Aluminium has got a good scrap value.

Aluminium cans (Fig.9.7) being light in weight, require special attention during heat processing. After heat processing, cooling has to be done under pressure. Aluminium cans with easy opening lids are becoming more and more popular now-a-days.

Fig. 9.7: Aluminium cans for heat processed fish products

9.5.3 Tin Free Steel Cans

This was developed in Japan under different names such as can super, Hinac coat, Hi-top by different manufactures. They are prepared by electroplating cold roller steel sheet with chromium in chromic acid. TFS is an important alternative to tin can. TFS has a steel base with a chromium/chromium oxide coating on the surface replacing the tin in conventional cans. The appearance of the can is bright or semi bright as compared to tin plate. Because of the low abrasion resistance of Tin free steel it needs to be protected by a lacquer film. However, the surface of the TFS provides an excellent substrate for lacquer adhesion, which ensures superior performance in terms of product compatibility for many food products. Polymer coated TFS cans have applications in sea food packaging (Fig.9.8).

Fig. 9.8 : Tuna in tin free steel (TFS Can)

You see cans were traditionally used for heat sterilized products. Today, there are several choices available: standard tin plates, light weight tin plate, double reduced tin plate, tin free steel and vacuum deposited aluminium on steel and aluminium. For food products packing, they are coated inside to get desirable properties like acid resistance and sulphur resistance. But, care has to be taken to avoid tainting of the lacquer.

Metal cans are advantageous as packages because of superior strength, high speed manufacturing and easy filling and dosing. Disadvantages of metal cans are weight, difficulty in reclosing and disposal.

9.5.4 Different Sizes of Cans in Use Commercially

Various sizes of cans designated by different trade name are usually employed commercially for different varieties of foods. Details of common sizes of cans used in the industry are given in Table 9.2.

Table 9.2: Common Name and Dimension of Cans Employed in the Industry

Common Name	Dimension (the first fig. Indicates inches and the next two figures 16th of an inch)
8 ounce	301 × 206
8 ounce tall	211 × 304
½ Tuna	307 × 113
No.1.Picnic	211 × 400
No.1.Tall	301 × 411
No.1. Flat	404 × 206
No.1.Tuna	401 × 206
	(Length × Breadth × Height)
¼ Dingley	404 × 302 × 014
½ Oval	309 × 575 × 103
½ Oblong	508 × 204 × 103

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 the unit.

1) What is glass made of?

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2) What are the major differences between glass containers and metal cans?

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3) Define the merits of Aluminium cans?

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9.6 NATURAL PACKAGING

You will remember that traditionally fish and cured fish were packed in containers such as baskets made from natural materials such as bamboo, palmyra etc. Even now in remote villages such baskets are used consistently. Fish vendor women still use such baskets (Fig. 9.9 and 9.10) lined with a polythene film in village markets. However, the trends are changing.

Fig. 9.9: Traditional bamboo baskets used for fish transportation

Fig. 9.10: Traditional Palmyra baskets for dried fish packaging

A very considerable portion of packaged foods is stored and distributed in packages made out of paper or paper based materials. Because of its low cost, easy availability and versatility, paper is likely to retain its predominant position in packaging industries. Paper is highly permeable to gases, vapours and moisture and loses its strength when wet. Ordinary paper is not grease and oil resistant, but can be made resistant by mechanical processes during manufacturing.

Paper pulp is produced from wood chips by acid or alkaline hydrolysis. The pulp is suspended in water and beaten with rotating impellers and knives to split the cellulose fibres longitudinally. The fibres are then refined and passed through heated rollers to get properties of the paper. Alkaline hydrolysis produces sulphate pulp and acid hydrolysis produces sulphite pulp. Sulphate pulp is used to make kraft paper. This is a strong paper, which is used for manufacture of corrugated fibreboard box.

Vegetable parchment paper is produced from sulphate pulp, which is passed through a bath of sulphuric acid. It has surface that is more intact than kraft paper and therefore, has greater oil resistance and wet strength properties.

Grease-proof paper is made from sulphite pulp in which the fibres are thoroughly beaten to produce a closer structure. It is resistant to oils and fats. But this property is lost when the paper become wet. It is widely used for wrapping fish, meat and dairy products.

Glassine is a grease-proof sulphite paper, which is given a high gloss finish by the finishing rollers. It is more resistant to water when dry but loses the resistance once it becomes wet.

9.6.1 Paper Board

Thicker paper is called as paper board. Paper board is heavier in weight, thicker, and more rigid than paper. Because of these properties, it is better suited to a variety of packaging products. About 70% of paper board packaging is used to protect food and other consumer goods (Fig. 9.11). Paperboards are used for carton marking. Boards are made in a similar way to paper but are thicker to protect foods from mechanical damage. The main characteristics of board are thickness, stiffness, the ability to crease without cracking, the degree of whiteness, surface properties and suitability for printing. White board is suitable for contact with food and is often coated with polythene, polypropylene or wax for heat sealability. It is used for ice cream, chocolate and frozen food items.

Fig. 9.11: Frozen shrimp in duplex cartons

Kraft paper is used for the manufacture of corrugated fibre board (CFB). Corrugated fibre board boxes (Fig. 9.12) are used as a shipping container for the export of frozen shrimp. It was stressed that for the fabrication of master cartons for frozen seafoods, virgin grade kraft paper should be used and the cartons should be given adequate water proofing treatment on both sides.

Fig. 9.12: Master cartons-corrugated fibre board

9.6.2 Cellophanes

You will be surprised to know that cellophane was the first commercial film used. Cellophane is manufactured from highly purified cellulose derived from bleached sulphite pulp. By incorporating various coatings and modifications, over 100 different grades of cellophane are available now. Cellulose film is not a plastic. It is made from cellulose which is found abundantly in wood pulp. Cellulose is essentially insoluble in most of the common solvents. It has therefore to be converted into an intermediate soluble derivative by chemical reaction, then dissolved and cast into sheet form. The properties familiar and most useful to the customer, converter and end user *viz*. moisture proofness, heat sealability, freedom from blocking etc. are built in the film by application of specialised surface coatings. These are applied by various techniques and from different media like water emulsions, solvent solutions or direct extrusion coating.

The coatings employed are based on nitro cellulose, vinyl polymers or vinylidene chloride copolymers for specific applications.

? Check Your Progress 4

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 is meant by natural packaging material?

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2) What are the main classifications of packaging materials made of paper?

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9.7 LET US SUM UP

In this unit, you learnt that packaging materials are widely used for many different purposes. You also were able to understand the properties of packaging materials and how they vary depending on the product to be packed and the purpose. All types of packaging materials cannot be used for food. While selecting packaging material for foods, it should be seen that the material should not cause any adverse effect to the food. You also learnt that packaging materials are classified into, synthetic, natural etc. Thus you have now understood the importance of packaging materials and their use in fish products.

9.8 GLOSSARY

Amorphous	:	Not crystalline.
Aroma	:	Pleasing odour or smell of a product.
Atactic	:	Polymers with molecules in which substituent groups of atoms are arranged at random above and below the backbone chain of atoms.
Biaxial	:	Having two axes.
Copolymerization	:	To polymerize different monomers together.
Creep	:	The tendency of a solid material to slowly move or deform permanently under the influence of stresses.
Crystallization	:	To cause to form crystals or assume a crystalline structure.
EOE	:	Easy open end.
Flexible		Which can be bent and folded.
Laminate	:	Combination of two or more plastic films by adhesion or by mechanical processing.
Metallized	:	Coating polymer films with a thin layer of metal, usually aluminium.
Monomer	:	Chemical compound composed of simple molecules from which polymers can be made.
Over Bags	:	Disposable bags in which food can be cooked and subsequently stored.
Permeability	:	The amount of gases diffusing through the plastic material in a given time.
Plasticized	:	To make or become plastic.
Pulp	:	Grinding wood into relatively short fibres to produce paper.
Steeped	:	To undergo the process of soaking in a liquid.
Translucent	:	Allows light to pass through, but not transparent.

9.9 SUGGESTED FURTHER READING

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9.11 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) Synthesized packaging materials are produced from raw materials, which are not of plant or animal origin. They are mainly plastics manufactured by different polymerization processes. Hence, it can be defined as man-made substances formed by chemical synthesis.

2) Different types of synthetic materials are Low Density Polythene, High Density Polythene, Linear Low Density Polythene, Polypropylene, Polystyrene, Polyester, Polyamides, Polyvinyl Chloride etc.,

3) In LDPE, the macromolecules structure are highly branched and close packing of the polymer chains is not possible, hence the density of the finished product is low whereas in HDPE the molecules are linear, crystalline and less branched, and has a greater density.

4) Polyester is produced by reacting ethylene glycol with terephthalic acid. Polyester is good for packing food material since it has great tensile strength, low gas permeability, excellent chemical resistance, lightweight, elasticity and stability over a wide range of temperature (-60 to 220^{o} C).

5) Nylons are strong, tough, highly crystalline materials with high melting and softening points, high abrasion resistances and low gas permeability where odour can be retained. The films are tasteless, odourless and non-toxic.

Check Your Progress 2

1) Retort pouches are synthetic pouches made up of different layers and capable of retorting or sterilizing at high temperatures.

2) Retort pouches are made of three layers, an outer layer consisting of polyester, middle layer consisting of aluminium foil and inner polypropylene

layer. The outer laminate, which is polyester, provides atmospheric barrier properties as well as mechanical strength .The aluminium ply provides protection from gas, light and moisture and ensures a better shelf life. The inner polypropylene layer provides the best heat-sealing medium.

3) The retort pouch can be produced in any shape and size; it has a thin profile and hence heating is faster and therefore there is reduction in process time, energy and ultimately cost. The pouch products have better retention of flavour, colour texture when compared to cans. The pouches require less storage space, can be easily opened and disposed off in comparison to cans.

4) Less physical strength: pouch and pouch seals are more vulnerable to damage than a can. They are easily damaged by sharp edges. Slow process line speed. The outputs from retort pouch lines are low (30-120 pack/min) compared with canning line (200-400 cans/min). Higher packaging costs along with low production make the cost of production high.

Check Your Progress 3

1) Glass is made up of oxide of silica, sodium, potassium or lithium and calcium and magnesium, which are fused together to form an amorphous transparent or translucent super cooled liquid without crystallization.

2) Glass containers are chemically inert and give excellent protection against odour and flavor contamination. The transparency of glass provides product visibility and it can also be moulded to variety of shapes and sizes. Glass containers require counter pressure during heat sterilization and can break making it risky. Metal cans have superior strength, high-speed manufacturing and easy filling and closing. They are light in weight and can be handled with ease and can be sterilized at high temperature and pressure.

3) Aluminium possesses good corrosion resistance. They offer good resistance to external atmospheric corrosion; easy to fabricate; machinery are simple. Cans can be manufactured in different shapes and sizes. They are lightweight.

Check Your Progress 4

1) Natural packaging materials are of animal or plant origin. They are manufactured directly from natural sources or by modified processes Eg. paper, bamboo, baskets and cellophane.

2) The main classification of packaging materials made of paper is vegetable parchment paper, glassine or greaseproof paper, paperboard, corrugated fibreboard box and cellophane.

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INTRODUCTION TO FISH, PROCESSING, PACKAGING AND VALUE ADDITION

Packaging and Value Addition of Fishery Products

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