CHAPTER

10

SYNTHETIC FIBRES AND PLASTICS

In this chapter we will learn about the natural and synthetic fibres, rubbers and different kinds of plastic.

Fibres

- Fibres are long thread-like structure of thinner strands.
- Due to their properties and structure, fibres are utilised to make clothes, ropes carpets, sweaters, etc.
- They may be natural or synthetic (man-made).

Natural Fibres

- These are obtained from plants and animals.
- Cotton and jute fibres are obtained from plants and are called plant fibres.
- While wool and silk are the examples of animal fibres.
- Wool is obtained from the fleece of sheep.
- Silk fibre is drawn from the cocoon of silkworm.

Cotton

- It is most widely used natural fibre.
- Cotton fibre is also known as cotton wool.
- Cotton is a soft fibre that grows around the seeds of cotton plant (cotton bolls) or cotton fruits.

- Cotton plants are usually grown at places having black soil and warm climate.
- In India, cotton is mainly cultivated in Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Punjab, Rajasthan, Tamil Nadu and Karnataka.

Jute

- It is obtained from the stem of jute plant, often called patson.
- It is cultivated during rainy season.
- It is mainly grown in West Bengal, Bihar and Assam.
- Jute is used for making gunny bags or sacks and for wrapping packages and some fine jute fibres are used to make fabric for clothes.

Synthetic Fibres

- The fibres made by man are called man-made or synthetic fibres.
- All the synthetic fibres are prepared by a number of processes using raw materials of petroleum origin, called petrochemicals.
- These are stronger than natural fibres.
- Depending upon the type of chemicals used for manufacturing the synthetic fibres, there are four major types of synthetic fibres which are given below

Synthetic Fibres	Composition	Uses
Rayon (artificial silk)	Obtained by chemical treatment of wood pulp	In textile industry, in manufacturing of tyre cord, to make carpets, for making bed-sheets, curtains, blankets, etc. Due to its texture, it is also called artificial silk.
Nylon (poly-amide)	Made without using any natural raw material (from plant or animal)	For making socks, ropes, tents, brushes, carseat belts, sleeping bags, parachutes, etc.
Polyester (e.g. terylene or dacron)	Made up of the repeating units of a chemical called ester.	In making fabrics like saree, dress materials and curtains, for making water hoses, conveyor belts.
Acrylic (artificial wool e.g. orlon or PAN)	As substitute for wool	For making sweaters, shawls, blankets, carpets, boots and gloves, etc.

Rubber

It can be classified into two forms, i.e. natural and synthetic rubbers.

Natural Rubber

- It is a natural polymer and possesses elastic properties so, it is also called elastomer. It has a variety of uses. It is obtained from rubber latex (a solution of rubber in water).
- This latex is chiefly obtained from the bark of rubber trees found in India, Sri Lanka, Malaysia, Indonesia and South America.

Synthetic Rubbers

These rubbers are made by vulcanisation of natural rubber or polymerisation of some monomers, e.g. Buna-S, Buna-N, Neoprene, etc.

Vulcanisation of Rubber

Vulcanisation is the heating of natural rubber with sulphur and an appropriate additive at a temperature range between 373-415 K to improve its physical properties. Thus, rubber gets stiffened, i.e. becomes less sticky and plastic, more resistant to swelling by organic liquids and has enhanced elasticity.

Plastics

- A plastic is a synthetic material which can be moulded into desired shape when soft and then hardened to produce a desirable article with durability. Plastic is also a polymer like synthetic fibre.

- A large number of plastic bags, water bottles, buckets, mugs, combs, toothbrush, toys, chairs, tables, covers of electric switches, plugs, sockets, insulation of electric wire, water tanks, etc., are articles made up of plastics.
- Some parts of television, refrigerator, cars, buses, trains, aeroplanes, ships, etc., are also made up of various types of plastics.

Types of Plastics

On the basis of effect of temperature, plastics are of two types

1. Thermoplastics

- The plastics which get deformed easily on heating and can be bent easily are known as thermoplastics, e.g. polythene and Polyvinyl Chloride (PVC).
- Thermoplastics are used for making insulation of electric wires and cables, various types of plastic containers (bottles, jars, etc.), combs, toys, raincoats, packaging materials, etc.

Note 'Polythene' (poly + ethene) is a polymer of a compound known as ethene. It is used for making commonly used polythene bags.

2. Thermosetting Plastics

- The plastics which when moulded once, cannot be softened by heating are known as thermosetting plastics, e.g. bakelite and melamine.
- An article made up of thermosetting plastic will retain its original shape permanently, even on heating.
- Thermosetting plastics are used for making handles of cooking utensils, plates, cups, electric switches, plugs, rockets, telephone instruments, etc.
- Melamine is a versatile material. It resists fire and can tolerate heat better than other plastics. So, it is used for making floor tiles, kitchenware and fabrics which resist fire.

Plastics as Materials of Choice

Due to various qualities and useful properties, plastics are the materials of choice for all sorts of uses. Plastic have many advantages over the traditional materials like metals, wood, etc.

Some important characteristic properties of plastics are given below

1. Plastic is Non-Reactive

- Metals like iron get rusted when left exposed to moisture and air, but plastics do not react with water and air.
- They are not corroded easily. So, they are used to store various kinds of materials including many chemicals.

2. Plastic is Light, Strong and Durable

- Plastic is lighter than metal due to its low density. So, plastic is used in cars, aircrafts and spacecrafts. It has good strength and durability (long lasting).
- Due to lower price, easy availability, light weight, good strength, durability and corrosion-resistance, plastic containers are preferred for storing food, water, milk, jams, pickles and soft drinks, etc.

3. Plastics are Poor Conductors of Heat and Electricity

- Plastics are poor conductors of heat. So, handles of cooking utensils (like frying pans and pressure cookers) are made up of plastic so that we can hold the hot utensils safely without getting our hands burnt.
- Plastics are poor conductors of electricity. So, electrical wires have plastic covering and handles of screw drivers (used by electricians) are made up of plastic, so as to protect us from electric current passing through them.
- Electric switches, plugs and sockets also have plastic covers due to these properties.

Some Plastics and their Uses

Plastics	Starting material (Monomer)	Uses
Polythene	Ethylene	Coats, milk cartons, bread wrappers, carry bags, toys, etc.
Polyvinyl chloride	Vinyl chloride	Rain coats, hand bags, toys, hosepipes, gramophone records and electric insulations, etc.
Polystyrene	Styrene	Ceiling tiles, lining materials for refrigerators, TV cabinets, etc.
Perspex	Methyl methacrylate	Lenses, transparent objects, domes and sky lights, aircraft windows, protective coatings, plastic jewellery, etc.
Teflon	Tetrafluoroethylene	Non-sticky coating for utensils and electric iron sole.

Plastics and the Environment

In our daily routine, we usually get things wrapped in plastic or packed in polythene bags. So, plastic waste keeps getting accumulated in our homes. Ultimately, the plastic wastes are dumped along with the household garbage. The use of plastic materials affects the environment very badly. It is because of the following reasons

(i) Plastic is non-biodegradable and causes environmental pollution as it takes several years to decompose. It is not environment friendly.

(ii) When the plastic waste materials are burnt, they burn very slow. They do not get completely burnt. In the burning process, they release lots of poisonous fumes (gases) into the atmosphere causing air pollution.

(iii) Sometimes, the animals (like cows) eat up the polythene bags and wrappers of food along with the left-over food thrown on garbage dumps.

The plastic material chokes the respiratory system of these animals, or forms a lining in their stomachs and can be the cause of their death.

Biodegradable and Non-Biodegradable Materials

- A material which gets decomposed through natural processes, such as action by bacteria, is called **biodegradable material,** e.g., plant wastes (such as peels of vegetables and fruits, fallen leaves, left over food stuffs, etc.), animal wastes, paper, jute, wood, cotton and woollen clothes, etc. They do not cause environmental pollution, so they are environment friendly.
- A material which is not easily decomposed by natural processes, is called **non-biodegradable,** e.g., plastics, glass, tin and aluminium cans, etc. They cause environmental pollution, so they are not environment friendly.

PRACTICE EXERCISE

1. An example of animal fibre is
   (a) flax (b) jute
   (c) silk (d) cotton
2. Identify the one, which is not obtained from a plant source?
   (a) Jute (b) Rubber
   (c) Cotton (d) Wool
3. The part of cotton plant that produces the cotton fibre is
   (a) cotton boll (b) flower
   (c) seed (d) root
4. Jute fibre is obtained from which part of the plant?
   (a) Root (b) Stem (c) Fruit (d) Seed
5. Most suitable type of soil for cultivation of cotton is
   (a) red soil (b) black soil
   (c) loamy soil (d) clay
6. Major source for synthetic fibres are
   (a) animal fat (b) oil from plants
   (c) petrochemicals (d) All of these
7. The source of rayon is
   (a) wood pulp (b) petrochemicals
   (c) wax (d) animal fibre
8. The term 'artificial silk' refers to
   (a) nylon (b) acrylic
   (c) polyster (d) rayon
9. Which of the following is called a polyamide?
   (a) Rayon (b) Nylon
   (c) Orlon (d) Terylene
10. Dacron is a
    (a) polyamide (b) polyester
    (c) rubber (d) None of these
11. Which fibre is being used, in place of wool, to make warm clothes?
    (a) Polyester (b) Polyamide
    (c) Acrylic (d) Rayon
12. The liquid that produces natural rubber is called
    (a) flax (b) latex
    (c) vulcanised rubber (d) nylon
13. The part of rubber plant which produces latex is
    (a) leaves (b) root
    (c) fruit (d) bark of stems
14. The example(s) of synthetic rubber is/are
    (a) Buna-S (b) Buna-N
    (c) Neoprene (d) All of these
15. The element used to vulcanise nature rubber is
    (a) sodium (b) phosphorus
    (c) sulphur (d) magnesium
16. In vulcanised rubber content of sulphur is around
    (a) 3-5% (b) 20-30%
    (c) 50-60% (d) 80-90%
17. Which of the following is not a use of vulcanised rubber?
    (a) Footwear (b) Balloon
    (c) Toys (d) Textiles
18. Plastics are different from fibres because plastics
    (a) are always lighter
    (b) can be moulded into desired shape
    (c) are always transparent
    (d) All of the above
19. An example of thermoplastics is
    (a) rayon (b) PVC
    (c) nylon (d) bakelite
20. Thermosetting plastic are the ones that
    (a) can not be softened by heating once moulded
    (b) can be remoulded again and again
    (c) can be moulded into any shape
    (d) Both (a) and (c)

21. An example of thermosetting plastics is
(a) polythene (b) bakelite
(c) PVC (d) polystyrene

22. Which of the following is named as versatile material?
(a) Bakelite (b) Teflon
(c) Melamine (d) Polythene

23. Plastics are used to store various kinds of materials including many chemicals because it is
(a) non-reactive (b) highly reactive
(c) light, durable and strong
(d) poor conductors of heat and electricity

24. Handles of screw drivers (used by electricians) are made up of plastic. It indicates that plastics are
(a) good conductor of electricity
(b) bad conductor of electricity
(c) biodegradable
(d) non-reactive

25. Paper, cotton, jute and woollen clothes etc. are biodegradable materials because
(a) They cause environmental pollution.
(b) They are environmental friendly.
(c) They are synthetic materials.
(d) Both (b) and (c).

26. Which of the following is a non-biodegration materials?
(a) Peels of vegetables and fruits.
(b) Fallen leaves.
(c) Wood
(d) Aluminium cans

27. Electrical switches and plugs are usually made up of
(a) PVC (b) bakelite
(c) nylon (d) polystyrene

28. Kitchenwares and crockery items are made up of
(a) melamine
(b) perspex
(c) PVC
(d) polythene

29. Teflon is not preferred to make
(a) non-sticky frying pan
(b) electric iron sole
(c) gaskets
(d) raincoat

30. Lenses, window pans, etc., are made up of
(a) PVC
(b) polythene
(c) perspex
(d) polystyrene

Answers

1	*(c)*	2	*(d)*	3	*(a)*	4	*(b)*	5	*(c)*	6	*(b)*	7	*(a)*	8	*(d)*	9	*(b)*	10	*(b)*
11	*(c)*	12	*(b)*	13	*(d)*	14	*(d)*	15	*(c)*	16	*(a)*	17	*(d)*	18	*(b)*	19	*(b)*	20	*(d)*
21	*(b)*	22	*(c)*	23	*(a)*	24	*(b)*	25	*(b)*	26	*(d)*	27	*(b)*	28	*(a)*	29	*(d)*	30	*(c)*