

## Fibres and Plastics

### Polymers:

A polymer is a compound of high molecular weight formed by the union of a large number of low molecular weight molecules called monomers of one or more types.

- The unit that is repeated again and again to give the complete structure of a polymer is called **the repeating** unit. It may or may not be similar to monomers.
- The polymers may be natural or manmade, e.g., natural fibres like jute, cotton, wool, silk etc. are some natural polymers while plastics like polythene, Teflon etc. and synthetic fibres like rayon, nylon, terylene are synthetic or manmade polymers.
- Synthetic fibres dry up quickly, are durable, less expensive, readily available and easy to maintain.
  - Cotton is a polymer called cellulose, which is made up of a large number of glucose units.

### Fibres:

#### A. Natural Fibres:

Fibres that are obtained from plants or animals are termed as natural fibres. They can be easily spun into thread, filament, rope which in turn can be further be woven, matted, or knitted. For instance, wool, jute, cotton, silk, flax, hemp, sisal, kenaf, coconuts are natural fibres obtained from plants whereas wool, silk and mohair are the fibres obtained from animals.

#### B. Synthetic Fibres:

Synthetic fibres have a wide range of uses ranging from many household articles like ropes, buckets, furniture, containers, etc. to highly specialized use in aircrafts, ships, spacecraft, health care, etc.

### Important Synthetic Fibres:

#### Rayon

It is synthetic fibre (e.g, manmade fibre) prepared from a natural raw material called cellulose by chemical treatment. It has silky look and similar to cotton.

- Rayon mixed, with cotton is used to make bed-sheets and mixed with wool is used to make carpets.
- Rayon is also called **artificial silk**. It is cheaper than silk.

#### Nylon

- It was prepared from coal, water and air. It was first fully synthetic fibre.
- It is a group of polymers containing amide groups; hence, it is a polyamide.
- It is chemically inert, heat resistant, tough and very strong.
- A nylon thread is actually stronger than a steel wire.
- Nylon was lustrous and easy to wash.



- It is used for making ropes, tents, toothbrushes, car seat belts, curtains, socks, parachutes etc.
- Nylon-66 (monomer hexamethylene diamine and adipic acid) and nylon-6 (monomer - caprolactum) are two important varieties of nylon.

### Polyester:

These fibres contain ester group. They do not get wrinkled easily but remained crisp, so are easy to wash.

- Terylene is a polyester which contains two units, i.e., ethylene glycol and terephthalic acid. Terylene, also called dacron or terene is made from petroleum products.
- Polyesters are used in textile industry making various garments.
- PET, polyester, is used for making bottles, utensils, films, wires and many other useful products.
- Polycot polywool, terrycot etc, are the mixtures of polyester and cotton, polyester and wool and terylene and cotton respectively
- Acrylic, an another synthetic fibre, resembles wool and used to make sweaters, shawls, blankets etc. The clothes made from acrylic are relatively cheap and available in a variety of colors.
- Polyester (poly + ester) is actually made up of the repeating unit of a chemical called ester.

### Testing of Fibres:

S. No.	Fibre	Types of burning	Bead of formation /smell
1.	Rayan	Burns readily	Smell of burning paper
2.	Nylon	Burns with difficulty	Head beads, smell of burning hair
3.	Wool	Burns slowly	No beads, smell of burning hair
4.	Acrylic	Shrinks from flame	Black beads sooty flame
5.	Cotton	Burns vigorously	No bead formation

1. The main disadvantage of synthetic fibre is that they melt on heating and this can be disastrous.
2. Synthetic fibres are prepared from petro chemicals.

### Plastics:

- Plastic is also a polymer like the synthetic fibre.
- All plastics do not have same type of arrangements of units.
- In some, it is linear, whereas in others it is cross-linked.
- On this basis, plastics can be of following two types:

1. **Thermoplastic:** The polymers which soften on heating, but regain their original properties after cooling are known as thermoplastic. polymers e.g. polythene, polystyrene, PVC etc. These polymers can be recycled, reused, coloured, melted and rolled into sheets. They are actually linear polymers.
2. **Thermosetting:** The polymers which do not soften on heating and retain their original shape permanently are known as thermosetting polymers. They retain their shape because of the presence of cross-linking e.g., bakelite, melamine etc. These polymers cannot be recycled or reused.

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### Bakelite:

It is poor conductor of heat and electricity. It is used for making electrical switches, handle of various utensils etc.

### Properties of Plastics:

- Plastic is non-reactive
- It is light, strong and durable.
- It is poor conductor of electricity and heat.
- Plastic has the several qualities but it is not environment friendly and causes pollution. Thus, we have to avoid the use of plastic as far as possible.

### Some Important Plastics:

- Polythene:** It is chemically inactive, water resistant, tough, flexible and strong and can be molded in desired shapes.
- Polyvinyl chloride (PVC):** It is tougher than polythene. It is a good insulator.
- Polystyrene:** It is very light and can be easily blown and easily moldable than polythene.
- Perspex:** It is extremely tough, light, and very transparent and has high optical clarity.
- Teflon:** It is very tough material and is resistant towards action of acids and bases. It is a bad conductor of heat. It is also called best plastics. It contains fluorine.
- Melamine:** It is a versatile material, resistant to fires and can tolerate heat better than other plastics. It is used for floor tiles, kitchenware, and fabrics that resist fires.

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Validity : 12 Months

S. No.	Plastic/synthetic fiber	Starting material (Monomer)	Uses
1.	Polythene	Ethylene, [CH <sub>2</sub> = CH <sub>2</sub> ]	Coats, milk cartons, bread wrappers, carry bags, toys etc.
2.	Polyvinyl chloride	Vinyl chloride [CH <sub>2</sub> = CH - Cl]	Rain coats, hand bags, toys, hosepipes, gramophone records and electric insulations etc.
3.	Polystyrene	Styrene [C <sub>6</sub> H <sub>5</sub> - CH = CH <sub>2</sub> ]	Ceiling tiles, lining materials for refrigerators, TV cabinets etc.
4.	Perspex	Methyl methacrylate $\left[ \text{CH}_2 = \begin{array}{c} \text{C} - \text{CH}_3 \\   \\ \text{COOCH}_3 \end{array} \right]$	Lenses, transparent, objects, domes and sky [CH = C-CH <sub>2</sub> ]. lights, aircraft windows, protective coatings, plastic jewelry etc.
5.	Teflon	Tetrafluoroethylene [CF <sub>2</sub> = CF <sub>2</sub> ]	Non-striking coating utensils, making seals and gaskets
6.	Rayon	Cellulose	Manufacture of tyre cord, carpets, textiles.