# SYNTHETIC FIBRES AND PLASTICS

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## **INTRODUCTION**

The clothes which we wear are made up of fabrics. Fabrics are made from fibres.

A fibre is a thread or filament like material which is so strong & flexible that can be converted into clothes, ropes and nets etc.

They are of two kinds :- (1) Natural fibres (2) Synthetic fibres

- (1) Natural fibres : These are long thin threads which are obtained from natural polymers obtained from animals or plants eg.
- (i) Cotton & Jute From cell wall of plant cells (Cellulose, is natural polymer)
- (ii) Wool From the fleece of sheeps & goats
- (iii) Linen From stalk of a plant (Flax)
- (iv) Silk From cocoons of silk worm.
- (2) Synthetic fibres :- Those fibres which are synthetically man made, and are polymer of small units are called synthetic fibre.
- ) The word polymer is made up of two Greek words poly which means many and mer means unit.
- ) All the synthetic fibres are prepared from raw materials of petroleum origin called petrochemical. eg. Nylon, Polyester etc.

## **POLYMERISATION**

Synthetic fibres are polymers. A polymer is a large molecule formed by the combining of many small molecules, each of which is called a monomer. The process of combining the monomers to form a polymer is called polymerisation. Polymerisation can be of various kinds, for example : addition polymerisation and condensation polymerisation.

## Types of Synthetic fibres

- 1. Rayon 2. Nylon 3. Polyester 4. Acrylic 5. Spandex
- 1. RAYON

It was prepared by chemical treatment (viscose process) of wood pulp (cellulose). It is also called artificial silk because it resembles in appearance like natural silk.

## Properties :

- (i) Rayon can absorb sweat because of its tendency to absorb moisture. So it is preferred over other synthetic fabrics in summer season.
- (ii) It is shiny and lustrous and resembles to silk.
- (iii) It can be dyed in a wide variety of colours.

Uses :

- (i) Rayon is mixed with cotton to make bed sheets and mixed with wool to make carpets.
- (ii) Shirts, ties and linings are made up of rayon fibre.
- (iii) It is used to manufacture tyre cords
- (iv) It is used to make bandages and surgical dressings.
- 2. NYLON
  - → Nylon was first introduced in 1930s.
  - > It was developed in Newyork (Ny) & London (Lon) so it was named as Nylon.
  - ▶ It was the first man made fully synthetic fibre.



Terrycot is used for making skirts, shirts and other dress materials.

- (iii) It is used to make light weight sails, conveyor belts.
- (iv) Polyester films, which is known as "mylar" are used for making magnetic recording tapes in audio cassettes, video cassettes and floppy discs.

Making Polyester : PET (polyethylene terephthalate), the commonly used polyester, is made from two monomers.terephthalic acid and ethylene glycol, by the process called condensation polymerisation terephthalic acid + ethylene glycol | polyethylene terephthalate (PET) + water.

# 4. ACRYLIC

Synthetic fibre prepared from acrylonitrile (Monomer unit). Acrylic fibre is also known as polyacrylonitrile ("PAN") or "Orlon" or Acrilan"

Properties :

- (i) It is warm, soft, light and flexible fibre.
- (ii) It closely resembles to wool in its properties & cheaper than natural wool.
- (iii) Acrylic yarn can be easily knitted.
- (iv) They are available in variety of colours.

Uses :

- (i) Acrylic fibre is used for making sweaters, socks & shawls.
- (ii) It is used for making carpets and blankets.

## 5. SPANDEX

Spandex is known for its high elasticity which makes it suitable for use in clothes, that require snug fitting eg swimming costumes. It is also known as "LYCRA" .

When spandex is blended with cotton fabrics, stretched fabric is obtained which is used for making T-shirts and caps.

Uses : It is used in the making of costumes, caps, T-shirts etc.

## ADVANTAGES AND DI SADVANTAGES OF SYNTHETIC FI BRES :

	Advantages	Disadvantages
1.	Its tensile strength is high and it can bear heavy loads without	Synthetic fibres can absorb very little moisture. It becomes sticky
	breaking.	when body sweats.
2.	These fibres are generally elastic in nature. It can regain its original shape after stretching or compressing to some extent.	These fibres have low melting points so melts easily, so it is dangerous to worn while working in the kitchen,
3.	These fibres are wrinkle resistant.	It requires very careful ironing.

## PLASTICS

Material that can be shaped by applying heat and pressure. Plastic means easy to mould. Plastic is a polymeric substance that can be moulded when soft and then hardened to produce a durable article. It is made soft by applying heat and pressure before moulding.

Types of Plastics :- On the basis of their reaction to heat, all types of plastic can be classified into two groups.



Plastic and Environment :

- (i) Plastic takes several years to decompose so it is not environment friendly. It causes environmental pollution (Air, Water & Land)
- (ii) (a) When plastic burns, it releases lots of poisonous gases into atmosphere causing air pollution.
  - (b) When plastic wastes are dumped in water they cause water pollution.
  - (c) Accumulation of plastic waste on road sides & collection of ugly dumps causes many diseases to humans and animals.
- Categorise the materials of the following products into "can be recycled" and "can not be recycled"
   Telephone instruments, plastic toys, cooker handles, carry bags, Ball point pens, Plastic bowls, Plastic covering on electrical wires, plastic chairs, electric switches.
- Q. Rana wants to buy shirts for summer. Should he buy cotton shirts or shirts made from synthetic material? Advise rana, Giving your reason?

Problems and solutions associated with Plastic disposal :

- Problems : Environmental and health hazards problems arises with their disposal because they are nonbiodegradable. Accumulation of plastics is a serious problem, because most of the method used to dispose them results in some type of pollution to the environment.
- (i) Buried plastic materials prevent rain water from seeping into earth, so plant growth is affected in those areas.
- (ii) Plastic waste may end up in littering road sides, floating in lakes and streams and collecting in ugly dumps. These provides homes for many diseases.
- (iii) When wastes are dumped in water. It causes water pollution through toxic substances present in plastics. It can cause death or reproductive failure in fish and other aquatic animals.
- (iv) When cows eats garbage they swallow materials like polythene bags and wrappers of food. It chokes the respiratory system of cows and forms a lining in their stomach and can be the cause of their death.
- (v) The polybags thrown carelessly here and there are responsible for clogging the drains.

Solutions :

- (i) Avoid the use of plastics as far as possible.
- (ii) Use cotton or jute bags instead of plastic bags when we go for shopping.
- (iii) Biodegradable and Nonbiodegradable waste should be collected separately and disposed off separately.
- (iv) Recycle the plastic waste. Take care in collection, sorting and processing the plastic waste with this aim that it can be used in manufacturing of other products.
- (v) Knowledge should be given to people about "green bin" and "blue bin" provided by municipality for separation of biodegradable waste such as food items (Green bin) and Nonbiodegradable waste such as plastics (Blue bin).
- (vi) People should also be advised to follow 4R principles. The "4R" principles are –

(a) Reduce (b) Reuse (c) Recycle (d) Recover

It will make environment friendly.

To overcome the problem of disposal of solid polymer waste, scientists were trying to make such type of plastics which should be "biodegradable" (decomposed by microorganisms) and "Photodegradable" (decomposed by sunlight) some polymers have been made. examples are –

(i) Poly s – Hydroxybutyrate – co – s – Hydroxy valerate (PHBV)

It is biodegradable and used in speciality packaging, orthopaedic devices and in controlled release of drugs.



- 30. Rayon is made from wood pulp while nylon is made from coal, air and water.
- 31. Nylon by far the most used synthetic fibre is prepared from coal, water and air.
- 32. Many articles like socks, ropes, tents, parachute etc., are made from nylon. A nylon thread is stronger than a steel wire.
- 33. Glass fibres are woven with cotton fibres to make water-proof and fire-proof sheets.
- 34. Water proof sheet layers are joined together by adhesives to form fibre glass material.
- 35. Optical fibres are very fine glass tubes.
- 36. Optical fibres are used in endoscopy.
- 37. Ceramic pottery is produced by treating clay at high temperatures.
- 38. The simplest and oldest type of pottery is earthenware.
- 39. Terra cotta is a primitive unglazed kind of pottery.
- 40. Porcelain is made from white clay and is translucent.
- 41. Porcelain was first made in China and is also known as Chinaware or Bone China.
- 42. Porcelain is used as insulator for high tension electric cables.
- 43. Plant cellulose is a natural polymer.
- 44. Wool and silk are also natural polymers having long chains of protein molecules.
- 45. Polythene is thermoplastic and is used for packing milk.
- 46. Polystyrene is very light, when blown contains many air bubbles.
- 47. Perspex is extermely light and transparent.
- 48. Polyester is made up of esters. Polycot, polywool, terry cot etc., are products prepared by mixing two kinds of fibres.
- 49. Synthetic fibres are durable, less expensive and dry up fast.
- 50. Plastic because of mouldability finds versatile use. Thermoplastics like PVC and polythene can be remoulded, while thermosetting plastics (like bakelite and melamine) can't be remoulded.
- 51. Thermosetting plastics are used as kitchen ware and also for electrical switches and handles.
- 52. Plastic is non-reactive and doesn't corrode easily, hence suitable as containers of food, but are nonbiodegradable.
- 53. Waste created by plastics is not ecofriendly. Burning of plastic release poisonous gases. Hence these shouldn't be disposed by burning.
- 54. Nagarjunsagar dam on river Krishna is made of granite stones.
- 55. Most famous temples of South India are made of granite stones.
- 56. Red Fort at Delhi and palaces of Fatehpur Sikri (Agra) are made of sandstone.
- 57. Bricks were extensively used by the people of the Indus Valley Civilization.
- 58. The famous Taj Mahal at Agra is made of white marble.
- 59. Cement is manufactured from silica, alumina, limestone and iron oxide.
- 60. In 1824, British engineer Joseph Aspdin discovered Portland cement.
- 61. Gypsum is mixed during manufacture of cement to slow the setting (hardening) process.
- 62. Glasses are super cooled liquids.
- 63. We should reduce use of plastic.
- 64. Polybags carelessly thrown are responsible for clogging the drains and also health problems for animals since cows and other stray animals sometimes swallow plastic bags and choke their respiratory system.
- 65. Use the 4R principle for use of plastic. Reduce, reuse, recycle and recover.

- Ex.9 Rana wants to buy shirts for summer, Should he buy cotton shirts or shirts made from synthetic
- material ? Advise Rana, giving your reason.
  Sol. Rana should buy cotton shirts for summer because cotton is a bad conductor of heat. It does not allow the transmission of heat from or to the body, thus protects body from heat. It has more capacity to hold moisturethan the synthetic clothes. So, it retains the sweat of the body and keeps it cool. So Rana should buy cotton shirts.
- Ex.10 Give examples to show that plastics are noncorrosive in nature.
- Sol. Plastics are noncorrosive in nature :
  - (i) They do not react with any substances.
  - (ii) Plastics do not react with air and water which are essential for corrosion.
  - (iii) They do not show any chemical reaction.
- Ex.11 Should the handle and bristles of a tooth brush be made of the same materials ? Explain your answer.
- Sol. No, heandle and bristels of a tooth brush should not be made of the same materials because handle should be hard while bristels should be made of the soft materials. Bristles should be soft so that it does not harm the gum of teeth. Handle gives the firm grip so it should be made of hard material.
- Ex.12 'Avoid plastics as far as possible.' Comment of this advice.
- Sol. Avoid the use of plastics as far as possible. Plastics are non -biodegradable materials. So sue of plastics is harmful for our environment. The plastics cannot be finally disposed off. Thus, plastics should be avoided as far as possible.

	Column A	Column B	
	(i) Polyester (ii) Teflon (iii) Rayon (iv) Nylon	<ul> <li>(a) Prepared by using wood pulp</li> <li>(b) Used for making parachutes and stocking</li> <li>(c) Used to make non-stick cookwares</li> <li>(d) Fabrics do not wrinkle easily</li> </ul>	gs
	Column A	ComunB	
	(i) Polyester	(a) Fabrics do not wrinkly easily	Ī
	(ii) Teflon	(b) Used to make non-stick cookwares	
501.	(iii) Rayon	(c) Prepared by using wood pulp	•
	(iv) Nylon	(d) Used for making parachutes and stockings	

Ex.13 Match the terms of Column A correctly with the phrases given in Column B.

- Ex.14 'Manufacturing synthetic fibers is actually helping conservation of forests. Comment.
- Sol. The natural fibres required the raw materials from plants and animals. so they lead cutting of trees and killing of animals. synthetic fibres are made up of chemicals and these chemicals are not available in forests. so manufacturing systhetic fibres is actually helping conservation of forests.
- Ex.15 Describe an activity to show that the thermoplastic is a poor conductor of electricity.
- Sol. Observe the electrical wires. These wires have plastic covering which show that plastics are poor conductores. The handles of screw dirvers are made of plastics. These obsefvations show that thermoplastic is a poor conductor of electricity.