

## Class 8 Chemistry Synthetic Fibers and Plastics

## Introduction

### Introduction

Threads are made up of thin strands which are in turn made up of still thinner strands these are called fibres. A fibres is a kind of thread which is woven to make a fabric. Fibres can further be classified into natural and synthetic fibre.



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## Polymer

### Polymer:

The term polymer is derived from two Greek words **POLY** meaning **many** and **MER** meaning **units**. Therefore polymer refers to combination of repeating units. Cotton is a natural polymer known as cellulose which is composed of large number of glucose units. Other examples of natural polymers include silk, wool, cellulose, DNA and proteins. Some of the synthetic polymers are nylon, Teflon polyester, polyethylene etc..

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## Natural fibres

### 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, coconut are natural fibres obtained from plants whereas wool, silk and mohair are the fibres obtained from animals.



Jute Sack (left) and cotton shirt (right)

### Synthetic fibres

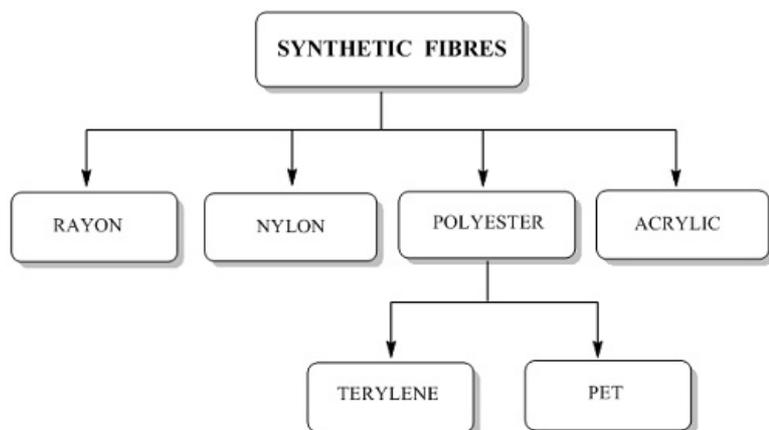
Fibres that are formulated artificially by human beings are termed as synthetic fibres. It is formulated by joining together a chain of small units that are actually chemical substances to form large units called polymer. For instance, rayon, polyester, nylon, acrylic etc.



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## Classification of synthetic fibres

### Classification of synthetic fibres



From the above table we observe that synthetic fibres can be classified into Rayon, Nylon, Polyester, and Acrylic. Polyester can further be classified into Terylene and PET. We will discuss these fibres one by one in the below topics.

### Rayon

- Rayon is formulated from natural resources like wood pulp, but still it is regarded as synthetic or man-made fibre having characteristics similar to silk.
- It is cheaper than silk.
- It is also termed as artificial silk.
- It can be easily woven down like natural silk and can be dyed in diverse vibrant colours.
- It is a good moisture absorbent and comfortable to wear.
- It is quite soft to skin with restrained dry strength.
- It does not possess the property of resiliency due to which they are easily prone to get wrinkles.
- For instance, rayon in accompany with cotton is used to make bed sheets. It is also used to make shirts, sarees.



**Rayon used to make shirts, Saree, Bedsheets**

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## Nylon

### Nylon

- This is the regarded as the first entirely synthetic fibre.
- In 1931 this fibre was formulated from coal, water and air for the first time.
- It refers to a clan of polymers called linear polyamides.
- It is an elastic, light weighted and strong fibre with the characteristic of being very lustrous, semi lustrous or even dull.
- This is a high tenacity fiber with good elasticity and is easy to wash.
- This fibre finds use in a variety of purposes for instance, in making ropes, seatbelts, toothbrushes, sleeping bags, tents etc.



Nylon used to make rope, Seat belts, tents

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## Polyester

### Polyester

- This fibre derived its name from a combination of two commonly known words namely polymer - having many parts and -ester - a chemical compound due to which fruits get their names.
- It is a durable fibre possessing the characteristics of resiliency due to which they are resistant to wrinkles.
- They are also impervious to most chemicals, shrinking, stretching.
- It can be used for the purpose of insulation by developing hollow fibers.
- It is used in making shirts, trousers, jackets, curtains and bedsheets, sarees, mouse-pads, ropes, fabrics for conveyor belt, insulating material as well as cushioning material in pillow.



**Polyester used to make curtains (left) and bedsheets (right)**

Polyester can further be classified into Terylene and PET.

<b>TERYLENE</b>	<b>PET</b>
<p>It is an artificial polyester fibre formulated by polymerizing ethylene glycol and terephthalic acid. It can be easily minutely drawn into fine quality fibres which in turn can be further woven like any other yarn. This in accompany with cotton called Terrykot and is used to make clothes like sarees , taoestry and many other articles like ropes, sheets, sails.</p>	<p><b><i>This is</i></b> a semi-crystalline thermo-plastic polyester formulated from ethylene glycol and terephthalic acid with the chemical name Polyethylene terephthalate. This is a strong lightweight clear and hence finds use in packaging foods and beverages like salad dressings, peanut butter, cooking oils, mouthwash, shampoo, liquid hand soap, window cleaner, films, wires, tennis balls and also convenience-sized soft drinks, juice and water.</p>



**Pet Bottle**

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## Acrylic

### Acrylic

- This synthetic fibre is formulated from a polymer called polyacrylonitrile.
- It is lightweight, soft, warm, and has resemblance with wool. Wool formulated from natural sources are quite expensive whereas this synthetic fibre is an inexpensive substitute for natural wool.
- It is also impervious to moths, oils, chemical substances, extremely resistant to worsening from sunlight exposure.
- Due to their resemblance with wool they find extensive use in making sweaters, tracksuits, linings for boots and gloves, equipping fabrics and carpets.

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## Characteristics of synthetic fibres

### Characteristics of synthetic fibres

Synthetic fibres possess following unique characteristics:

- They are durable and inexpensive.
- They are light weight, smooth and soft than any other fibre.
- They are easy to maintain as compared to natural fibres.
- They can be easily washed and dried.
- They are resilient to wrinkles which makes them more demanding in clothing industry.
- Their tenacity makes them find use in many industries.

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## Plastics

### Plastics

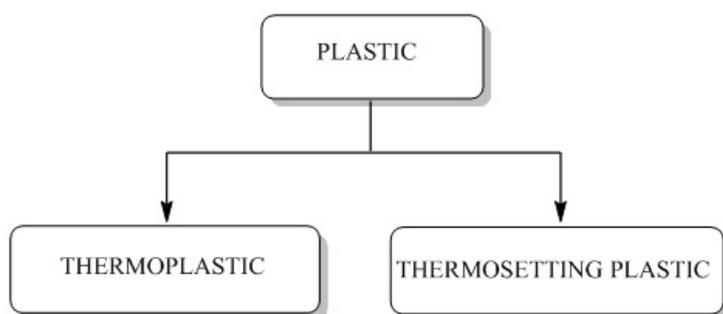
- This is another polymer formulated from hydrocarbons available in natural materials like natural gas, oil, coal, minerals and plants in which units are either aligned in linear arrangement or in cross linked arrangement.
- This is the absolute reason due to which many plastics begin with the keyword **poly** for instance, polystyrene, polypropylene and many more.
- This fibre finds extensive use in the modern industry due to their resistance towards corrosion and chemicals, good durability, low-slung thermal and electrical conductivity, high ratio between strength and weight, availability in vivid colors, resistance to shock and water, inexpensive, low toxicity.
- They are expansively used in making toys, suitcases, bags, cabinets, brush, chairs, disposable cups, tables, head liners, bottles, CD and cassette boxes, cutlery, electrical connectors, and many other innumerable stuffs.



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## Classification of plastics

### Classification of plastics



## Class 8 Chemistry Synthetic Fibers and Plastics

## THERMOPLASTICS:

### THERMOPLASTICS:

- This category of fibre gets easily deformed on exposure to heat and can also be easily bent.
- They are melt processable, which means that they are first heated, formed, and then cooled in their final shape.
- Polyethylene, Polypropylene, Polystyrene, and PVC are some of the examples of these kind of plastics.
- They find extensive use in making toys, electrical insulator and can be polished well, hence often used in manufacturing vehicle windows and light covers.

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## THERMOSETTING PLASTICS

### THERMOSETTING PLASTICS:

- This category of plastic once solidified during the molding process, cannot be softened back. Due to the reason that the units acquire three-dimensional cross-linked structure with strong covalent bonds for the most part that tends to preserve their strength and structure even on exposure to heating.
- If the plastic is exposed to long term heat, it may get charred.
- Phenolic resins, amino resins, polyester resins, silicon resins, epoxy resins, Bakelite, melamine and polyurethanes are some of the examples of these kind of plastics.
- Bakelite being the poor conductor of heat and electricity is used for making electrical switches and handle of several utensils. Melamine due to its resiliency to fire and tolerance to heat is extensively used to make floor tiles, kitchenware and fabrics used by firemen that can resist fire.



use of Bakelite for making handles



Use of Melamine for making fire proof suits

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## Characteristics of plastics

### Characteristics of plastics

Plastics possess following unique characteristics:

- They have lighter weight but possess good strength.
- They are inexpensive and hence finds extensive use in several household industries.
- They are non- reactive and hence are resistant to corrosion.
- They are durable and hence can be moulded into any shape and size.
- They are poor conductor of heat and electricity for which they are being extensively used in manufacturing handles of electrical appliances, utensils, switch boards etc.

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## Uses of plastics

### Uses of plastics

- In addition to the above mentioned uses of plastic, they are extensively used in biomedical industry. They are extensively used for packaging tablets, threads for stitching, gloves and several medical instruments.
- They are also used to manufacture cookware due to their resistance to heat and electricity.
- Teflon is a plastic with a unique property. No water or oil sticks to this kind of plastic and hence used in making cookware.

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## Biodegradable Vs Non-biodegradable materials

### Biodegradable Vs Non-biodegradable materials



Materials that are organic and hence gets easily decomposed by microorganisms are termed as biodegradable wastes. Once decomposed they can be used as humus to increase the fertility of soil. This kind of materials include kitchen wastes, dead plants and animals, human excreta etc.



**Fig.** Biodegradable wastes- Potato peels (left) and dead plants (right)

Whereas the materials that are inorganic and hence cannot be decomposed by any means are termed as non-biodegradable wastes. They persist in the environment for a long time thereby polluting the environment. They cannot even be burnt as their burning releases a lot of hazardous gases in the environment causing air pollution. This kind of materials includes plastic, metals, glass etc.



**Fig.** Non-biodegradable wastes- plastics and glasses

## **Class 8 Chemistry Synthetic Fibers and Plastics**

## **Side effects of Non-biodegradable materials**

### **Side effects of Non-biodegradable materials**

The non-biodegradable materials takes long time to decompose and may not even get decomposed due to which they persists in the environment for a long time. These kind of materials when thrown with garbage persists over there. When animals feed on that garbage they feed on those materials too. Plastics cause the main threat to the animals feeding on garbage as they choke the respiratory tract of these animals. In addition to this it also forms a lining on the stomach and can even cost on their lives.

In addition to this these wastes even clog the drains, and sometimes even make the spread dirtiness all around in the public places.

## Class 8 Chemistry Synthetic Fibers and Plastics 4R- Reduce, Reuse, Recycle, and Recover

### **4R- Reduce, Reuse, Recycle, and Recover**

- The biodegradable materials can be collected separately and can be reused after proper treatment. They can be recycled. This is termed as 4R strategy which means Reduce, Reuse, Recycle, and Recover.
- Some of the ways to limit the use of non-biodegradable materials are as follows:
- Prohibition to the disposal of plastic bags near water bodies or nearby places where animals can feed upon.
- Limiting the use of plastic by using steel lunch boxes, jute bags or cotton bags for shopping.
- Recycling and then reusing the non-biodegradable wastes.

