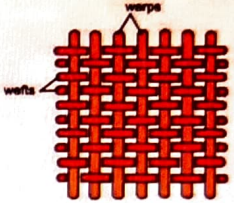
Textile

- The term **textile** is defined as the complete set of materials that are based upon the fibres on making different types of end products including apparels, home furnishings and industrial fabrics.
- **Textile** can be produced by different techniques weaving , knitting, nonwoven etc. for making the final product.

- **Weaving** is the process of interlacing two sets of threads, known as warp and weft, to create fabric.
- The warp threads run lengthwise, while the weft threads run widthwise, interlacing to form a cloth.
- Weaving is typically done on a loom, a device that holds the warp threads in place while the weft threads are woven through them.
- **Knitting** is a method of creating fabric by interlocking loops of yarn with needles.
- **Non-woven** fabric is a sheet or web structure made of fibers or filaments that are bonded together by mechanical, thermal, or chemical means, without being woven or knitted.



Fibre

- A **fibre** is a fine single filament which is used in making of **yarns and thread** which comprise of the basic component of all textile items- such as fabrics, mats, strings, cords, twines and ropes.
- It is defined as a **fine strand of tissue of plant, animal or any synthetic material drawn out into filament and subsequently cut into required length.**

Characteristics of a fibre

(i) Length to diameter ratio

- For a fibre to be suitable for textile purposes, its length to diameter ratio **must be at least in the range of hundreds.**
- This physical structure enables fibres to be twisted together to form yarns and threads.
- Larger items having bigger diameters such as cords and ropes are made by first assembling fibres into yarns and in turn assembling them into cords and further into ropes through twists and turns.

(ii) Strength

- A fibre for textiles must be **strong.** Its inherent high strength enables it to withstand the harshness of the spinning (yarn or thread-making) and weaving processes and to provide the desired strength in the woven cloth.

(iii) Flexibility

- A fibre should be essentially **flexible.** Flexibility permits the fibres to be duly spun and woven and gives to the textile fabric its unique folding and draping characteristics.

(iv) Fibre-length

- Fibre-length is an important physical parameter.
- Fibres can be infinitely long, but they must not be shorter than 6-12 mm (1/4-1/2 in) in length, so as to ensure that they are held together by the imparted twists during spinning.

(v) Elasticity and resilience

- Besides having good strength and flexibility, a textile fibre should also have a good degree of **elasticity and resilience** without detrimental brittleness.
- For fibres for clothing, garment, a good degree of moisture absorption is desirable for good feel and comfort.

(vi) Density

- The density of the fibre largely influences its draping qualities when it is made into a fabric. Smaller density and lower diameter make a finer fibre.
- Fabrics made from very light fibres may not drape well; if the fibre is too dense.

Textile fibre and filament

- **Textile Fibre**: Fibres have been defined by the textile institute as units of matter characterized by **flexibility, fineness, and a high ratio of length to thickness.**
- In individual textile fibres, the length/width ratio is at least 1000/1.
- **Filament**: A filament is a very long fibre. The length of filaments may range from a **few hundred meters**, as in the case of **silk, to several kilometers** as in the case of man-made fibres.
- The thickness of filaments tends to be similar to that of fibres.

Classification of fibres

- The textile fibres may be divided into two major groups

(a) natural fibres

(b) man-made fibres

- The natural fibres have been classified into three groups-

Man-made fibre

Animal fibres

- wool
- silk
- hair fibres etc.

Vegetable fibres

- Cotton
- jute
- flax
- hemp etc.

Mineral fibres

- Asbestos

Natural fibres

- **Vegetable fibres** are further divided into four subgroups according to **source of origin**

(a) ***Seed fibres***- cotton

(b) ***Bast fibres(stem)***- flax, hemp

(c) ***Leaf fibres***- manila, sisal

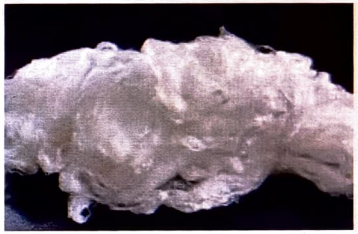
(d) ***Fruit fibres***- coir

Vegetable fibres

- **Mineral Fibers:** Asbestos is the only naturally occurring mineral fiber that was used extensively for making industrial products but is now restricted due to its suspected carcinogenic effect.
- The **man-made fibres** are divided into two broad categories, namely

(a) ***regenerated*** (natural polymer)

(b) ***synthetic fibres***



Regenerated fibre

- The regenerated fibres are those in which the **fibre forming material is of natural origin.**
- Synthetic fibres are made by the **chemical synthesis of simple polymer forming materials.**

Synthetic fibre

Regenerated Fibres

The regenerated fibres are further divided into the following four sub-groups-

1. **Cellulose fibres-** rayon, such as viscose; polynosic (in which the fibre is either wholly or mainly cellulose) .
2. **Cellulose esters-** acetate and triacetate.
3. **Protein fibres-** casein
4. **Miscellaneous-** alginate, natural rubber etc.

Synthetic fibres are classified according to their chemical structure

- Because the synthetic fibres are often made from copolymers or from modifications of polymers, a fibre may belong to two or more of the chemical sub-groups.
- **1.Polyamides:** Nylon 6, 6-6
- **2. Polyesters:** Dacron, Terylene
- **3. Polyvinyl derivatives:**

(a) Polyacrylonitrile

(i) acrylic (ii) Modacrylic

(b) Polyvinylchloride (PVC)

(c) Polyvinylidine chloride

(d) Polyvinyl alcohol (PVA)

(e) Polytetrafluoroethylene for example, Teflon

(f) Polyvinylidine dinitrile

(g) Polystyrene

(h) Miscellaneous polyvinyl derivatives

Synthetic fibres are classified according to their chemical structure

4. Polyolefins:

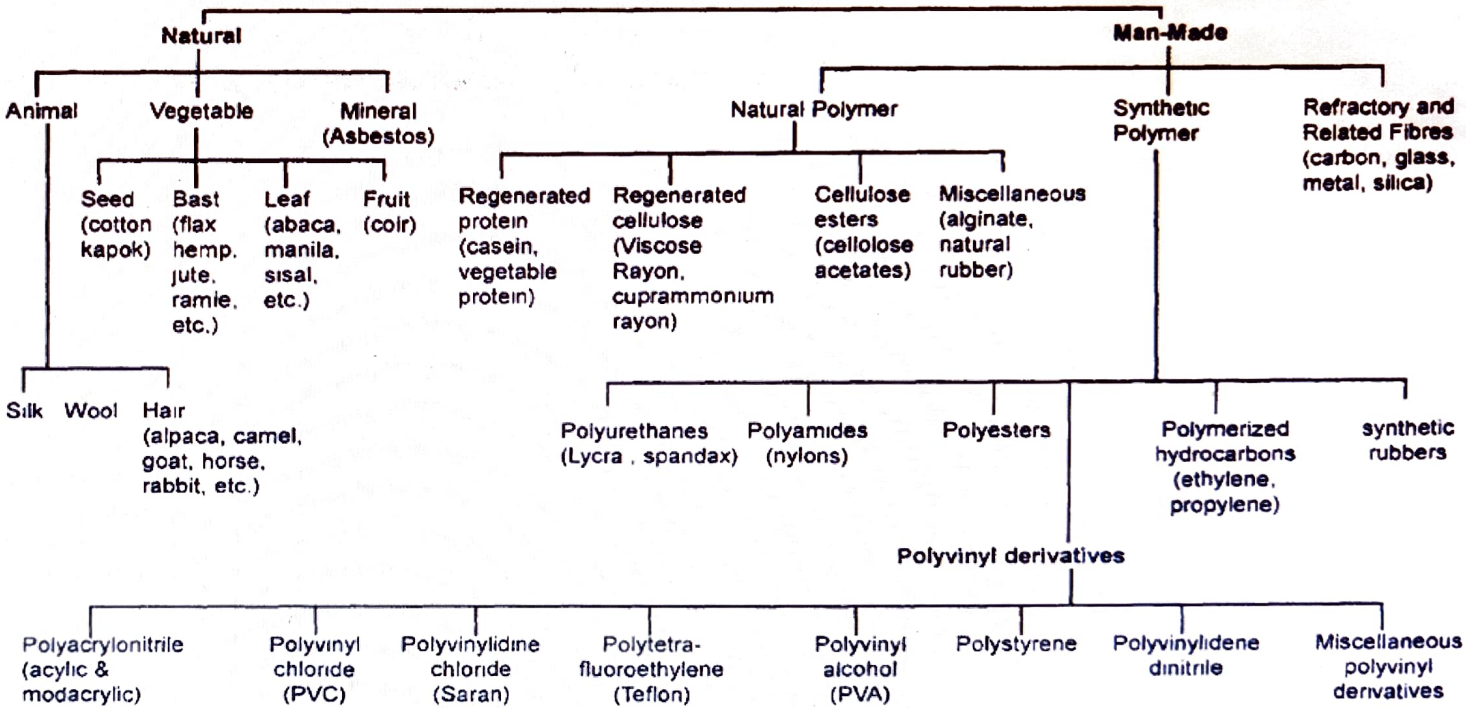
(a) polyethylene

(b) polypropylene

5. Polyurethanes: lycra or spandex

6. Miscellaneous synthetics: glass and metallic, carbon.

Classification of Textile Fibres



Polymerization

- Textile fibres, like most substances, are made up of molecules.
- Fibre molecules are called polymers. The 'unit' of a polymer is the **monomer.**
- At the molecular level the polymer is extremely long and linear, whereas the monomer is very small.
- Monomers are usually chemically reactive, whereas polymers tend to be unreactive.
- This is illustrated by the chemical reaction called polymerisation, which causes the monomers to join end-to-end to form a polymer.
- The length of the polymer is most important.
- All fibres, both man-made and natural, have long to extremely long polymers.
- Length of a polymer can be obtained by determining its degree of polymerisation.
- This is often abbreviated DP and defined by the following mathematical expression:

- D. P. =**average molecular weight of polymer/ molecular weight of the repeating unit in the polymer**