Introduction to Textile (Basics of Textiles)

Engineering

Application of scientific, economic, social, and practical knowledge in order to design, build, and maintain structures, machines, devices, systems, materials and processes.

Textile Engineering

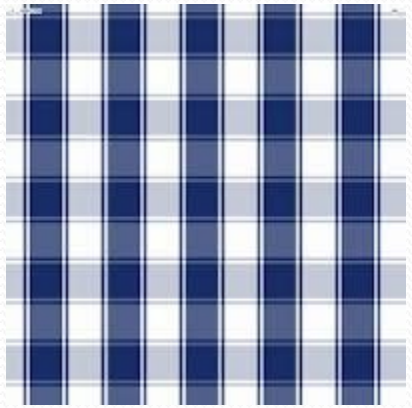
Application of scientific, economic, social, and practical knowledge in order to design, build, and maintain textile products, related machines, systems, materials and processes.

Textiles: A basic flow chart

Fibre

Yarn

Fabric



Processing

Garment

1- Fibre

It is defined as one of the delicate, hair portions of the tissues of a plant or animal or other substances that are very small in diameter in relation to there length.

Textile Fibre

Textile fiber can be spun into a yarn or made into a fabric by various methods including weaving, knitting, braiding, felting, and twisting.

- Staple yarn
- Filament yarn

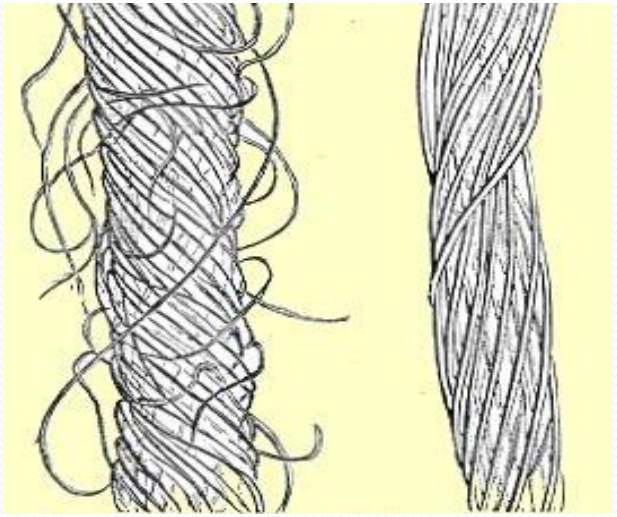
Essential requirements for textile fibres

- length of at least 5 mm,
- flexibility,
- cohesiveness,
- sufficient strength
- elasticity,
- fineness,
- uniformity,
- durability,
- luster

Banana fibre is not a textile fibre

2- Yarn

Assemblage of fibers, twisted or laid together to form a continuous strand that can be made into a textile fabric.

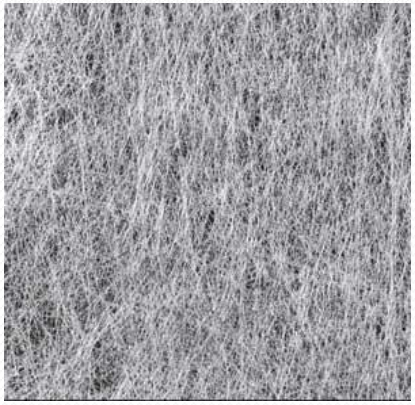


- Natural fibre yarn
- Man made fibre yarn

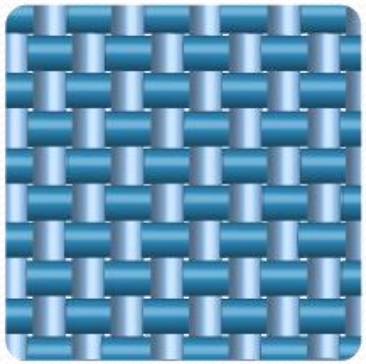
Fabric

Fibers alone or in the form of yarns are combined to make a planar structure called fabric.

Non-Woven Fabric



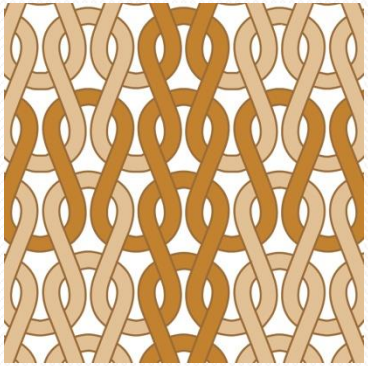
Woven Fabric



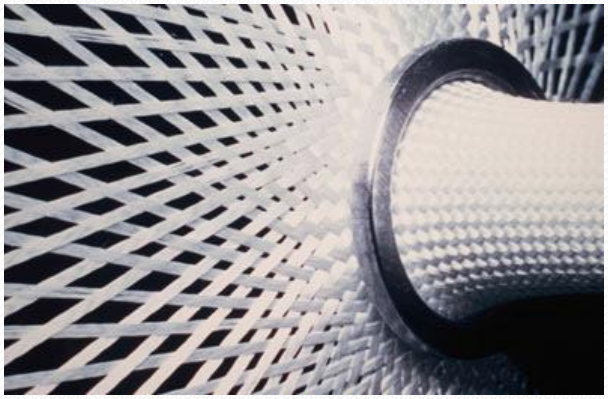
Fabric

Fibers alone or in the form of yarns are combined to make a structure called fabric.

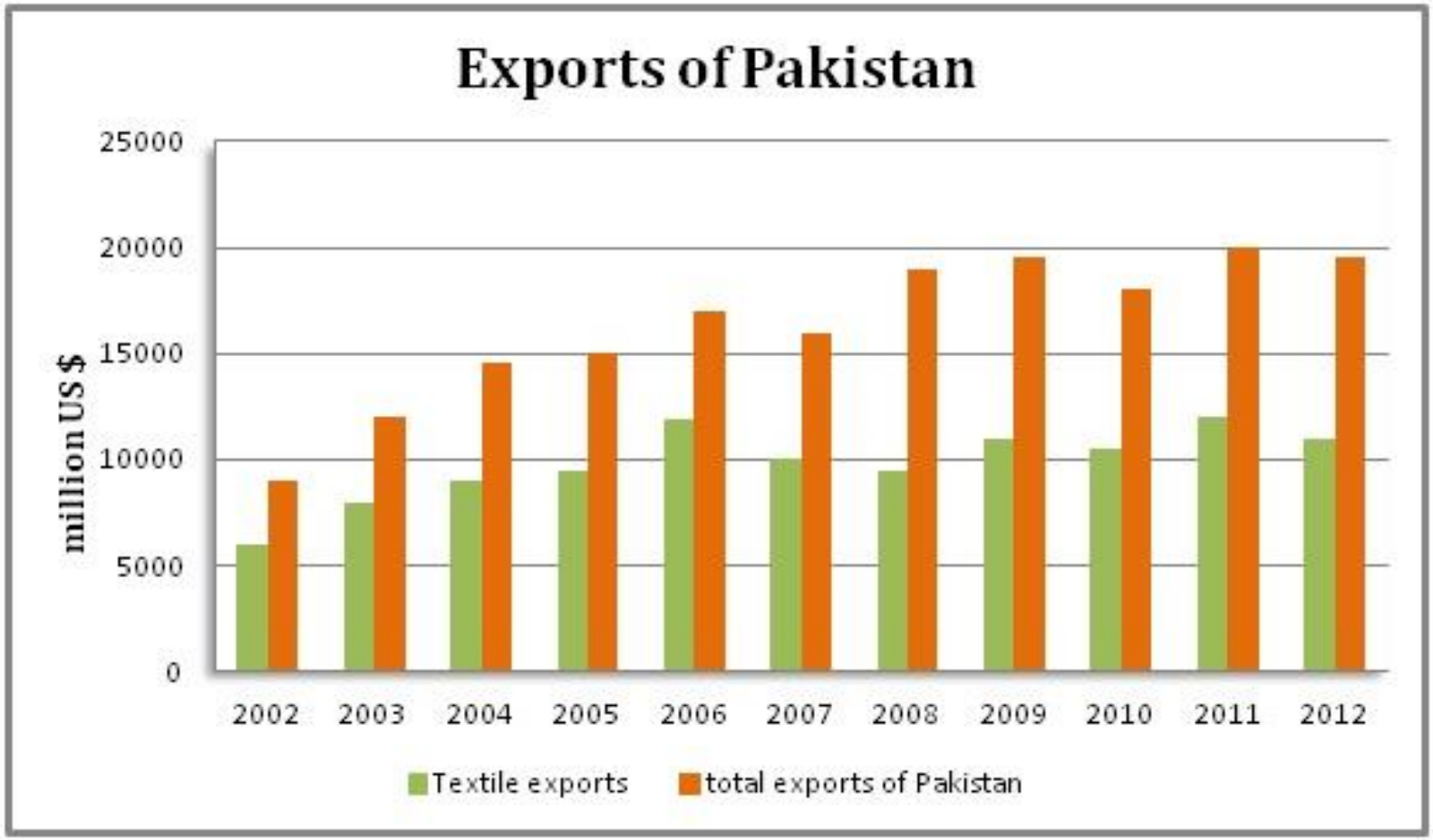
Knitted Fabric



Braided Fabric



Pakistan's Textile Growth



http://www.pakonomy.com/2012/06/29/textile-industry-at-the-brink-of-destruction

History: Industrial Development

8000 B.C. flax was used by the Swiss Lake Dwellers

Before 4000 B.C. Silk was used in Ch

Silk fabric of 2700 B.C. China

Between 3500 to 3000 B.C. sed in

A cotton blanket used in China

About 2000 B.C. Domesticated sheep were raised in Mesopotamia.

History: Industrial Development

Manufactured by hand before 500 B.C. in China

Machi the 18th century of the

rial Revolution

Intensi volution(1770-1850)

Flyin John kay

Spin James Hargreaves

Wate rd Arkwright

Spin Samuel Crompton

Power loom Edmund Cartwrigt

History: Industrial Development

Economical development

The Great Silk Road the 2nd century B.C. to the 9th century A.D.

By the 12th century, England was a major exporter of wool

After A.D. 1500, India was a major exporter of dyed and cotton fabric of Europe

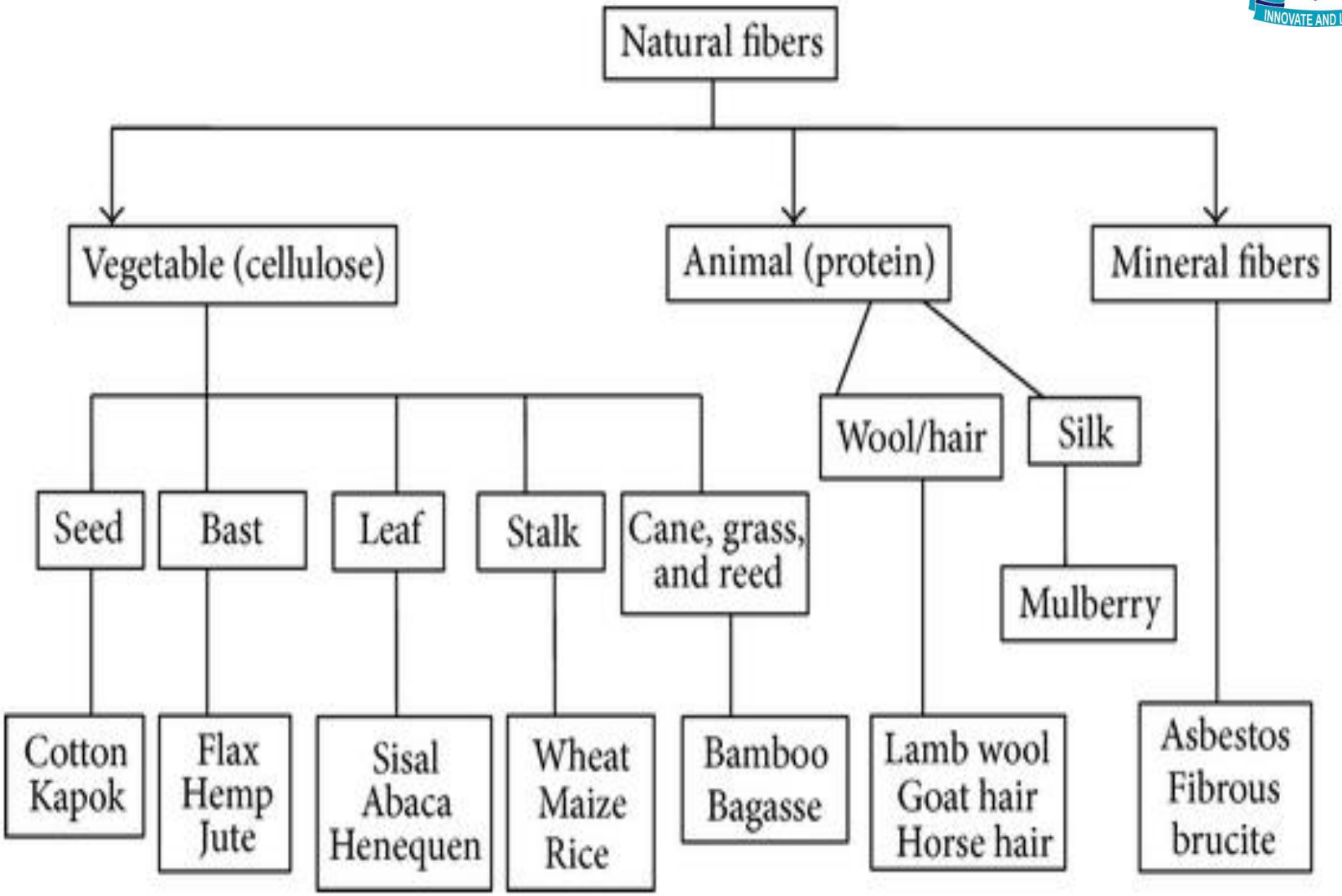
After Industrial Revolution, the textile and apparel industries developed in Europe.

In the 1940s and 1950s, the industry was consolidated.

Now, the traditional industry is changing from labor-intensive to automation.

Classification of textile fibers

- Natural
- Man-made


Natural fibers
Vegetable (cellulose)
Animal (protein)
Mineral fibers
Seed
Bast
Leaf
Stalk
Cane, grass, and reed
Wool/hair
Silk
Mulberry
Cotton
Kapok
Flax
Hemp
Jute
Sisal
Abaca
Henequen
Wheat
Maize
Rice
Bamboo
Bagasse
Lamb wool
Goat hair
Horse hair
Asbestos
Fibrous
brucite

Natural Fibers

- Vegetable Fibers

  are those that are derived from a different plant. Major recognize textile fiber are

  1. Cotton
  2. Flax
  3. Hemp
  4. Jute
  5. Sisal
  6. Bamboo

Natural Fibers

- Animal fiber

  obtained from the animal skin. major recognize animal fiber are
  - Wool
  - Silk
- Mineral fiber

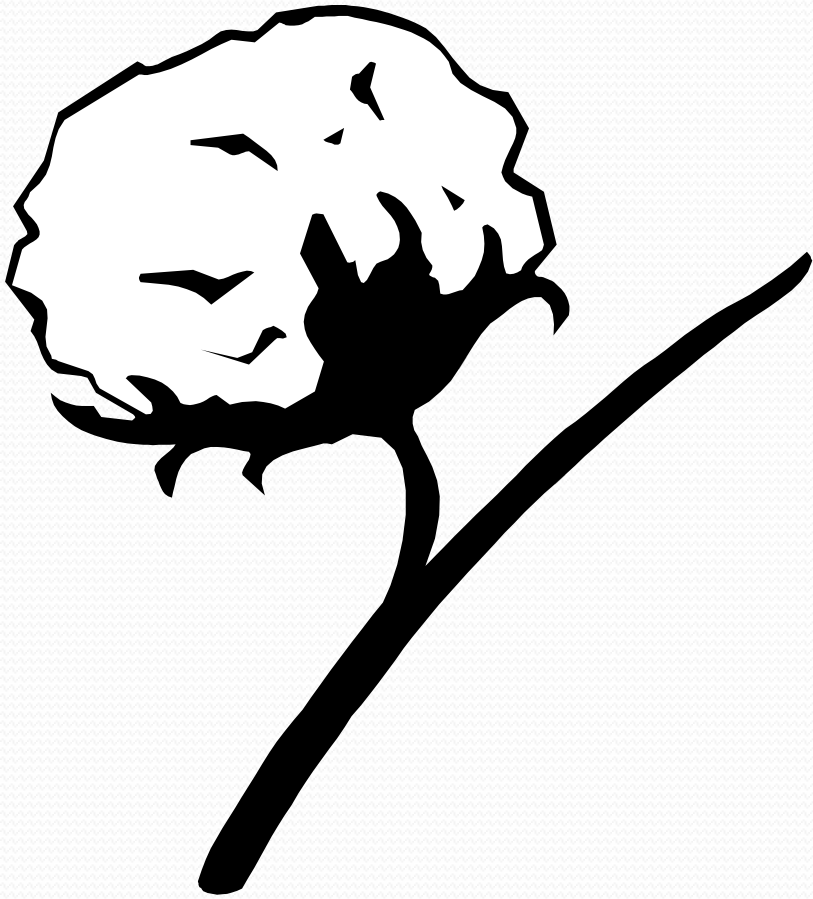
  obtained from verities of rocks .
  - Asbestos

Naturals fibers Sources

- Cellulosic (plants)
  - Cotton
    - From cotton plants
  - Flax (linen)
    - From flax stems
- Protein (animals)
  - Silk
    - From cocoons of silkworms
  - Wool
    - From fleece (hair) of sheep or lambs
- Minerals fiber(rocks)
  - Asbestos
    - From rocks

Cotton

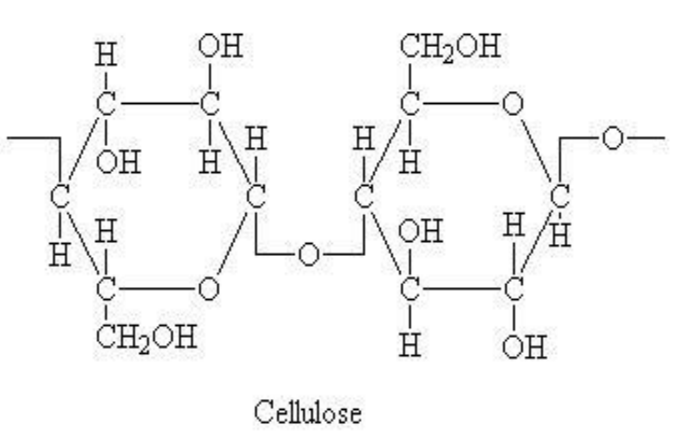
- The cotton fiber grows in the seedpods, or bolls of the cotton plant. Each fiber is composed of single elongated cell that is flat twisted and ribbon like with a wide inner hollow (lumen).cotton fiber can be used as blend with other fiber like polyester, viscose ,acrylic etc.



Cotton

- It contains 90% cellulose, 6% moisture and the remainder fats and impurities

Carbon = 46.68%
Hydrogen = 6.21%
Oxygen = 49.11%



- The outer surface is covered with a protective wax like coating which gives fiber an adhesive quality

Properties of Cotton fibers

- It has 8% moisture regain.
- The cellulose is arranged in a way that gives cotton unique properties of strength, durability, and absorbency
- Good resistant to alkali
- Poor resistance to acids
- Comfortable - there are no surface characteristics of cotton that make it irritating to human skin. Cotton feels good against skin, it has a soft hand.

- Hydrophilic cotton has a natural affinity for water.
- Moisture passes freely through cotton , aiding in evaporation and cooling.
- Good Heat Conductivity .Cotton allows heat to dissipate ,making it a wonderful fiber to maintain a comfortable sleeping temperature.

Usages of Seed Fibres

Cotton

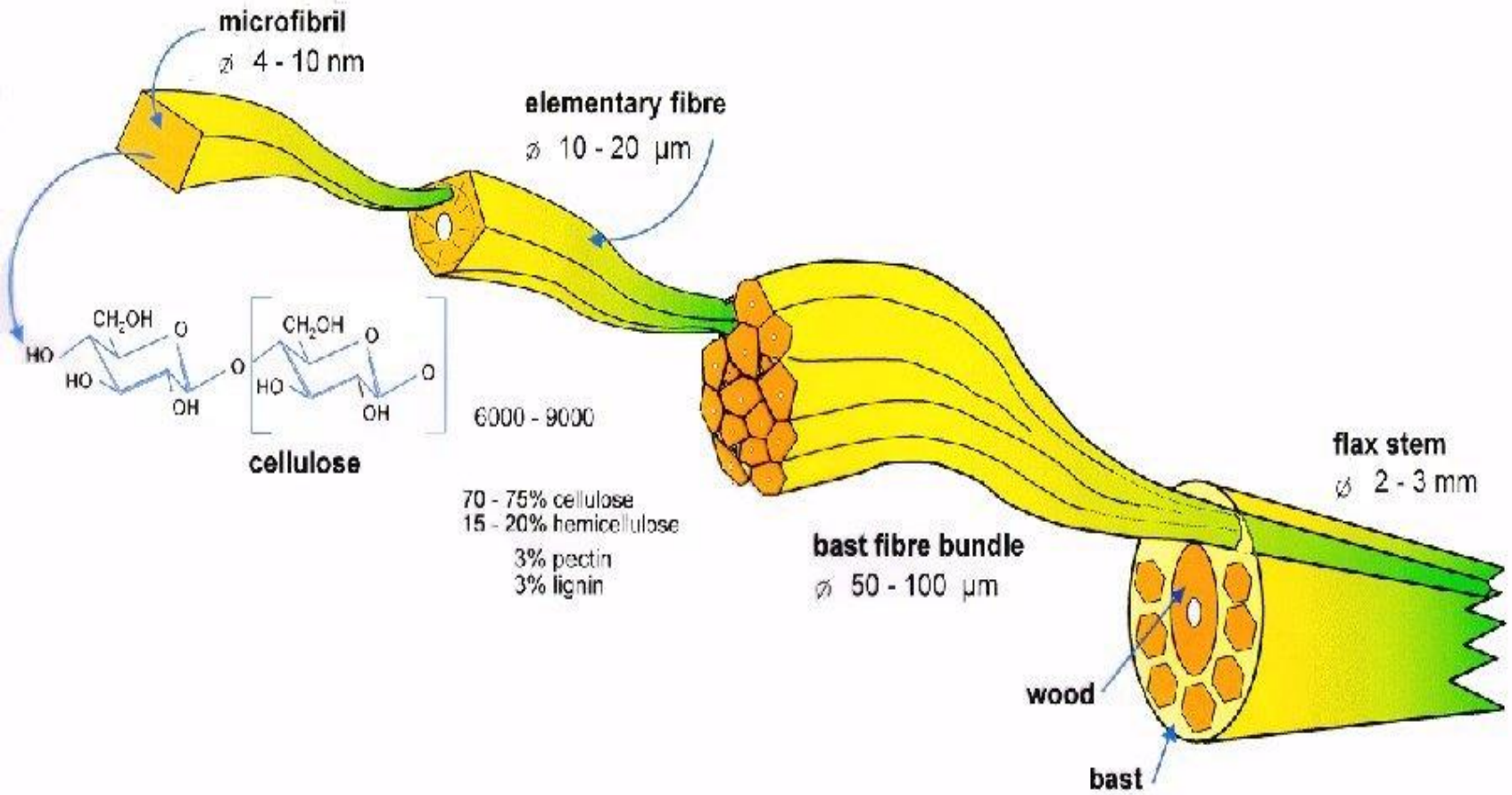
- Cotton is prized for its comfort, easy care, and affordability and is ideal for clothing, bedding, towels, and furnishings.

Bast Fibers

Flax Fiber

- The linen fiber is obtained from the stalk of the flax plant. It has lumen and composed of about 70 % cellulose and 30% pectin,ash,woody tissue and moisture.

Flax fiber bundle



Properties of flax fibers

- Flax fiber is relatively smooth and lustrous .
- More brittle and less flexible than cotton.
- Moisture regain of raw flax is 12%.

Usages of Bast Fibers

Flax

- Linen apparel includes items for:
  - warm-weather use
  - high fashion
  - casual
  - professional wear

- Technical products include:
  - luggage
  - bags
  - purses
  - sewing thread

Usges of Bast Fibers

Flax

- Home Textiles
  - Used in bed, table, and bath items for residential

Protein Fiber

- **Wool**
  - Wool is obtained from the fleece of domesticated animals like sheep and goat. It is also derived in lesser quantity from camels, yaks and rabbits. Wool is a versatile, durable and elastic fiber. It is made up of proteins. The fleece of sheep is spun to make yarn. The yarn is then weaved to make woolen clothes.

Sources of Wool fiber

- Sheep
- Goat
- Camel
- Rabbit
- Yak

SHEEP

There are many breeds of sheep that provide us wool differing in their fineness, shine, length, and resistance

The finest wool is obtained from the Merino Sheep

GOAT

Wool is also obtained from goats. The important breeds of goat found in India are Kashmiri, Gaddi, Chamba and Angora. The fibre obtained from Angora Goat is called mohair

CAMEL

The hairs on the body of a camel are also used as wool. Bactrian camel of Siberia, Mongolia and China give us the best quality wool. A male camel yields on an average 12 to 15kg of wool annually and a female camel yields about 6 to 8kg of wool.

Rabbit

Wool is also obtained from rabbit hairs. Angora rabbit gives a very fine wool.

Wool fiber properties

- The color of the wool fiber could be white, near white, brown and black.
- Standard moisture regain is 16%-18%.
- The wool decomposes under the action of sun light, fiber become discolored and develop a harsh feel.
- The elastic recovery of wool fiber is good.
- Wool is effected by insects and micro organism.

End product of wool fiber

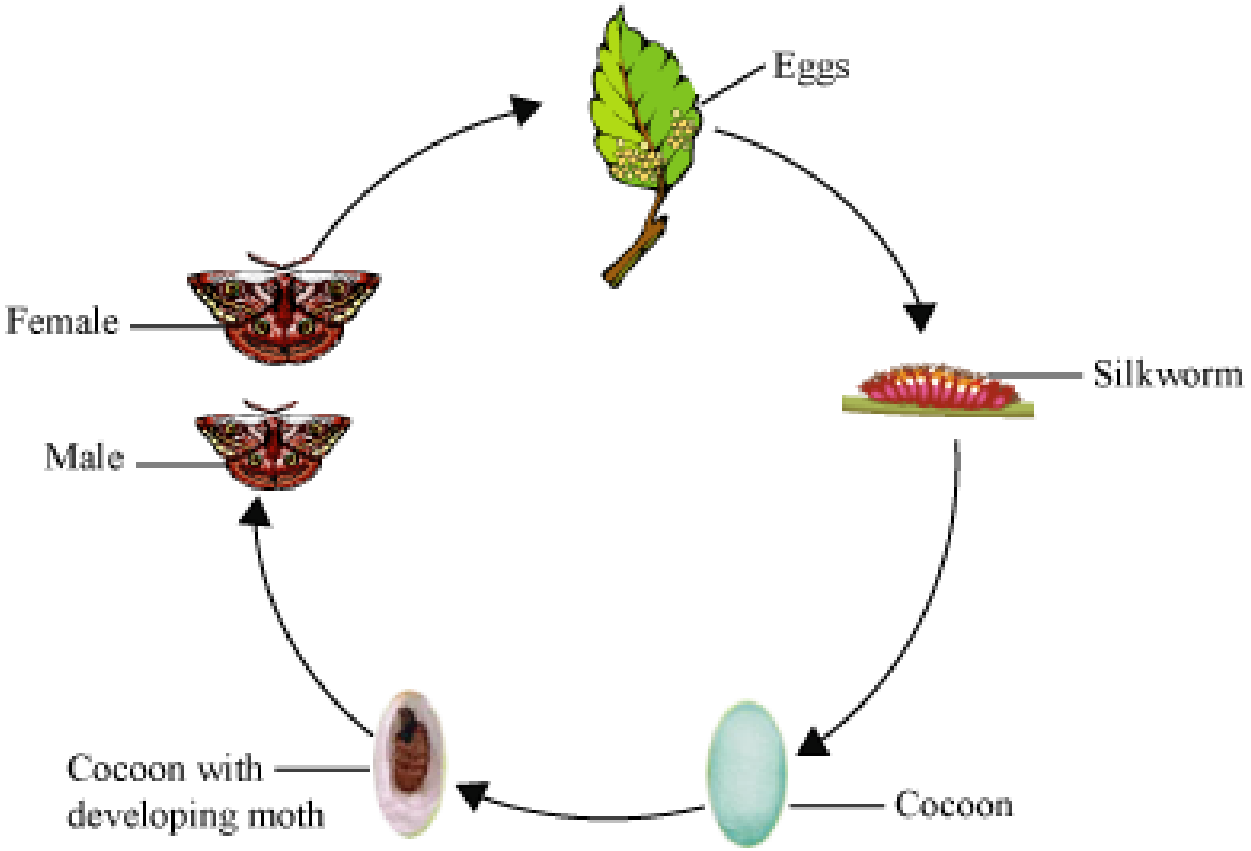
END USES OF WOOL FABRIC:

- Apparel-- outerwear, sports wear, sweaters, socks, suits
- Interiors-- carpets, wall hangings
- Industrial-- felt pieces used in machines, used to clean up oil spills

Silk Fibers

- Silk is an important animal fiber. It is strong, lustrous, soft, hard wearing and is produced in long continuous strands. It is made up of proteins. The rearing and management of silk worms for obtaining the silk is called sericulture.

Life Cycle of silk worm



Properties

- Silk is not always easily recognized. Pure silk fiber has great absorbency, making silk apparel items cool in the summer and warm in the winter. Silk is neither wrinkle or sun resistant, and over-exposure to sunlight will weaken and fade the fabric. Though silk can be hand-washed, dry-cleaning will increase the life and beauty of the fiber.

End product of Silk

Because of its strength, beauty and luxurious feel, silk fabric is used for many different things

- **Men's Clothing**
  - Men’s clothing and made with silk fiber like dress shirts, suits .
- **Women's Clothing**
  - Used in different types of dresses including wedding gowns, evening gowns, skirts and scarves
- **Home furnishing**
  - Many home items are made with silk fiber including sheets, pillow cases, table cloths and wall covering

Minerals fibers

- Asbestos is a natural fiber obtained from verities of rocks, It is fibrous foam of silicate of magnesium and calcium ,containing ion ,aluminum and other minerals. Asbestos fibre is acid proof, rust proof and flame resistant fibre. Its use has therefore been restricted due to carcinogenous nature and research shows that it can cause a breathing problem and cancer.

Man made fibers

- Regenerated Fibers
- Synthetic Fiber(organic)
- Inorganic Fiber

Synthetic and regenerated fibres

Synthetic fibres and **regenerated fibres** are manufactured. All manufactured fibres start as filament fibres.

- **Regenerated fibres** are made from natural materials, such as cellulose from wood, that are chemically processed. Viscose and rayon are regenerated fibres.

- Synthetic fibres are all **man-made** from organic **polymers**, made by refining crude oil or coal. Polyester, nylon and acrylic are synthetic fibres.

Nylon was the first synthetic fibre to be created from chemicals obtained from crude oil.

Modern fibres

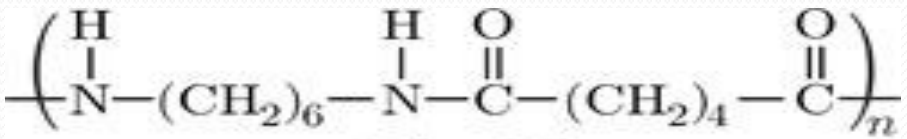
- **Microfibres** are very fine synthetic fibres, often made from polyester and polyamide. They can be blended with other fibres such as cotton. Fabric made from microfibres is lightweight and durable, and can be waterproof.

This top is made from lyocell, a microfibre made from cellullose-derived wood-pulp. It is lightweight, breathable and crease-resistant.

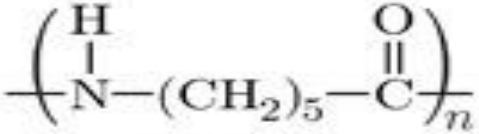
- **'Smart' fibres** are synthetic fibres which alter their properties in response to their environment, for example, changing colour in reaction to **light** or **heat**.

Nylon

- The fiber forming substance is any long-chain synthetic polyamide in which amide linkages are attached directly to aromatic rings. There are several forms of nylon, each depends upon the particular chemical synthesis, they are nylon 4,6,6 6,6,10 .



Nylon 66



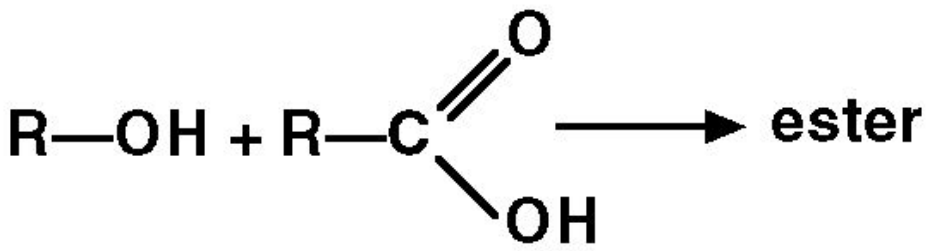
Nylon 6

Nylon

- **Nylon** is very much suitable for hosiery and the knitted fabrics because of its smoothness, light weight and high strength. Nylon is a lustrous fiber. Nylon is used for a wide variety of apparels, home furnishing and industrial applications. It has a wide use in sports items.

Polyester

Polyester is a term often defined as "long-chain polymers chemically composed of **at least 85% by weight of an ester and an alcohol and a terephthalic acid".** In other words, it means the linking of several esters within the fibers. Reaction of alcohol with carboxylic acid results in the formation of esters



(R is any hydrocarbon chemical group)

Polyester

- The most popular and one of the earliest uses of polyester was to make polyester suits. Polyester clothes were very popular ,due to its strength. Polyester was also used to make ropes in industries. PET bottles are today one of the most popular uses of polyester. It is used in apparels in pure or blend with other textile fiber.

Inorganic Fibers

- Inorganic fibers are essentially composed by inorganic chemical compounds, based on natural elements like **carbon** and other minerals such as **silicon** and **boron**, which, in general, after receiving treatment at high temperatures, are turned into fibers.
- The outstanding features of these fibers are their resistance to high temperatures and high mechanical strength. Because of these important properties they are also Known as“**high-performance fibers**”.