

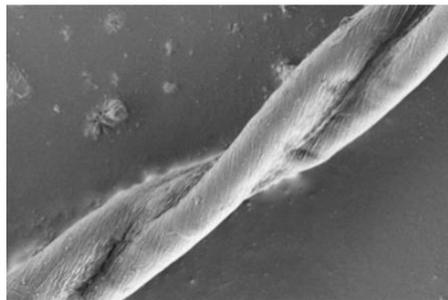
Lecture: By Dr. Priyanka Srivastava

Part-III

Fibre structure and characteristics:

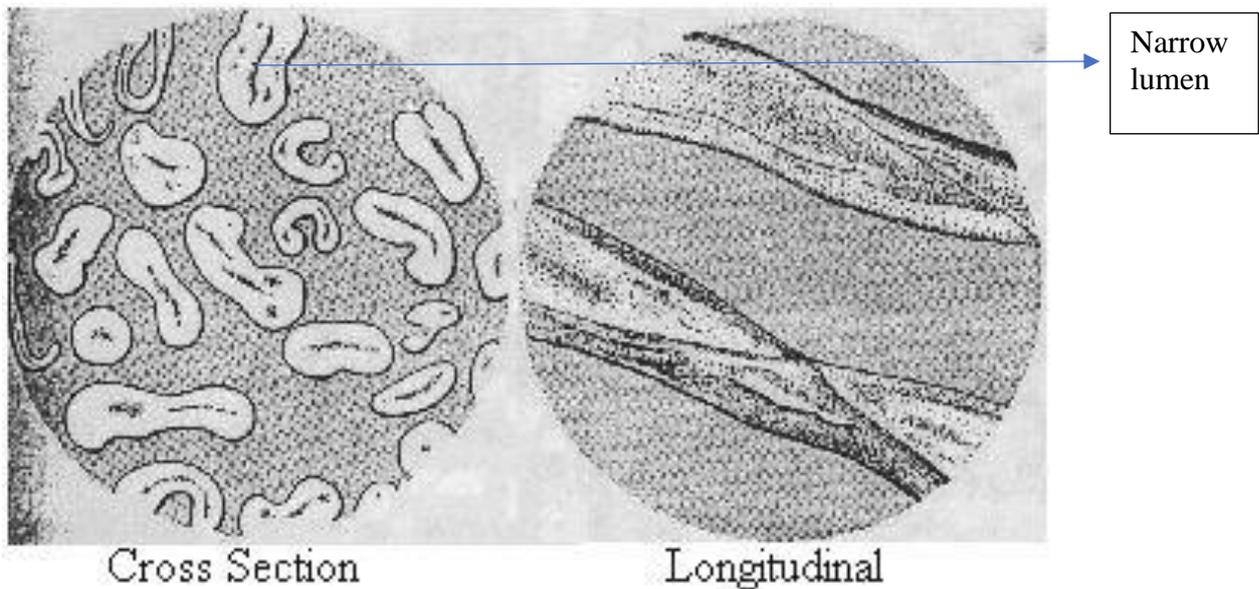
Cotton fibres have a pronounced three-wall structure. The cuticle layer consists of wax and pectin materials. This outer wax layer protects the primary wall, which is composed of cellulose crystalline fibrils. The secondary wall of the fibres consists of three distinct layers, which include closely packed parallel fibrils with spiral winding of 25 –30° and represent the majority of cellulose within the fibres. Lumen is surrounded by the tertiary wall.

Longitudinal view: Mature cotton looks like a flat, twisted, ribbon or a collapsed twisted tube. Cotton fibre consists of characteristic convolutions or twists along its length that are randomly left handed or right handed and number 40 – 65/cm.



A part of cotton fibre showing a twist

Cotton is hydrophilic and the fibres swell considerably in water. Fibres are stable in water. The toughness and initial modulus of cotton are lower compared to hemp fibres, whereas its elongation at break (5-10%) and its elastic recovery are higher. The fibres are resistant to alkali but degraded by acids. The microbial resistance of cotton is low, it burns readily and quickly, can be boiled and sterilized.



Cross sectional view: Mature cotton has been or kidney – shaped cross section, and a small lumen. However, by swelling it is almost round when moisture absorption takes place. Immature cotton also has a bean – shaped cross section but a larger lumen. Mercerised cotton looks almost round to oval, a small point at or near the centre representing the lumen.

Chemical composition of raw cotton :

a) Cellulose	=88 -97 %
b) Protein	= 1 – 2%
c) Oil and wax	= 0.4 – 1.5 %
d) Hemicellulose and Pectin	= 0.4 – 1.5 %
e) Minerals	= 0.7 – 1.6 %
f) Others	= 0.5 – 0.6%

Polymer (or) Fibre forming Substance:

Linear cellulose polymer $-(C_6H_{10}O_5)_n = 10000$

Fine Structure :

Crystalline region=65 to 70%, Amorphous region =35 to 30%

Classification of Fibres:

Cotton fibres are classified into three groups on the basis of its staple length:

1. Long staple fibres: Staple length of 2.5 cm to 6.5 cm, fine textured with good lusture. They are expensive and used in making fine fabrics. Eg. Sea-Island cotton, Egyptian cotton.
2. Medium staple fibres: Staple length of 1.3 to 5.0 cm. Have higher yield but of lower price due to its coarse texture. Eg. American Upland cotton.
3. Short staple fibres: Staple length 9.5 to 19 mm. having coarse and lustreless fibres. Used in making carpets, blankets, rugs etc. Eg. Asiatic cotton.