Microscopic appearance of Fibers

A microscope with a magnification of minimum 100 power can be used to easily distinguish between different types of fibers. The Foldscope microscope has a magnification power of 140x. If you couple a Foldscope microscope to a cell phone that has 10x zoom capability, you can magnify objects up to 1400x (140 x 10).

Among microscopic tests and chemical tests, microscopic tests are mainly used for identifying natural fiber . This visual test can identify natural fibers more easily than manmade ones. Synthetic fibers are very similar in appearance and the large number of varieties makes it a little tough to distinguish synthetic (manmade) fibers even under a microscope. Chemical treatments are often required to distinguish between manmade fibers.

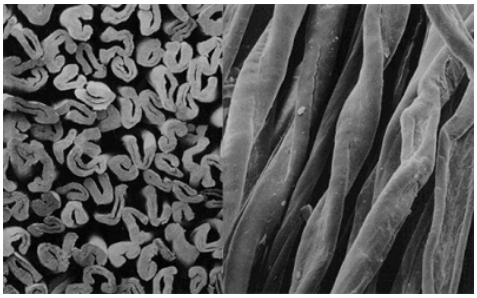
This lesson will describe the appearance of several types of fibers:

1) Natural Fibers
    a. Plant
        i. Cotton
        ii. Linen
        iii. Hemp
        iv. Jute
        v. Ramie
    b. Animal
        i. Wool
        ii. Silk
2) Artificial (manmade) Fibers
    a. Rayon
    b. Cellulose acetate
    c. Acrylic
    d. Polyester
    e. Nylon

Natural Fibers: Vegetable Fibers

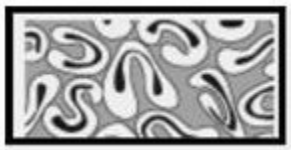
1. Cotton

Longitudinal View



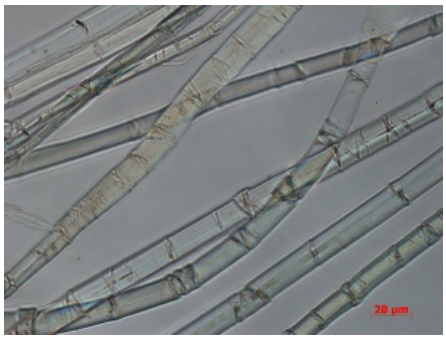
- Mature flat and ribbon-like with convolutions, thick wall and small lumen (channel that runs down the center of the fiber)
- Immature very thin wall and a large lumen with few convolutions

Cross-Sectional View



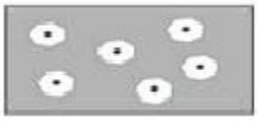
- Kidney Shaped
- Elliptical
- Very thin like a strip
- Nearly round or circular

2. Linen



Longitudinal View

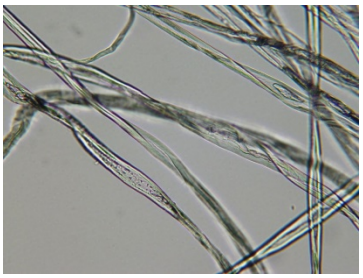
Smooth and Bamboo like with cross marking nodes, no lengthwise striations, narrow lumen



Cross-Sectional View

Sharp polygonal shape with straight sides. Immature oval shape with a large lumen.

3. Hemp



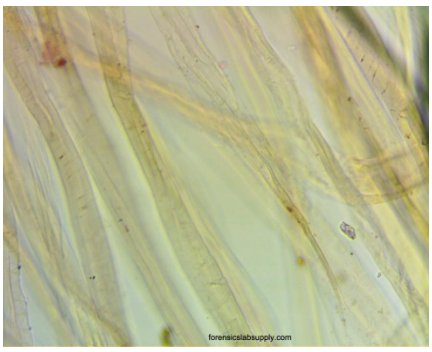
Longitudinal View

Smooth and cylindrical with a cross marking nodes, no lengthwise striations, broad lumen

Cross-Sectional View

Partly polygonal

4. Jute



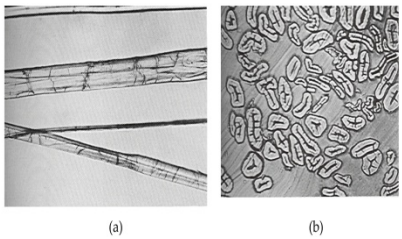
Longitudinal View

Cylindrical with uneven in diameter, a lumen is broad and varies greatly

Cross-Sectional View

Rounded polygonal with a central lumen

5. Ramie



(a) (b)

Longitudinal View

Irregular and broad with cross marks irregularly distributed,.

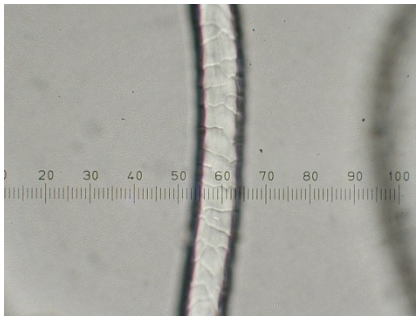
Cross-Sectional View

Oblong

Natural Fibers: Animal Fibers

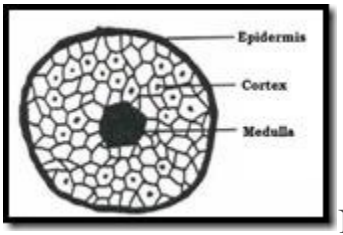
1. Wool

Longitudinal View



Cylindrical, irregular, rough surface, scale-like structure, dark medulla may appear on coarse wool fibers

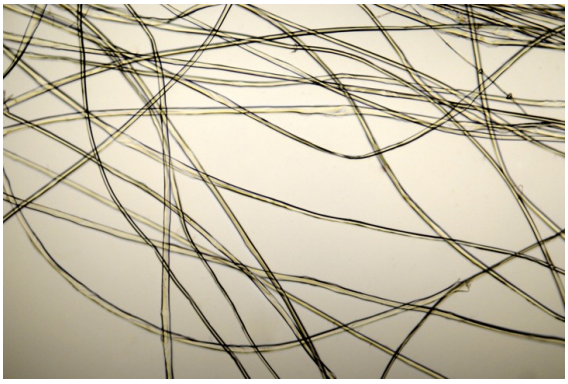
Cross-Sectional View



Nearly round or circular, medulla may be visible

2. Silk

Longitudinal View



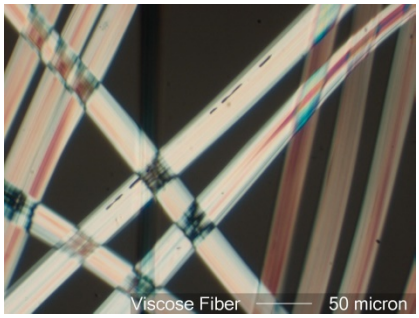
Smooth surface, Structureless, triangular shaped transparent rod(Wild silk/Tussah silk – broader fiber with fine, longitudinal lines passing across filament)

Cross-Sectional View

Triangular shape with rounded corners(Tussah silk flat wedge or spindle-shaped

Man-made Fibers

1. Viscose Rayon



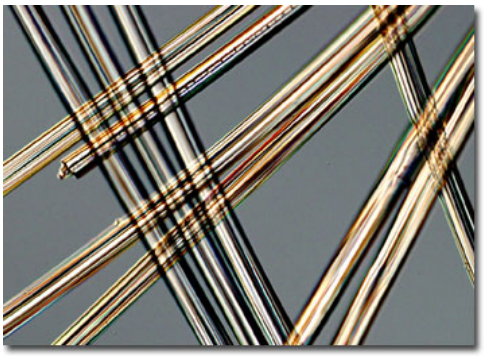
Longitudinal View

- Normal type fairly dense longitudinal striations or fine lines
- Special type-may be smooth and Structure less

Cross-Sectional View

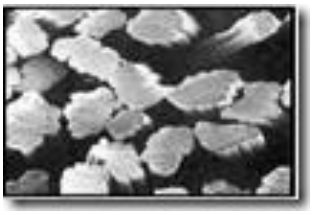
- Irregular with a serrated outline
- Oval or round

2. Cellulose Acetate fibers



Longitudinal View

Uniform in width with a few distinct longitudinal striations



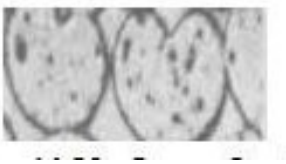
Cross-Sectional View

Irregular with a serrated outline

3. Acrylic

Longitudinal View

Smooth surface, uniform diameter, rod-like appearance, some types with irregularly spaced striations



Cross-Sectional View

Rounded or Dumbbell shaped

4. Polyester

Longitudinal View

Structureless, uniform diameter, rod-like appearance

Cross-Sectional View

Circular

5. Nylon

Longitudinal View

Structureless, uniform diameter, rod-like appearance

Notes

1) Flax, Jute, Hemp and Ramie are all soft woody fibers obtained from the stems or stalks of plants. Their morphology appears very similar under a light microsope.
2) Artificial, manmade fibers all look quite similar. Their morphology reflects the manufacturing process. These are difficult to differentiate visually, melting point measurements and response to chemical treatments are typically used to tell these apart.

References

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