FLAX FIBER

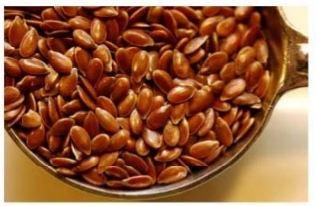
Bast Fiber

Flax Plant

Introduction

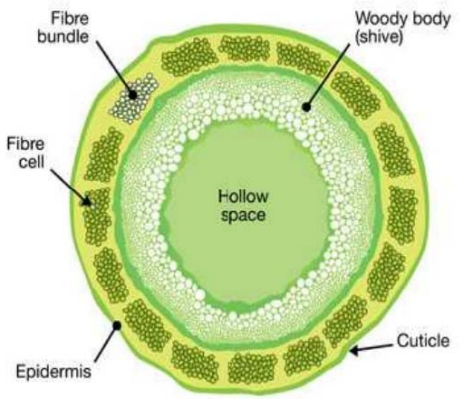
- Flax fiber comes from the stem of a plant **"Linum Usitatissimum".**
- The fibers form bundles or strands that are present in the fibrous layers lying beneath the bark of the plant.
- In the inner bark of this plant there are long, slender, thick-walled cells of which the fiber strands are composed.

- Flax Plant grows to a height of about 0.5–1.25 meter
- Stem has diameter between 1.6 and 3.2 mm
- Seeds in the plant are contained in small spherical balls, at the top of the stalks; this is called the linseed, from which linseed oil is produced.



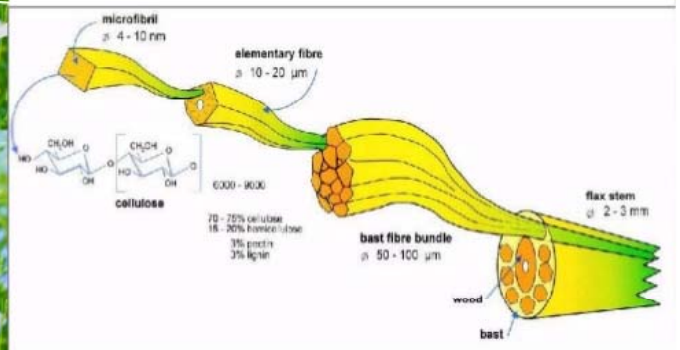
History of Flax Fiber

- Flax was probably the first bast fiber to be used by man for making textiles.
- During the 17th century, linen manufacture became established as a domestic industry in many countries of Western Europe.
- During the 18th century, with the rise of cotton, the linen industry was forced into the background.
- Countries of production: Canada, Russia, China, India, UK



Cross-Sectional View of Flax Plant

Microscopic View of Flax Plant Stem



Composition %age of Bast Fibers

FIBROUS MATERIAL:	CELLULOSE	HEMI- CELLULOSE	LIGNIN*
FLAX	70 – 75	15- 20	2.0 -3.0*
HEMP	67-75	16 – 18	2.9 -3.3*
JUTE	59 – 71	12 – 13	11.8-12.9*
KENAF (bast)	65	13	21.6*

* *The higher the lignin percentage, the lower the quality.*

Production and Processing of Flax Fiber

The flax fiber plant produces a taller stem.

The steps which are involved in the production and processing of flax fiber are:

- Cultivation
- Harvesting
- Rippling
- Retting
  - Dam Retting
  - Dew Retting
  - Tank Retting
  - Chemical Retting
- Breaking & Scutching
- Hackling

Cultivation Process

- Flax plant is sown in March or April
- Has very short growing period (100 days)
- They produces less branches and longer finer fiber
- When plants have flowered and seeds are ripened, crop is pulled by root.

Harvesting Process

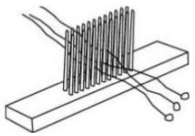
- Harvesting can be done after 30 days of flax plant blooming/growing
- Harvesting should be done on a warm, sunny day
- Pull (don't cut) the plants by grasping below the roots
- Brush off the dirt from the roots
- Stack the flax plant into bundles, and place the tied bundles in a sunny location to dry
- Harvesting can be done both by manual and mechanical methods

Harvesting Process

Rippling Process

Rippling is the process that removes the seeds and leaves from the stem.

Wooden Device



Iron Device

Retting Process

Retting is the process that softens and separates the fibrous core of the plant from the outer layer which is composed of woody matter.

Retting is carried out in the following four ways:

1. Dam Retting
2. Dew Retting
3. Tank Retting
4. Chemical Retting

Dam Retting

Dew Retting

Chemical Retting

Retting can be carried out chemically by treating the flax straw with the solutions of:

- Caustic Soda
- Sodium Carbonate
- Acids
- Soap

• Cottonization Process

Breaking and Scutching Process

Breaking:

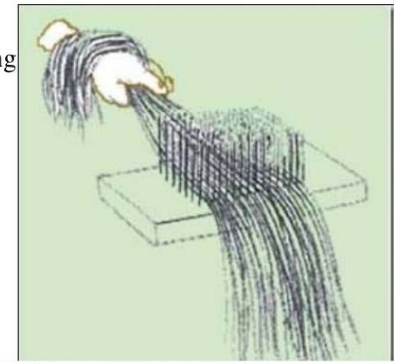
The flax straw is passed between fluted rollers in a breaking machine, so that the woody core is broken into fragments without damaging the fibers running through the stem.

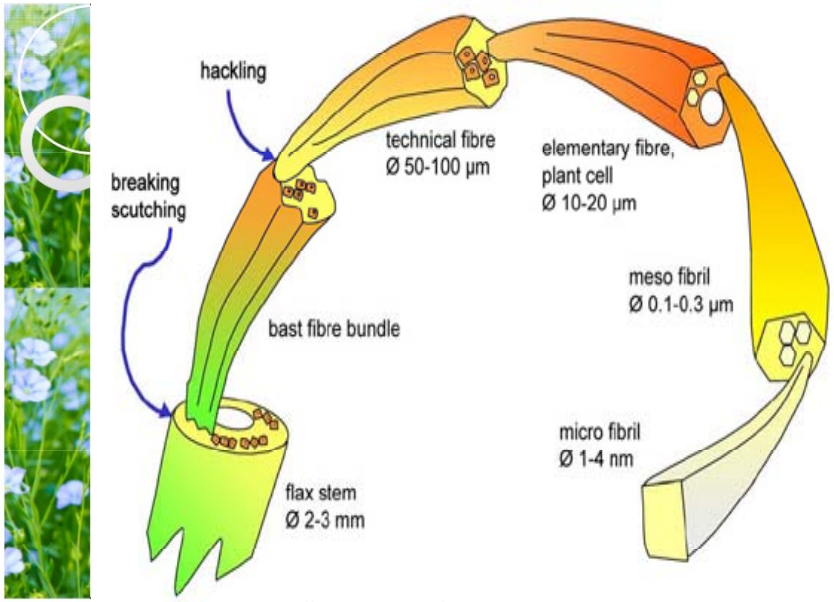
Scutching:

The broken straw is then subjected to the process known as "Scutching" which separates the unwanted woody matter from the fiber. This is done by beating the straw with blunt wooden or metal blades.

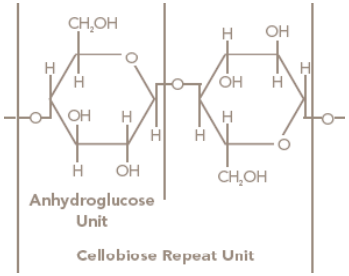
Hackling Process

Hackling separates the long line fibers from the shorter tow. A hackle is a bed of pins, which are usually used to comb the fibers for drawing and aligning purposes.



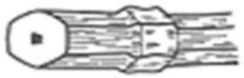


Polymer of Flax Fibers



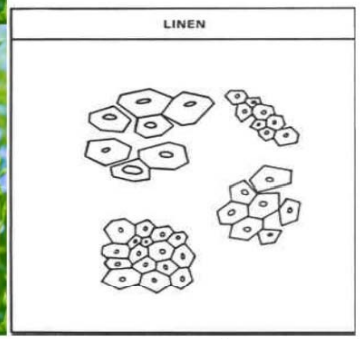
DP=18000 cellubiose unit
Length of polymer= 18000 nm
Thickness of polymer= 0.8 nm
Fibril oriantation angle=6 degree

Cross-section is polygonal

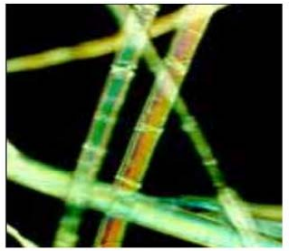


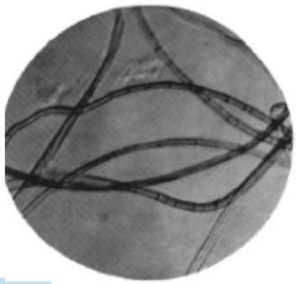
Polygonal, lumen

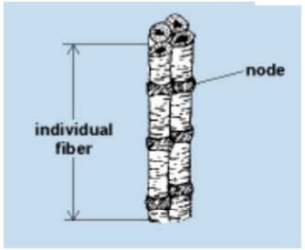
Flax



Structure of Flax Fiber

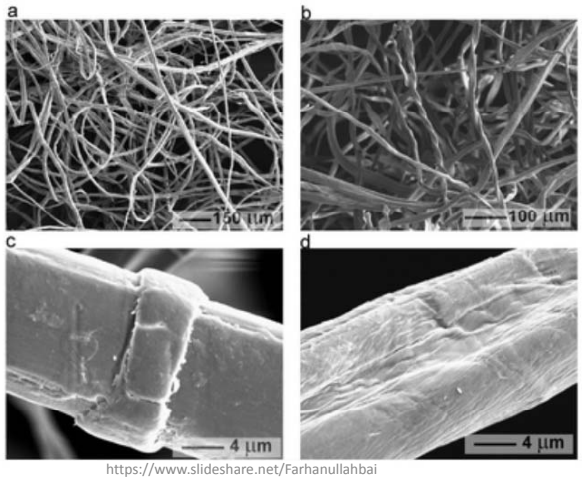






Longitudinal View

Comparison of Flax & Cotton fiber:



Properties

1. **Fiber Surface & Appearance:** Soft, yellowish white in color and Lustrous appearance
2. **Tensile Strength:** *Wet flax fiber is 20% stronger than dry*

   Tenacity = 2-7 gm/denier (18~63 GPT)
3. **Elongation:**

   Elongation at break = 1.8% dry, and 2.2% wet
4. **Elastic Properties:** The very inelastic natures due to very crystalline polymer system.
5. **Specific Gravity:** 1.54
6. **Length:** 30~38 cm

Properties

6. **Effect of Moisture:**

   Moisture Regain = 12%
7. **Effect of Heat:** Highly resistant up to 120ċ
8. **Effect of Sunlight:** Loss of Strength
9. **Effect of Acids:** Effected by hot dilute and cold concentrated acids
10. **Effect of Alkalis:** Good Resistance to alkaline solution

Properties

11. **Effect of Insects:** Not attacked by insects
12. **Effect of Microorganisms:** In wet condition, attacked by mildew but highly resistance in dry condition
13. **Effect of Solvents:** Not adversely affected by dry-cleaning solvents in common use
14. **Chemical Properties:**

    Difficult to bleach and dye because it is harder and rigid than cotton.

End Uses

Demand when extra strength and resistance to moisture required.

Expensive as compared to cotton due to production method

Generally used in:

- Sail Cloth
- Tent
- Shoe threads
- Sewing threads
- Handkerchiefs, towels, tablecloth, sheets
- Garments

https://www.slideshare.net/Farhanullahbaig/Flax-Fiber