Discipline: Botany

Paper: Plant Resource Utilization

Lesson: Fibers-Jute

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Learning Outcome

- ✓ **What are fibers?**
- ✓ **Classify fibres based on their origin?**
- ✓ **What are the steps involved in Jute processing?**
- ✓ **What is jute used for?**

General Introduction

The word 'fibre' has various meanings, considering the logic in which it is applied. Fibres are hair like materials that are discrete group or continuous pieces. They can be matted into fabric, paper or any other form/product. Fibers may be natural, synthetic or semi-synthetic.

The significance of a plant to yield fibers is considered as **second only to food**. Since ancient times, fibres satisfied one of the three basic needs for human lives- food, clothing and shelter (roti, kapda aur makan). In fact, diverse utilization of fibres for humans is directly related to progression in civilization and technological advancement. It is well known reality that for clothing, primitive human was not only dependent on skin and hide but also on plant leaves and other plant parts. Further, in modern world, with expansion of human needs and desires their dependency on plant fibres greatly multiplied.

The Fibers are derived from various flowering plants belonging to different families, mostly tropical in origin. The important fibre yielding plants include families Malvaceae, Linaceae, Tiliaceae, Musaceae, Bombacaceae, Arecaceae, Liliaceae, Poaceae, Moraceae, Asclepiadaceae and Bromeliaceae etc.

Realizing the significance of fibres and to promote natural fibres, United Nations General Assembly observed 2009 as International Year of Natural Fibres.

Classification

Fibres are variously classified, depending on their sources or origin - natural or man-made. Natural fibres are fibres obtained from plants or from animals. On the contrary, man-made fibres are synthetic in nature (either purely synthetic or regenerated from natural sources). Again, the fibres that

originate from plants i.e. vegetable fibres may be classified into various categories either based on their morphological and anatomical origin or based on their uses. The various systems of classifications are described in the following sections.

Classification based on source or origin of fibre

Vegetable Fibres: Vegetable fibres, plant fibres or botanical fibres are the natural fibres obtained from plants. Vegetable fibres are mainly composed of cellulose. Examples: jute, cotton etc.

Animal Fibres: Animal fibres are the natural fibres obtained from animals. Animal fibres are mainly composed of proteins such as keratin, collagen and fibroin.

- Animal hair and wool: Animal fibres or wool is obtained from hair of various animals. Examples: Goat hair, horse hair, sheep's wool etc.
- Avian fibres: Animal fibres obtained from bird's feathers.
- Silk fibres: It is obtained from silkworm insects that secret silk fibres by glands during cocoon formation.

Man-made Fibres: Unlike natural fibres (those obtained from either animals or plants), some fibres are synthesized by man.

- Synthetic Fibres: It includes fibres of mineral origin such as asbestos, spun glass etc. Some synthetic fibres are synthesized from petrochemicals. Examples: Nylon, polyester, polypropylenes and acrylic fibres.
- Semi-synthetic or Regenerated Fibres: These fibres are obtained from chemically processed cellulose (e.g. Rayon, Tencel) or

chemically processed proteins (e.g. ardil from groundnut protein). Fibers are also regenerated from soybean protein or milk protein.

Classification of vegetable fibres based on their morphological and anatomical origins

- **Bast Fibres:** This category of fibres include fibres derived from the cortex, pericycle and phloem. Fibres are also called as extra-xylary fibre or stem fibre or soft fibre. For separation of fibre from the central part of the stem, a microbiological process i.e. retting is required. Bast fibres are moderately durable and resistant to any rough treatment. Bast fibres are mainly extracted from dicotyledonous plants. Some bast fibre yielding plants include jute, flax and hemp etc.
- **Surface Fibres:** This category of fibre is obtained from surface of seed, fruits, leaves and stem.

  Hairs: Trichomes originate on the surface of the seed or inner wall of the fruit. Ginning is required to separate fibre from seed. Examples: cotton and *Calotropis* etc. Trichome derived from inner wall of the capsule also yield fibre. Example: Kapok or Silk cotton tree (*Ceiba pentrandra*).

  Mesocarp of fruit: Coir fibre derived from the mesocarp (husk) of the coconut fruit (*Cocos nucifera*).

- **Leaf Fibres:** These fibres are derived from the lamina and petioles of some monocotyledonous plants. The scattered fibro-vascular bundles provide the highly lignified and coarser fibres. These leaf fibres are weaker than stem fibres and separated by mechanical extraction. Examples: Sisal (*Agave sisalana*), Musa or Abaca (*Musa textilis*).

- **Wood or xylary fibres:** Wood fibres originate from xylary tracheids of some of the species of shrubs and trees and are widely used for paper making. The softwood fibres are preferred over hardwood fibres for paper making. The principal source of pulpwood include *Abies*, *Picea*, *Pinus* etc.

Classification of fibres based on their uses:

Vegetable fibres can be classified into various categories according to their uses as summarized in the following table:

Table : Various groups/categories of fibers with their uses and source plant

Groups/ Categories	Uses	Source plant of the Fibres
Textile Fibres	For fabrics and netting, the fibres needs to be spun into threads and then woven and used for luxury clothing, domestic and commercial fabrics, tents etc. For cordage fibres, the fibres needs to be twisted only and these fibres are used for ropes and twines.	cotton, hemp, jute, flax and ramie. abaca or Manila hemp, sisal, hemp and flax.
Brush or broom Fibres	Twigs, bark or leaves of various plants may be the source of such fibres.	piassava fibre (palm leaves and stem), broomcorn (inflorescence of *Sorghum*

		vulgare var. *technicum*).
Filling Fibres	These fibres are used in upholstery, and for stuffing the mattresses, pillows and cushions etc.	kapok, cotton or jute etc.
Natural Fibres	Layers and sheets extracted from bark of some plants yield rough clothing after pounding.	tapa cloth obtained from bark of paper mulberry (*Broussonetia papyrifera*).
Paper-making Fibres	*Stipa tenasissima* (esparto grass) commonly used for manufacture of specialized paper in U.K.	These fibres are derived from the various plant species belonging to more than 44 different families of plants, including Cyperaceae, Poaceae, Arecaceae, Musaceae, Malvaceae, Linaceae, Tiliaceae.
Plaiting and rough weaving Fibres	More elastic strips/ plaits of fibres are roughly woven to baskets, chairs, mats, hats, sandals and thatched roofs of houses.	Sisal, Bamboo, stem of wheat, barley, rice etc.

Table : Some Other common fibre yielding plants with their origin

Botanical name	Family	Common Name	Type of fibre
Crotalaria juncea	Fabaceae	Sunn hemp, Sann	Bast fibre
Linum usitatissimum	Linaceae	Flax, Linseed, Alsi	Bast fibre
Boehmeria nivea	Urticaceae	Ramie, China grass, Rhea	Bast fibre
Cannabis sativa	Cannabaceae	Bhang	Bast fibre
Musa textilis	Musaceae	Abaca, Manila hemp	Leaf surface fibre
Agave sisalana	Agavaceae	Sisal	Leaf surface fibre
***Gossypium* Species**	Malvaceae	Cotton, Kapas	Seed surface fibre
Calotropis procera	Apocynaceae Subfamily: Asclepiadeae	Aak	Seed surface
Ceiba pentandra	Bombacaceae	Silk cotton tree, Kapok	Inner wall of the fruit surface
Cocos nucifera	Arecaceae	Coconut	Fruit surface fibre Coir (mesocarp)

Source: Author

Jute (*Corchorus* species)

Jute is a vegetable fibre or plant fibre, popularly called as **golden fibre** due to its colour and cash value. Jute is second only to cotton in world's production of fibres. Jute is also considered as fiber of future not only due to its biodegradable and eco-friendly nature but also its low cost and strength among all natural fibres.

Origin of word Corchorus: Greek literature- 'korkhoros' meaning 'pot herb'

Botanical name: *Corchorus* species
C. capsularis (white jute)
C. olitorius (tossa jute)

Systematic Position:

Family: Malvaceae (Earlier placed in Tiliaceae)
Sub family: Grewioideae

Chromosome Number: 2n = 14
Vernacular Names: Pat or Patson (in hindi)

History and Origin

The centre of origin for *C. capsularis* is Indo-Burma. While the primary centre of origin of *C. olitorius* is Africa with a secondary centre in Indo-Burma or India.

Production

Before 1947, India dominated in Jute production and produced 99 per cent of the world's production. After partition, most of the superior jute cultivation land area went to west Pakistan (now Bengladesh) whereas India retained the jute mills. In 2012, India contributed 55.1 percent of total

world's jute production and ranked first among world's jute producing countries (Table).

Table : Top five jute producing countries with their per cent of total world's production

Country	Production in 2012 (metric tonne)	Per cent of total world's production
India	**1,910,000**	**55.1**
Bangladesh	**1,452,044**	**41.9**
China	**45,500**	**1.3**
Uzbekistan	**20,000**	**0.57**
Nepal	**14,424**	**0.41**

Source: Data extracted from FAOSTAST, 2014

In India, during 2012- 13, West Bengal was the largest producer followed by Bihar, Assam, Andhra Pradesh and Orissa (Table).

Table : State wise jute production in India during 2012-13 in decreasing order of production

State	Area (000 hectare)	Production (000 *bales)	Yield (Quintals/ hectare)
West Bengal	**577**	**8349.0**	**2605**
Bihar	**139.1**	**1690.0**	**2182**
Assam	**70.0**	**823.0**	**2166**

Andhra Pradesh	**25.0**	**225.0**	**1620**
Orissa	**22.4**	**177.7**	**1427**
Meghalaya	**12.6**	**86.31**	**1236**
Total	**827.7**	**11406.7**	**2553**

*** 1 bale = 180 kgs.**

Source: Directorate of Jute Development, Ministry of Agriculture, Govt. of India)

Morphology of Plant

Both the species of cultivated jute are tall ranging from 3-4 m, woody, annual, usually unbranched or with few branches at top. Leaves are simple, alternate, ovate, serrate margins with characteristic curved bristles. Flowers are yellow in colour, solitary or arranged in few flowered cymes. Fruits are capsule with many seeds.

***Corchorus capsularis* (white jute/tita/bitter pat):**

It is lowland species. It is a highly adaptable species and is grown on 75 per cent of total cultivated area in India, but quality of whitish fibre is inferior. It is 3 - 3.7 m tall with ovate glabrous leaves having a bitter taste due to presence of 'corchorin', a bitter glycoside. Due to its bitter taste, the species is locally known as tita or bitter pat. Yellowish flowers mature in to small, globular and wrinkled capsules and produce chocolate brown seeds (Figure).

Historically, this species was used not only for rope and twines for household and other purposes but also for making handmade clothes. Abul Fazal's *Ain-e- Akbari*, an ancient book (1590), reveals that villagers of India used to wear clothes made from jute.

Figure : *Corchorus capsularis*: morphology of plant showing its various parts. Note the characteristic features of capsule.

Source:

http://upload.wikimedia.org/wikipedia/commons/1/16/Bekl%C3%A4dnadsv%C3%A4xter%2C_Corchorus_capsularis%2C_Nordisk_familjebok.png

http://www.stuartxchange.org/PasauNaBilog.html

***Corchorus olitorius* (tossa jute/mitha/sweet pat):**

It is upland species and cannot tolerate waterlogged conditions but yields much better quality of fiber than *C. capsularis*. Comparatively, it is much taller species than *C. capsularis* and has leaves with shining upper surface and coarse under surface; they do not have bitter taste (due to absence of corchorin). Locally, the species is also known as mitha or sweet pat due to its tasteless leaves; it is also used for culinary purposes. Flowers are yellowish, relatively larger in size in comparison to *C. capsularis*, and at maturity develop into a long, cylindrical, ridged capsules with characteristic beak (Figure), and produce bluish green to black coloured small seeds.

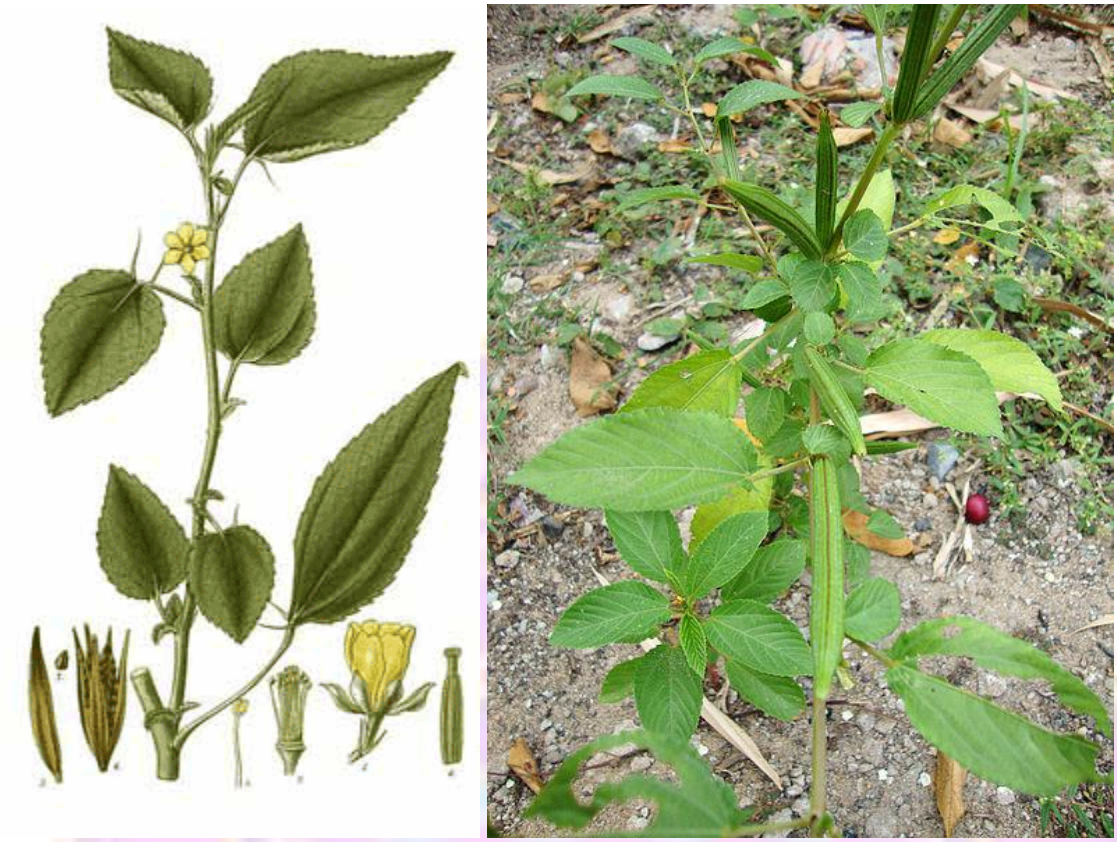


Figure : *Corchorus olitorious*: morphology of plant showing its various parts. Note the characteristic features of capsule.

Source:
http://commons.wikimedia.org/wiki/File:Corchorus_olitorius.jpg

http://commons.wikimedia.org/wiki/File:Corchorus_olitorius_(3).JPG

Ecology and Cultivation

Jute is primarily a monsoon crop. It grow in warm and humid climate, requires loamy or alluvial soil and standing water. It thrives best where

annual rainfall ranges from 150 to 250 cm, temperature from 20°C to 40°C and 70 to 90% relative humidity.

The crop is mainly cultivated in Ganga-Brahmaputra delta and their tributaries. Sowing is done from March to early June depending on species, rainfall and type of land. Seeds are sown by broadcast or dropped in furrows or line using drills. The seed are sown closely to produce unbranched jute plants. Unlike cotton, jute does not require much of fertilizers and pesticides. In early stages, weeding is needed.

Harvesting

The plant matures in four to six months. It is harvested from June to September depending upon month of sowing (early or late). Early harvesting gives low yield, lack strength but white coloured fibre; whereas, late harvesting produces more yield but coarser fibres. For optimum yield and good quality fibres, it is advisable to harvest crop when half of the plants are at fruiting stage.

The jute plants are cut close to the ground level with the help of sickle or pulled out/uprooted by hand in case the land is flooded **(Figure)**. The stems are now tied into bundles and left in the field for 2 to 3 days for the leaves to wilt and shed off.

Figure : Jute crop field during harvesting

Source: http://julzcrafts.com/tag/julz-craft-supplies/

Stem Anatomy and location of fibres

Jute fibre is a bast fibre or stem fibre derived from the secondary phloem. The fibre surrounds the woody central part of the stem. In fact, it is located **in wedge-shaped bundles outside the xylem (Figure)**. Fibres are grouped in concentric rings alternating with the thin walled tissue. This thin walled phloem tissue breaks up through microbiological decomposition during retting.

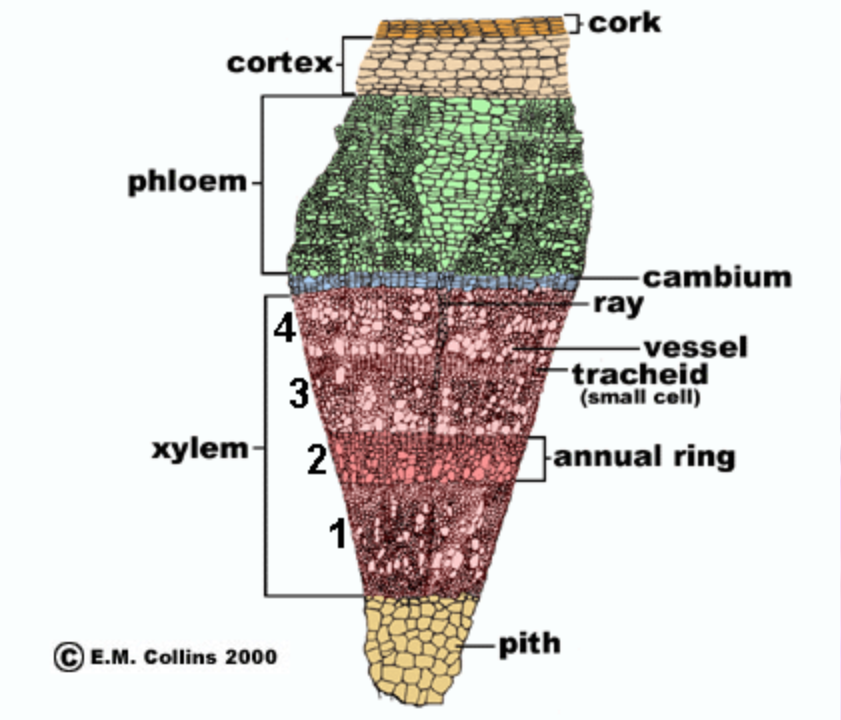
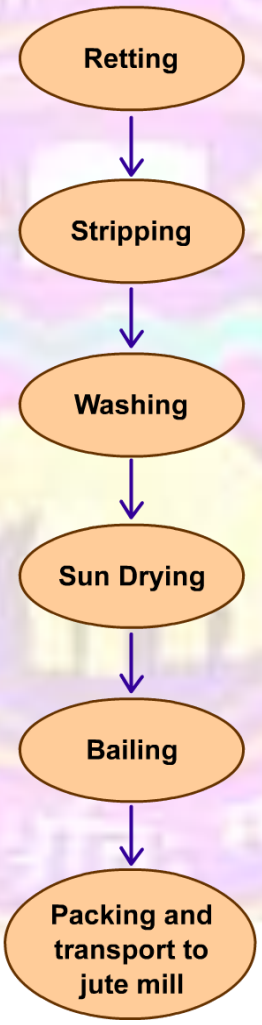


Figure : T.S. of Jute stem showing the phloem wedges, the source of fibre.

Source: http://waynesword.palomar.edu/exm5hint.htm

Processing of Jute (Extraction of Fibres)

Bundlles of leafless stalks of jute, are transported from field to nearest water bodies for extraction of fibre. Stagnant water body such as pond or ditch are used for steeping the bundles. Sometime slow-running water is preferred for steeping the bundles for good Retting as stagnant water spoils the quality of fibres. To extract fibres from woody central part of the jute stem, the following steps are need to followed **(Figure)**.



Source: Author

Figure: Flow chart showing various steps involved in processing/extraction of raw jute fibres.

(A) Retting

(Source: http://www.globalnaturalfibres.org/jute)

(B) Stripping

(Source: http://upload.wikimedia.org/wikipedia/commons/a/a5/Jute_fibre_extraction.jpg)

(C) Sun drying

(Source: http://en.wikipedia.org/wiki/File:Jute_Drying_Roadside.jpg)

(D) Bailing

(Source:http://www.jci.gov.in:8080/jci/common/JCI_Photo/IMG_0479.JPG)

Figure: Pictures showing various steps involved in processing/extraction of raw jute fibres: (A) Retting, (B)Stripping, (C) Sun Drying, and (D)Bailing .

Retting

Retting is a microbiological process which loosens the outer bark as well as separates the fibres from the woody central stalk during steeping **(Figure A)**. Bundles may be arranged in many layers on top of each other at right angles to the first in deep water. Bundles may be loaded with logs of wood or banana stem to ensure the bundle remain submerged/steeped in water to at least half to one meter depth.

The retting usually takes 10 to 30 days, depending upon maturity of the crop, the quality of retting water and its temperature. Depth of immersion and nature of water body (i.e. stagnant or flowing) also influence retting process and determines its completion.

Recently, **ribbon retting** technology is widely adopted over the conventional stem retting. Only the outer skin, also called as ribbon is retted, the process is called as ribbon retting.

When the bark is easily peeled off from the stick or woody part, the retting is considered completed and the fibres are ready for stripping.

Stripping

After retting, next step is stripping or extracting the fibre. It is the process of removing the fibres from the central woody stick **(Figure B)**. Firstly, the root or 'butt' ends needs to be beaten with wooden mallet so as to loosen the fibre, then, fibres can be separated from the stick.

Washing

The stripped fibres are washed in clean water to remove the adhering periderm and pith. To remove the black colour, extracted fibers can be dipped in tamarind water for 15 minutes and again washed in clean water.

Sun drying

After washing, the excess water can be squeezed off and then fibres are spread out on bamboo railing for sun drying for two to three days **(Figure C)**.

Bailing and Packing

The dried fibres depending on their quality or grades are rolled into bundles and pressed into bales **(Figure D)**. After bailing (kutcha bales), the packed raw jute is ready to transport to jute market or direct to jute mills.

Characterization and Composition of Fibre

Jute fibres range from 1.83 to 3.05 m in length are pale yellow or yellowish white and weaker than that of hemp and flax. Jute fibre is composed of cellulose and lignin. **It contains 53 - 63 % cellulose (in cotton more than 90%); hemicelluloses, 22 - 26%; lignin 11-12% and other components** such as waxes, gums, fats and minerals. High content of lignin (in comparison to cotton) reduces its durability.

Tests for Lignin

- Fibres + Aniline hydrochloride/Aniline sulphate = Fibres turns bright yellow
- Fibres + Few drops of acidified phloroglucinol (a saturated solution of phluroglucinol in 18% HCl)= Fibers turns cherry red

Explaination: In these reactions, lignin present in the cell wall gives respective colours.

Tests for cellulose

Burn tests:

- Cotton fibre flare up when lit but no melted bead is left.
- Continue to glow after burning.
- The smoke colour is white or gray.
- Smell of burning fibre is like that of burning paper.

Chemical tests:

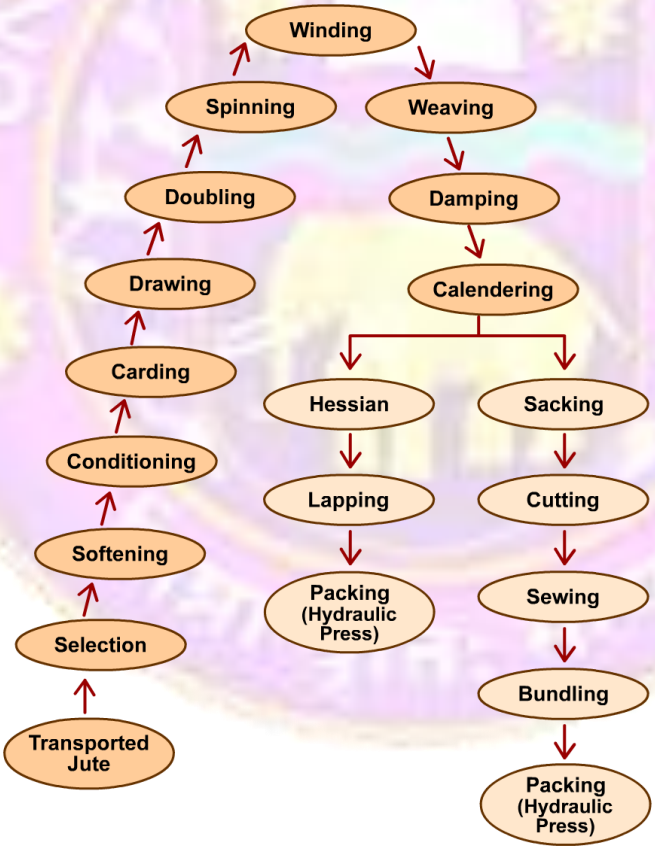
- Cotton fibre + Schultze's solution (Chor-zinc-iodide) = Fibres turns blue
- Cotton fibre + Few drops of iodine solution = Fibres turns yellow
- Cotton fibres + Few drops of conc. H_2SO_4 + Iodine solution = Fibres turn blue

Explaination: Cellulose is first hydrolysed by conc. H_2SO_4 into a colloidal hydrocellulose which forms a blue compound on reaction with iodine solution.

Jute Industry in India

Mr. George Acland brought spinning machine from Dundee (U.K.) and established first Jute Mill at Rishra (near Kolkata), on River Hooghly, in 1855.

During 2012-2013, a total of 8362 thousands bales raw jute were produced from 822 thousands hectare of jute cultivation land area. Presently, seventy six Jute Mills are working in India; leading state is West Bengal with 59 Mills followed by Andhra Pradesh that operates 7 Mills. It is estimated that more than 4 million families are dependent on Jute cultivation and jute industry in India, directly or indirectly.



Source: Author

Figure : Flow chart summarizing various steps involved in further processing in jute mills in manufacturing the various jute products.

Utilization of Jute fibres and its products:

Jute fiber is a low cost fibre. Rough weaving of raw jute fibres are used for making various fabrics for bagging, packaging and wrapping textiles. Fibers are also used for making rope, twine and matting, and decorative fabrics, woven carpets, curtain, linoleum and oil cloth **(Figure)**. Leaves and young shoots are also used as vegetables. Some of the products of jute fibres and their uses are described below:

- Hessian Cloths: It is a fine fabric also called as burlap, used to pack a range of goods and commodities such as grains, pulses, vegetables etc. The capacity of these bags limits 60 kg. of weight.
- Sacking Cloths: For making such fabric, low grade of raw jute fibres are loosely woven. Bags made up of sacking cloths are used for packing cement, sugar and food grains with varying capacity (ranging from 50 to 100 kg weight).
- Serim Cloths: It is enormously light weight hessian cloth.
- Bags: Hessian or sacking cloths are used for making fancy bags used for marketing. Sometimes, bags are also laminated with polythene.
- Canvas: It is obtained from closely woven, finest grade of jute fibres used for protection from weather.
- Geotextiles: The jute mattings are used for preventing soil erosion due to floods, and restoration and control of landslides. In afforestation

programmes, Jute bags are also used for filling soil for preparing saplings.

- Culinary utilization: Jute leaves and young shoots are generally used for vegetables. Soup and other preparations are very common in African countries such an Nigeria, Egypt and Sudan.

Hessian made gunny sack

Stacked Sacks

Source: http://en.wikipedia.org/wiki/Gunny_sack#/media/File:Hemp-sack,asabukuro,japan.JPG

http://en.wikipedia.org/wiki/Bag#/media/File:Coffee_Stacked_Bags.jpg

Jute Rope

Made from *Corchorus capsularis*

Source:

http://upload.wikimedia.org/wikipedia/commons/2/2a/Jute_Rope_%28%E0%AE%9A%E0%AE%A3%E0%AE%B2%E0%AF%8D_%E0%AE%95%E0%AE%AF%E0%AE%BF%E0%AE%B1%E0%AF%81%29.jpg

http://commons.wikimedia.org/wiki/File:Yute_-_Sacos.jpg

Jute fabrics

Geotextiles

Source:

http://upload.wikimedia.org/wikipedia/commons/f/f9/Cloth_800.jpg

http://upload.wikimedia.org/wikipedia/commons/c/c8/Geotextile-GSI.JPG

Figure : Pictures showing the uses of jute fibres and its various products

Did you Know ……Jute Fiber is a Green Fibre

- Cultivation of jute crop does not harm soil, plants need very low amount of pesticide and fertilizers.
- Jute fibre is renewable natural fibre. It is eco-friendly as its components (cellulose and lignin) is 100% bio-degradable.
- Unlike synthetic fibres, jute fibres do not release toxic air pollutants on burning.
- Considering its bio-degradable nature, jute is more superior and can be called as fibre of future or green fibre.

Let us take oath today to use eco-friendly products to save Mother Earth for Generations to Come!

Regulation Mechanism for Jute In India

Ministry of Textiles, Government of India deals with all regulatory organizations in India related to jute sector **(for detail visit: http://texmin.nic.in/).** It includes subordinate offices, advisory board and statutory bodies under direct control of Ministry of Textiles. There are also Public Sector Undertakings and some other organizations supported by Ministry of Textiles in India.

Office of Jute Commissioner: It is the subordinate office under Ministry of textiles. The functions and activities of Office of Jute Commissioner include: (i) providing advice to the ministry of Textiles regarding policy matter formulation pertaining to jute industry, (ii) implementation of developmental activities through various bodies such as National Jute Board particularly for promotion of jute handicraft and jute handloom in decentralized sector, and R&D programmes through various textile research associations like Indian Jute Industries' Research Association (IJIRA), (iii) monitoring price of both raw jute and jute goods and implementing minimum support price(MSP) for jute and mesta cultivators through Jute Corporation of India, and (iv) market promotion both in domestic and export market. **(For detail visit: http://jutecomm.gov.in/)**

Jute Advisory Board: It is a advisory board under Ministry of Textiles.

National Jute Board: It is statutory body under ministry of Textiles and has been constituted according National Jute Board Act, 2008 (12 of 2009) and was effective on and from April 1st, 2010. **(For detail visit: http://www.jute.com:8080/web/njb/home/)**

Public Sector Undertakings

- **Jute Corporation of India (JCI) Ltd, Kolkata:** It is a Government of India enterprise set up in 1971 with the aim to provide minimum support price (MSP) for jute producers and serves as a stabilizing agency in the raw jute market. **(For details visit: http://www.jci.gov.in:8080/jci/)**
- **National Jute Manufactures Corporation Ltd.(NJMC), Kolkata:**

It was registered on June 3, 1980, as Government of India Undertaking, comprising the six Jute Mills including National, Kinnison, Khardah, Alexandra, Union in West Bengal and Unit RBHM in Katihar (Bihar). The main objective of the NJMC are to carry on manufacturing of Jute Goods for supply to various food processing agencies of the Government. **(For details visit: http://njmc.gov.in/)**

- **Birds Jute & Exports Ltd. (BJEL), a subsidiary of NJMC:** BJEL, a processing unit of jute fabric was established in 1904 as subsidiary of Bird & Co. In 1980, on nationalization, Bharat Process & Mechanical Engineers Limited (BPMEL), Ministry of Heavy Industry took over the assets of BJEL. Further, in 1986, Government of India, has transfer shares of BJEL to NJMC.

  BJEL operating as a processing unit for bleaching, printing and dyeing of jute, and blended fabric.

Research Organizations supported by Ministry of Textiles

- **Indian Jute Industries Research Association (IJIRA), Kolkata:**

  It was established in 1937, the first co-operative R & D organisation to render services to the Indian Jute Industry and Government Agencies who are involved in promotion of Indian Jute in domestic and foreign market. IJIRA has its headquarter in Kolkata and 3 regional centres located at Cherthala (Kerala), Vizianagram (Andhra Pradesh) and Guwahati (Assam). **(For detail visit: http://www.ijira.org/)**

- **International Jute Study Group (IJSG), Dhaka, Bangladesh:**

  It is an inter-governmental panel constituted under the aegis of UNCTAD to act as International Commodity Body (ICB) for Jute, kenaf

and other allied fibres. **(For detail visit: http://jute.org/index1.html)**

- **Institute of Jute Technology (IJT), Kolkata:**

  It is an autonomous educational institute jointly founded by University of Calcutta and Indian Jute Mill's Association in 1937, with sole objective to impart knowledge of jute technology and train the students. The institute not only offers regular B.Tech and M.Tech degree courses but also organizes training programmes for Jute Mill Sector. **(For detail visit: http://www.ijtindia.org/)**

- **Central Research Institute for Jute Allied Fibres (CRIJAF), Barrackpore, Kolkata** : It is premier institute on jute and allied fibre crops of ICAR under Crop Science and deals with six natural fibre crops viz. Jute, Sisal (*Agave sisalana*), Sunnhemp (*Crotalaria juncea*), Ramie (*Boehmeria nivea*), Mesta (*Hibiscus cannabinus* and *H. sabdariffa*) and Flax (*Linum usitatissimum*). This institute has four Research Stations - (i) Sunnhemp Research Station located at Pratapgarh (Uttar Pradesh), (ii) Ramie Research Station located at Sorbhog (Assam), (iii) Sisal Research station located at Bamra (Orrisa), and (iv) Seed Research Station located at Budbud (West Bengal). **(For detail visit: http://www.crijaf.org.in/)**

- **National Institute For Research in Jute and Fibre Technology (NIRJFT), Kolkata:** It is a premier institute under ICAR and dedicated to the research of jute & allied fibres leading to the diversify utilization and industrial growth since January 1939. **(For detail visit: http://www.nirjaft.res.in/)**

Summary

- Fibres are a category of hair like structures that are in discrete groups or continuous pieces, and can be matted for making fabric, paper or any other products.
- Depending upon their origin, the fibre may be natural or synthetic or semi-synthetic. Vegetable fibers (natural fibers derived from plants) may be classified as bast fibre, surface fibre or hard fibre.
- Jute is a vegetable fibre derived from the stem i.e. bast fibre. *Corchorus capsularis* and *Corchorus olitorious* are two species that yield Jute fibre. **Its significance is second only to cotton**. Jute fiber is also called as golden fiber due to its colour and cash value.
- India ranks first among world's jute producing countries by producing 55.1% of total world's production in 2012. In India, during 2012-13, West Bengal was the largest jute producer State followed by Bihar, Assam, A.P. and Orissa.
- Jute is primarily a monsoon season crop, requires loamy or alluvial soil and standing water in a warm and humid climate.
- The fiber extraction takes place through a microbiological assisted process- retting, followed by stripping, sun drying, bailing and packing.
- Jute Fibre contains 53 - 63 % cellulose, 22 - 26% hemicelluloses, 11-12% lignin and other components such as waxes, gums, fats and minerals.
- Jute fibers are used for making various fabrics for bagging, packaging and wrapping textiles. Fibers are also used for making rope, twine and

matting, and decorative fabrics, woven carpets, curtain, linoleum and oil cloth. It is also utilized as geotextile fabric.

- Jute leaves and young shoots are also used as vegetables.
- In 1855, Mr. George Acland brought spinning machine from Dundee (U.K.) and established first Jute Mill at Rishra (near Kolkata), on River Hooghly.
- During 2012-2013, a total of 8362 thousands bales of raw jute were produced from 822 thousands hectare of jute cultivation land area. Presently, seventy six Jute Mills are working in India; leading state is West Bengal, it has run 59 Mills followed by Andhra Pradesh that operates 7 Mills.
- It is estimated that more than 4 million families are dependent on Jute cultivation and jute industry in India, directly or indirectly.
- Ministry of Textiles, Government of India deals with all regulatory organizations in India related to jute sector

Exercise/Practice

Define fibres? Describe briefly the classification of vegetable fibers based on their origin.

Define vegetable fibres? Write a detailed account of the various uses of jute fibre.

Differentiate between the followings:

- Animal fibre and vegetable fibre
- Bast fibre and Surface fibre
- White jute and tossa jute
- Natural fibers and Synthetic fibres

Define the followings:

- Ribbon Retting
- Semi-synthetic fibres
- Natural Fibres
- Corchorin
- Phloem wedge

Draw a labeled diagram of T.S. of Jute stem.

Write short notes on the followings:

- Chemical tests for lignin in jute fibres
- Indian States producing Jute
- Retting
- Synthetic fibers
- Coir
- Geotextiles

Expand the followings: IJIRA, NJB, JCI, IJSG, IJT, CRIJAF, NIRJFT .

Glossary

Animal fibre: The fibers are derived from the animals, composed of proteins (such as keratin, collagen or fibroin).

Ardil: It is the regenerated or semi-synthetic fibred regenerated from ground nut proteins.

Bale (Katcha): It is a package of raw jute (bound with jute rope) consisting of various morahs (small bundles), generally weighing 130 to 150 kg but sometimes 55 kg.

Bale (Pucca): It is hydaulically pressed bales of raw jute bound with jute ropes having standard size of (120x45x50) cm and net weight of 180 kg.

Bast Fibre: Fibres derived from the stem of the plants are called as bast fibres or soft fibres.

Coir: It is an economically important plant fibre, obtained from mesocarp of coconut fruit.

Corchorin: It is a bitter glycoside, a secondary metabolite synthesized by C*orchorus capsularis*. Due to its bitter taste the *C. capsularis* is called as bitter jute (locally, tita pat)

Geotextiles: It is class of fibers used in river embankments, to prevent soil erosion and to stabilize landslide sites.

Mesta: It is a stem or bast fibre used as a substitute for jute fibre; obtained from *Hibiscus sabdariffa* and *Hibiscus cannabinus*.

Natural fibre: Unlike man-made fibre, it is the class of the fibres derived either from animal source or from plant source.

Regenerated Fibres: These are semi-synthetic fibre obtained from chemically processed cellulose (e.g. Rayon, Tencel) or chemically processed proteins (e.g. ardil from groundnut protein).

Retting: It is microbiological assisted process used for separation of the fibres from plant's central woody part.

Sacking: It is the loosely woven fabric made from a lower grade of jute mostly used for manufacturing jute bags. These bags are generally used for packing cement, grains and sugar etc. with varying capacity (50 Kg to 100 Kg.)

Twine: A bunch yarn made by twisting together two or many strands of yarn.

Vegetable fibre: Fibres originated from plants are classified as vegetable fibres. Example: jute, cotton etc.

Yarn: It is product of considerable length and relatively small cross-section of fibres and/or filaments with or without twists.

References/ Bibliography/ Further Readings

Books:

- Kochhar, S.L. 2009, Economic Botany in Tropics. Third Edition Macmillan and Co. New Delhi
- Wickens, G.E. 2007, Economic Botany: Principles and Practices, Springer Kluwer Academic publishers, Dordrecht, The Neatherland

Web Links:

http://texmin.nic.in/

http://jutecomm.gov.in/

http://www.jute.com:8080/web/njb/home/

http://www.jci.gov.in:8080/jci/

http://njmc.gov.in/

http://www.ijira.org/

http://jute.org/index1.html

http://www.ijtindia.org/

http://www.crijaf.org.in/

http://www.nirjaft.res.in/