# A Comprehensive Study on Jute Fiber and Its Applications

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## ABSTRACT

*Jute is a long, shiny vegetable fiber that can be spun into coarse, strong threads. The fibers are off-white to brown, and 1–4 meters (3–12 feet) long. Bangladesh is the world's largest exporter of jute. It is one of the cheapest and the strongest of all natural fibers and considered as fiber of the future. Jute is second only to cotton in world's production of textile fibers. Jute is not only a major textile fibre but also a raw material for non-traditional and value added non-textile products. Jute has seemingly limitless uses. Core uses are twine and rope, sackings, carpets, wrapping fabrics (cotton bale), and the construction fabric manufacturing industry. Other uses include espadrilles, floor coverings, home textiles, high performance textiles, Geotextiles, and composites. While jute is being replaced by synthetic materials in many of these uses, jute is still valuable due to its biodegradable nature. Recently jute fibres are used in a wide range of diversified products: decorative fabrics, chic-saris, salwar kamizes, soft luggage's, footwear, greeting cards, molded door panels and other innumerable useful consumer products. This article is an overview about jute fibers, its cultivation & production, features, physical properties, morphology and chemical composition. Further we discussed the photochemical and thermal degradation, moisture effect and the drawbacks of jute fiber. Finally, production process of jute fabrics and some uses has been described.*

***Keywords**: **Jute, Textile, Fibers, Fabrics.***

## 1. INTRODUCTION

Jute is a versatile, natural fiber that has been used for thousands of years to make things such as rope, twine, hessian bags, rugs, and much more, yet for last couple of decades it lost its world market due to over usage of polythene etc. But the recent world wide climate movement has further reminded us the necessity of jute since jute cleans the air, uses of less fertilizer, herbicides and pesticides, and improves soil conditions. It also has high biological efficiency, sound agricultural practices and biodegradability. The 'green' credentials of jute bags and fabrics are excellent when it is rapidly growing worldwide awareness of environmental problems and of the need for sustainable development.

Jute is a natural fiber popularly known as the golden fiber. It is one of the cheapest and the strongest of all natural fibers and considered as fiber of the future. Jute is second only to cotton in world's production of textile fibers. India, Bangladesh, China and Thailand are the leading producers of Jute. It is also produced in southwest Asia and Brazil. The jute fiber is also known as Pat, kosta, Nalita, Bimli or Mesta (kenaf). Jute is a long, soft, shiny vegetable fibre that can be spun into coarse, strong threads. It is produced from plants in the genus Corchorus, which has been classified in the family Tiliaceae, or more recently in Malvaceae. Jute fibres are composed primarily of the plant materials cellulose (major component of plant fibre) and lignin (major components of wood fibre). It is thus a ligno-cellulosic fibre that is partially a textile fibre and partially wood. It falls into the bast fibre category (fibre collected from bast or skin of the plant) along with kenaf, industrial hemp, flax (linen), ramie, etc. The industrial term for jute fibre is raw jute. The fibres are off-white to brown, and 1–4 meters (3–12 feet) long.

## 2. PRODUCTION

Jute is a rain-fed crop with little need for fertilizer or pesticides, in contrast to cotton's heavy requirements. Production is concentrated in India, mainly Bengal, and mostly in Bangladesh. The jute fiber comes from the stem and ribbon (outer skin) of the jute plant. The fibers are first extracted by retting. The retting process consists of bundling jute stems together and immersing them in slow running water. There are two types of retting: stem and ribbon. After the retting process, stripping begins; women and children usually do this job. In the stripping process, non-fibrous matter is scraped off, then the workers dig in and grab the fibers from within the jute stem**.** India, Pakistan, and China are the large buyers of local jute while the United Kingdom, Spain, Côte d'Ivoire, Germany and Brazil also import raw jute from Bangladesh. Bangladesh is the world's largest producer of jute [1, 2].

Table 1: Annual production of jute in different countries

| COUNTRY | PRODUCTION (TONNES) |
|---|---|
| BANGLADESH | 1,523,320 |
| INDIA | 1,237,270 |
| PEOPLE'S REPUBLIC OF CHINA | 43,500 |
| MYANMAR | 30,000 |
| UZBEKISTAN | 18,930 |
| NEPAL | 14,418 |
| VIETMAN | 14,000 |
| ZIMBABWE | 2,298 |
| EGYPT | 2,200 |
| THAILAND | 2,184 |
| WORLD | 2,861,996 |

### 2.1 Cultivation

Low-lying, slightly acidic, alluvial soils in river complexes are particularly suited to jute growing, specially when these solids are flooded each year. After flooding, a deposit of silt is left on them, when the flood-waters recede. These soils are slightly acidic in nature, which is helpful for the growth of the plant. The rainfall should be average 80mm to 100 mm during the growth of the plant. 65% to 90% humidity and 25C to 40C is most beneficial to the crop.

### 2.2 Jute Genome

On 16 June 2010, Prime Minister Sheikh Hasina declared that Bangladesh successfully completed the draft genome of jute (Corchorus olitorius). A consortium of researchers from University of Dhaka, Bangladesh Jute Research Institute (BJRI) and private software firm DataSoft Systems Bangladesh Ltd. in collaboration with Centre for Chemical Biology, University of Science Malaysia and University of Hawaii were involved in this project [3].

## 3. HISTORY

For centuries, jute has been an integral part of culture of Bengal, in the entire southwest of Bangladesh and some portions of West Bengal. During the British Raj in the 19th and early 20th centuries, much of the raw jute fibre of Bengal was carried off to the United Kingdom, where it was then processed in mills concentrated in Dundee. Initially, due to its texture, it could only be processed by hand until it was discovered in that city that treating it with whale oil, it could be treated by machine. The industry boomed ("jute weaver" was a recognized trade occupation in the 1901 UK census), but this trade had largely ceased by about 1970 due to the appearance of synthetic fibers. Margaret Donnelly, a jute mill landowner in Dundee in the 1800s, set up the first jute mills in Bengal. In the 1950s and 1960s, when nylon and polythene were rarely used, one of the primary sources of foreign exchange earnings for the erstwhile United Pakistan was the export of jute

products, based on jute grown in then East Bengal now Bangladesh. Jute has been called the "Golden Fibre of Bangladesh." However, as the use of polythene and other synthetic materials as a substitute for jute increasingly captured the market, the jute industry in general experienced a decline. During some years in the 1980s, farmers in Bangladesh burnt their jute crops when an adequate price could not be obtained. Many jute exporters diversified away from jute to other commodities. Jute-related organizations and government bodies were also forced to close, change or downsize. The long decline in demand forced the largest jute mill in the world (Adamjee Jute Mills) to close in Bangladesh. Bangladesh's second largest mill, Latif Bawany Jute Mills, formerly owned by businessman, Yahya Bawany, was nationalized by the government. Farmers in Bangladesh have not completely ceased growing jute, however, mainly due to demand in the internal market. Between 2004–2010, the jute market recovered and the price of raw jute increased more than 500%.
Jute has entered many diverse sectors of industry, where natural fibres are gradually becoming better substitutes. Among these industries are paper, celluloid products (films), non-woven textiles, composites (pseudo-wood), and geotextiles. In December 2006 the General Assembly of the United Nations proclaimed 2009 to be the International Year of Natural Fibres, so as to raise the profile of jute and other natural fibers [4].

## 4. PROPERTIES OF JUTE

Jute fiber has some standard physical properties. These are

i. Ultimate Jute Length: 1.5 – 4 mm
ii. Ultimate Diameter of Jute: 0.015 - 0.002 mm.
iii. Jute Fiber Length: 150 to 300 CM (5 to 12 Feet)
iv. Jute Color: Jute fiber can be White, Yellow, Brown or Grey
v. Strength of Jute: 3.5 to 5 G/Den
vi. Specific Gravity: 1.48
vii. Moisture Regain of Jute: 13.75 % (Standard)
viii. Elasticity: Breaking Extension 1.8% and Elastic Recovery very low
ix. Resiliency: Bad
x. Dimensional Stability of Jute: Good on average

The chemical properties of jute fiber are:

i. Effect of acids: Easily damaged by hot dilute acids and concentrated cold acid.
ii. Effect of alkalis: Fibers are damaged by strong alkali. Fibers loses weight when it is heated with caustic soda.
iii. Effect of bleaches: Resistant to bleaching agents (bleaching powder, $H_2O_2$, NaOCl, $NaClO_2$, $Na_2O_2$, $CH_3COOH$, $KMnO_4$ etc.).
iv. Effect of light: Color changes slightly in presence of sunlight. It happens due to presence of lignin in fiber.
v. Effect of mildew: Prevention ability is better than cotton and linen.
vi. Dyeing ability: Easy to dyeing. Basic dye is used to color jute fiber.

Some features of jute are given below: (Coied everything from wikiedia)

- Jute fiber is 100% bio-degradable and recyclable and thus environmentally friendly.
- Jute has low pesticide and fertilizer needs.
- It is a natural fiber with golden and silky shine and hence called *The Golden Fiber*.
- It is the cheapest vegetable fiber procured from the bast or skin of the plant's stem.
- It is the second most important vegetable fiber after cotton, in terms of usage, global consumption, production, and availability.
- It has high tensile strength, low extensibility, and ensures better breathability of fabrics. Therefore, jute is very suitable in agricultural commodity bulk packaging.
- It helps to make best quality industrial yarn, fabric, net, and sacks. It is one of the most versatile natural fibers that have been used in raw materials for packaging, textiles, non-

textile, construction, and agricultural sectors. Bulking of yarn results in a reduced breaking tenacity and an increased breaking extensibility when blended as a ternary blend.

- The best source of jute in the world is the Bengal Delta Plain in the Ganges Delta, most of which is occupied by Bangladesh.
- Advantages of jute include good insulating and antistatic properties, as well as having low thermal conductivity and a moderate moisture regain. Other advantages of jute include acoustic insulating properties and manufacture with no skin irritations.
- Jute has the ability to be blended with other fibers, both synthetic and natural, and accepts cellulosic dye classes such as natural, basic, vat, sulfur, reactive, and pigment dyes. As the demand for natural comfort fibers increases, the demand for jute and other natural fibers that can be blended with cotton will increase. To meet this demand, some manufactures in the natural fiber industry plan to modernize processing with the Rieter's Elitex system. The resulting jute/cotton yarns will produce fabrics with a reduced cost of wet processing treatments. Jute can also be blended with wool. By treating jute with caustic soda, crimp, softness, pliability, and appearance is improved, aiding in its ability to be spun with wool. Liquid ammonia has a similar effect on jute, as well as the added characteristic of improving flame resistance when treated with flame proofing agents.
- Some noted disadvantages include poor drapability and crease resistance, brittleness, fiber shedding, and yellowing in sunlight. However, preparation of fabrics with castor oil lubricants result in less yellowing and less fabric weight loss, as well as increased dyeing brilliance. Jute has a decreased strength when wet, and also becomes subject to microbial attack in humid climates. Jute can be processed with an enzyme in order to reduce some of its brittleness and stiffness. Once treated with an enzyme, jute shows an affinity to readily accept natural dyes, which can be made from marigold flower extract. In one attempt to dye jute fabric with this extract, bleached fabric was mordanted with ferrous sulphate, increasing the fabric's dye uptake value. Jute also responds well to reactive dyeing. This process is used for bright and fast colored value-added diversified products made from jute.

## 5. MORPHOLOGY OF JUTE FIBER

### 5.1 Fiber Strand/Filament

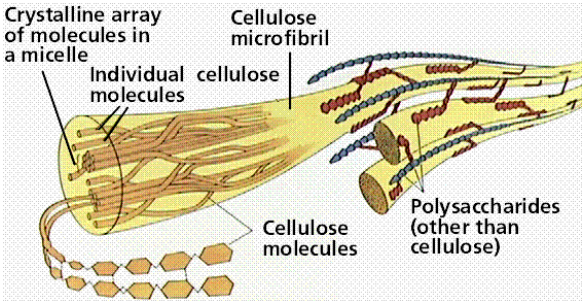


Fig. 1: Structure of cellulose as it occurs in a plant cell wall [4].

A well carded textile filament of jute is a dead tissue consisting of fiber cells numbering about 20 to 80 and having dimension of about 10 to 100 mm in length and 0.03 to 0.06 mm in breadth [5]. It appears from the cross sectional view that the fiber cells are more or less polygonal in outline-with defined angles and are attached to one mother through the middle lamella, a dense space, between the cells to form a wedge-shaped bundle. The fiber cell known as the ultimate fiber is elongated in the direction of the stem axis and associates with the other fiber cells of the bundle in such a way as to form a string of fiber known as the fiber strand or filament.

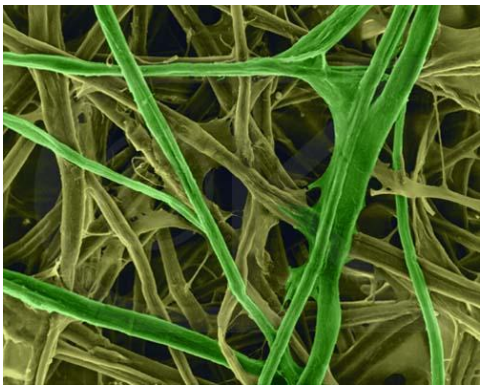

Fig. 2: Cellulose Fibers from Print Paper (SEM x1080) [6]

**5.2 Structure of Jute Cell**

Jute is multicelled in structure (Fig. 3). The cell wall of a fibre is made up of a number of layers: the primary wall and the secondary wall (S), which again is made up of the three layers (S1, S2 and S3). As in all lignocellulosic fibres, these layers mainly contain cellulose, hemicellulose and lignin in varying amounts. The individual fibres are bonded together by a lignin-rich region known as the middle lamella. Cellulose attains highest concentration in the S2 layer (about 50%) and lignin is most concentrated in the middle lamella (about 90%) which, in principle, is free of cellulose. The S2 layer is usually by far the thickest layer and dominates the properties of the fibres. Cellulose, a primary component of the fibre, is a linear condensation polymer consisting of Danhydro- glucopyranose units joined together by ß-1, 4-glucosidic bonds. The long chains of cellulose are linked together in bundles called micro-fibrils.

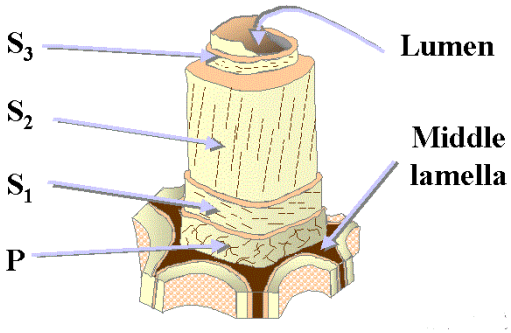


Fig. 3: Jute fibre structure

**5.3 Constituents of Jute**

Jute is complex lignocelluloses based polymeric fiber. It is not uniform in chemical composition as shown by the multi-cellular structure of the fiber. Jute has three principal constituents, namely cellulose, hemicelluloses and lignin. The approximate composition of raw jute materials is:

Table 2: Typical composition of jute fiber

| SUBSTANCES | WEIGHT PERCENT (%) |
|---|---|
| CELLULOSE | 62-65 |
| HEMICELLULOSE | 15-16 |
| LIGNIN | 14-20 |
| ASH | 0.7-1.20 |
| EXTRACTIVES | 1.2-2 |
| WAX | 0.5 |

The cellulose, hemicelluloses and lignin all exist in the form of long chain molecules. In addition to these major components, it contains minor constituents such as fats and waxes, inorganic (mineral) matters, pectinious materials, nitrogenous mater, vitamins and traces of pigments like- carotene and xanthophylls. The chemical composition of jute fiber is shown in Table-02. The main structural element of jute fiber is cellulose, which is held entirely within the cell units whereas the lignin and

hemicelluloses are distributed throughout the entire body of the fiber serving as a cementing material. The chemistry of jute refining prevails that jute is said to contain **[7].**

Table 3: Typical composition of cellulose in jute fiber

| NAME | PERCENT (%) PRESENT |
|---|---|
| A-CELLULOSE | 62-65 |
| TRUE CELLULOSE | 15-20 |
| FURFURAL COMPLEXES | 18-22 |
| KETOCYCLOHEXANE | 7-9 |

## 6. PHOTOCHEMICAL AND THERMAL DEGRADATION OF JUTE

All cellulose-containing fibers lose strength on prolonged exposure to sunlight. This effect is mainly attributable to the ultraviolet component of the radiation. In jute, however, a similar strength reduction occurs after only about 350hr exposure, and so, although the exposure times are not precise, it is clear that jute loses strength at more than twice the rate for cotton. On continuous exposure to strong sunlight, jute darkens in color and loses strength due to photo-degradation of its lignin constituent. However, jute yarn loses only about 5-7% of its strength on storage away from sunlight for 2 years. Tensile strength and elongation of jute yarn remain practically unaffected on heating at 130ºC for 6 hours in air, and at 200ºC for 2 hours under vacuum. Exposure to sunlight for periods up to 600 hours gave values of $k = 15.4\times 10^{-7}$ for jute in unit of reciprocal DP per hour exposure. Exposure to artificial sources of UV light such as a mercury arc lamp or a xenon arc lamp gave lower values of k than for sunlight. With the mercury lamp, the k value was $8.9\times10^{-7}$ for jute whereas the xenon lamp gave $5.9\times10^{-7}$ units for jute.

In jute fiber here will be a loss in strength due to primary bond breakage in the cellulose constituent. The rate of bond breakage in jute is greater than cotton. The cohesion between the ultimate cells in jute is also reduced as a result of changes in the middle lamella.

The rate of photochemical breakdown of cellulose thus appears largely independent of whether lignin is present or not, and contrary to views that have been expressed in the past, lignin is not acting as a photo-sensitizer for the breakdown. The greater loss in strength of jute compared with cotton therefore related to photochemical changes taking in the middle lamella, which reduce the cohesion between ultimate cells. Color changes in jute are associated with the lignin content of the fiber, the isolated a cellulose and hemicelluloses fractions being unaffected by exposure to UV light of the correct wavelength band. It was evident that the intensity of yellowing became more pronounced as the lignin content increased [8].

Cellulose-containing fibers also lose strength on prolonged exposure to elevated temperatures, but in this case cotton and jute show only minor differences in strength losses under similar heating conditions. At 140ºC both fiber have lost 50% of strength after 80-85 hr exposure, whereas at 160ºC only about 10 hr exposure is required for the same fall in strength. Thus although the temperatures is a major factor determining the rate of loss in strength, cotton and jute behave similarly, and there is no suggestion that the cohesion of the middle lamella is changed by exposure to heat.

## 7. MOISTURE EFFECT ON JUTE

Cellulose holds small amount of water tenaciously. Even when dried in the oven at 150ºC, up and can act as a desiccant for other materials holding their moisture upto 2-3%; absorption then follows a steady trend; above 9% moisture content the sorption capacity of the cellulose sample increases again. Jute, like most of the other textile fibers, is hygroscopic, i.e. it takes in or gives out moisture to its surrounding atmosphere. When jute neither absorbs nor gives up moisture to the air around them they are said to be in equilibrium with that particular atmosphere. The amount of moisture held by jute can be expressed in two ways, by moisture content or moisture regain.

The equilibrium moisture held by jute yarn when exposed to atmosphere of different relative humidity shows appreciable hysteresis according to whether absorption from low humidity or desorption from high humidity is concerned. Thus at 65% RH and 20ºC the equilibrium moisture regain is about 12.5% for absorption by dry fiber and 14.6% for desorption of wet fiber, whereas

exposure to 100% RH gives an equilibrium regain of 34-35%. Appreciably higher moisture regain value of jute (11% at 65% RH) compared to that of cotton (about 7% at 65% RH) is attributable to the presence of hemicelluloses present in the jute. Transverse swelling of jute increases appreciably on removal of either lignin or hemicelluloses. With an increase in RH up to 70%, the tenacity and modulus values of jute increase, but beyond 70% RH they decrease. Jute swells in either to the extent of about 22%, a value similar to that of cotton, despite the greater proportion of non-crystalline material in jute. Delignification has a pronounced effect, and it is reported that when the lignin content has been reduced to 0.87% the swelling may reach almost 40%**.** Moisture absorption reportedly brings about a reduction in the degree of (X-ray) crystalline value of jute [9, 10, 11, 12].

## 8. DRAWBACKS OF JUTE

In contrast to cotton, the chemical composition of jute is not homogeneous. This indicates that jute fibers, although being considered as important natural textile fibers, are much woodier in nature with a lignin content of 13-15%. For this reason, the chemical reactivity of jute is more akin to wood than it is to other textile fibers. Jute fibers being of woody and coarse in nature, having been suitable for making cordage, ropes, camouflange nets, etc. from the very dawn of human civilization. The muslin, the reputed fine cloths of erstwhile Bengal and the noted 'Patta' cloth of the ancient India were said to be made of jute fiber. Unfortunately, despite of all of its potentialities, jute fibers being hard, brittle, unyielding in contrast to cotton or linen had been neglected as textile fiber source for long days. Jute possesses certain characteristic properties that are essentially unalterable; however genetic treatment may slightly modify these properties somewhat but not to the extent required for the desired application. It is therefore to improve the characteristic properties of this natural polymer chemically so that the improved natural polymer will behave like synthetic polymers with respect to durability, sustainability, and mechanical strength but will at the same time be degradable and eco-friendly. Jute suffers from certain undesirable visco-elastical properties. It's modulus of elasticity and compressibility is quite high in comparison with flax, cotton and synthetic fibers. This inherent visco-elastic behavior of jute fiber makes it incompatible with other textile fibers. The residual oil is the major contaminant in the jute products and creates greater problems in addition to the natural and inherent defects such as falling of fibers from jute products, exudation of emulsion oil from jute products, harshness and coarseness of yarn and fabrics, loss of resiliency of jute carpet in usage, declining of fiber strength in usage, browning, fading of color, heavier product with less cover area and contamination in material packed in jute goods. Jute also has a tendency to absorb water, for this reason it decays very quickly and does not stay for very long time. The main drawback of jute fiber, which is responsible for its limit use, is that of discoloration due to the development of yellow to brown color after sufficient exposure to light [13].

## 9. PRODUCTION PROCESS OF JUTE FABRIC [14]

### Selection / Batching

As jute grown in different areas varies in strength, color and fineness, the first step in preparing the fiber is "batching", consisting of blending the various fibers to obtain uniformity in strength and color to give the precise quality of yarn for spinning. This involves the opening of various qualities of bales. These are then examined, sorted and mixed to form various batches.

### Softening

In the first mechanical operation in the mill, the jute is fed into a softener in which the jute, treated with an emulsion oil and water, passes between sets of heavy spiral fluted rollers. This process renders the fiber thoroughly pliant and removes any barky portions adhering to the fiber. The piled jute is cut in order to remove the roots.

### Carding

The fibers are then carded in machines, known as breaker cards and finisher cards, which reduces the

average length of the fibers by teasing and combing, and deliver them in the form of a long continuous ribbon, 5" or 6" in width, called sliver.

**Drawing**
The carded jute is next fed into drawing machines in three stages through the first, second and third drawing frames which draw out and attenuate the sliver, parallelize the fibres, and by means of a doubling process, produce a smoother, more even sliver. However, in case of sacking weft, the passage through, drawing frame is only done twice *i.e*, through first and second drawing frames.

**Spinning**
The last operation in the preparing department is spinning, a process which imparts a slight twist to the sliver and delivers the material on to bobbins in the form of rove, a loose yarn ready for spinning. The spinning machinery known as sliver spinning, an extra drawing operation delivers a crimped sliver, which can be fed direct to the sliver spinning form. Spinning frames convert the rove to finished yarn.

**Beaming**
After spinning, the yarns are wound into the form required -spools for warp yarn and cops for weft yarn -for subsequent processing. Jute yarn is processed much like other textile fibers, the yarn itself being dressed (i.e, sized or starched), before being passed on to the warp beam ready for weaving.

**Weaving**
Jute fabrics are of simple construction and are woven on a variety of looms. Woven fabrics are inspected, damped and calendared to produce the desired smoothness of finish.

**Dyeing**
The woven cloth is then dyed in the desired Azofree reactive dyes and colors.

**10. USES OF JUTE**
Jute is the second most important vegetable fiber after cotton due to its versatility. Jute is in great demand due to its cheapness, softness, length, lustre and uniformity of its fibre. It is called the 'brown paper bag' as it is also used to store rice, wheat, grains, etc. It is also called the 'golden fibre' due to its versatile nature. The uses of jute are given below [2, 15, 16, 17]:

- Jute matting is used to prevent flood erosion while natural vegetation becomes established. For this purpose, a natural and biodegradable fiber is essential.
- Jute is used chiefly to make cloth for wrapping bales of raw cotton, and to make sacks and coarse cloth. The fibers are also woven into curtains, chair coverings, carpets, area rugs, hessian cloth, and backing for linoleum.
- The fibers are used alone or blended with other types of fiber to make twine and rope. Jute butts, the coarse ends of the plants, are used to make inexpensive cloth. Conversely, very fine threads of jute can be separated out and made into *imitation silk*.
- Jute fibers are also be used to make pulp and paper. Jute has a long history of use in the sackings, carpets, wrapping fabrics (cotton bale), and construction fabric manufacturing industry.
- Traditionally jute was used in traditional textile machineries as textile fibers having cellulose (vegetable fiber content) and lignin (wood fiber content). But, the major breakthrough came when the automobile, pulp and paper, and the furniture and bedding industries started to use jute and its allied fibers with their non-woven and composite technology to manufacture nonwovens, technical textiles, and composites. Therefore, jute has changed its textile fiber outlook and steadily heading towards its newer identity, i.e., wood fiber. As a textile fiber, jute has reached its peak from where there is no hope of progress, but as a wood fiber jute has many promising features.

- Jute is used in the manufacture of a number of fabrics such as Hessian cloth, sacking, scrim, carpet backing cloth (CBC), and canvas. Hessian, lighter than sacking, is used for bags, wrappers, wall-coverings, upholstery, and home furnishings. Sacking, a fabric made of heavy jute fibers, has its use in the name. CBC made of jute comes in two types. Primary CBC provides a tufting surface, while secondary CBC is bonded onto the primary backing for an overlay. Jute packaging is used as an eco-friendly substitute.
- Diversified jute products are becoming more and more valuable to the consumer today. Among these are espadrilles, soft sweaters and cardigans, floor coverings, home textiles, high performance technical textiles, Geotextiles, composites, and more.
- Jute floor coverings consist of woven and tufted and piled carpets. Jute Mats & Rugs are made both through Powerloom & Handloom, in large volume from Kerala, India. The traditional Satranji mat is becoming very popular in home décor. Jute non-wovens and composites can be used for underlay, linoleum substrate, and more.
- Jute has many advantages as a home textile, either replacing cotton or blending with it. It is a strong, durable, color and light-fast fiber. Its UV protection, sound and heat insulation, low thermal conduction and anti-static properties make it a wise choice in home décor. Also, fabrics made of jute fibers are carbon-dioxide neutral and naturally decomposable. These properties are also why jute can be used in high performance technical textiles.
- Thus, jute is the most environment-friendly fiber starting from the seed to expired fiber, as the expired fibers can be recycled more than once.
- Jute is also used to make ghillie suits, which are used as camouflage and resemble grasses or brush.
- Another diversified jute product is Geotextiles, which made this agricultural commodity more popular in the agricultural sector. It is a lightly woven fabric made from natural fibers that is used for soil erosion control, seed protection, weed control, and many other agricultural and landscaping uses. The Geotextiles can be used more than a year and the bio-degradable jute Geotextile left to rot on the ground keeps the ground cool and is able to make the land more fertile.
- In combination with sugar, jute can be used to build aeroplane panels.
- Diversified byproducts from jute can be used in cosmetics, medicine, paints, and other products.

## 11. CONCLUSION

After cotton, Jute is a widely used natural fiber in the world. It has many applications in many sectors. Due its natural degradation properties it can be used to make environmental friendly products such as ropes, fabrics, sacks, bags, carpets, packaging, composite materials for furniture and structural purposes and many more. It's also really important for Bangladesh because we produced highest numbers of jute fiber in our body politic. So by importing jute fiber and environment friendly jute products we can earn huge number of foreign currency which can significantly affect our GDP.

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