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COMPARATIVE PHYSICAL ANALYSIS OF BANANA AND JUTE FIBRE

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Abstract: Agricultural residues represent a notable category of sustainable materials that are currently being investigated for their possible utilization in various applications. India being a tropical country is very rich in vegetable or natural fibres. Vegetable fibres mostly long and staple with considerable stiffness and durable. Here, two type of natural fibre such as banana and jute are compared against their physical properties. Physical analysis such as length, diameter, fineness and strength determined under the present study. Length of fibre and fineness is higher of banana than jute fibre whereas the tenacity is more in jute as compared to banana fibre. Beyond cotton fibre other natural fibre should be explored to fulfil the human demands. With this thought banana and jute fibre can be used for textile purposes or it can be blended for cost reduction and to get good textile properties.

Key words: Agro waste, Banana Fibre, Jute fibre, Eco fabric, Biodegradable, physical properties

I. INTRODUCTON

Agro waste leftovers serve as valuable sources of natural fibers, presenting an environmentally sustainable substitute for manufactured polymers. In addition, natural fibers include supplementary attributes like renewability, exceptional absorption capabilities, and favorable mechanical qualities [**1**]. Furthermore, it should be noted that these materials possess the characteristic of being biodegradable and capable of being recycled.

India being a tropical country is very rich in vegetable or natural fibers. It may be classified into five classes according to plants part from which they are obtained. a. seed fibre b. bast fibre c. leaf fibers. d. wood fibre e. miscellaneous fibre. Among the available agro based, natural cellulosic fibers, potential of banana fibers as a natural fibre is high. Its sustainability is undeniable and has unexplored potentiality in textile field [**2**].

Banana and jute, both the fibers belongs to natural fibre composed mainly of lignin, cellulose, and hemicellulose. Therefore, it is called lignocellulosic fibre, which has been discovered to have a cellulose content of 60-65%, 6-19% hemicellulose, 5-10% lignin, 3-5% pectin, ash 1-3%, and 3-6% extractives [**3**]. Banana fibre has advantages and disadvantages to hemp fibre, such as good mechanical properties, good water absorption, coarse and stiff fibre, breathable, lustrous, antiseptic and antibacterial, UV protection, and anti-static. Jute is the second most important natural fibre (after cotton) in terms of global consumption, is extensively used for the manufacture of flexible packaging fabrics besides its prospective use as carpet backing, decorative fabrics, and in some other fields of technical textiles. Jute fibre is considered to be economic, recyclable, biodegradable and environmentally friendly material, especially as reinforcement material in biocomposites or biopolymer **[4].**

II. METHODOLOGY

Materials

Mechanically extracted banana and jute fibre utilized for the study was procured from Banana Pseudostem processing Unit, Farm no. 3, Navsari Agricultural University, (NAU) Gujarat.

a) Banana Fibre

b) Jute Fibre

Determination of physical properties of the banana and jute fibre

Ultra structural view

The ultra structural studies were carried out using Scanning Electron Microscope. The fibre samples were mounted on a specimen stub and coated with gold in a sputter coater. The stubs containing the coated specimens were mounted on the specimen stage of Phillips XL30 Scanning Electron Microscope. Fibre specimens were examined at an accelerating voltage of 10kV. Certain selected portions from the scans were recorded.

Fibre Length

To determine the length of banana and jute fibre wooden ruler was used. Single fibre was clipped with thumb and length was measured on the other end. 50 readings were taken and average was calculated.

Fibre Diameter

Microscope with micrometer lens was used to measure the diameter of banana and jute fibre with a magnification of 10x zoom. An average of 5 readings was taken to analyze fibre diameter. The test was carried out at MMC lab in Uttar Pradesh Textile Technology Institute, Kanpur.

Fibre Fineness

For testing banana fibre fineness ASTM D7025 standard filament fibre fineness was used. The Tex was determined by using average weight of 10 readings of 100 cm length of the fibre and calculation was done by using the formulae:

$$\text{Tex} = \frac{W \times l}{L}$$

Where, W = Weight of the fibre

l = Length of the sample

L = the unit length of the sample

Bundle Fibre Strength

For testing the bundle fibre strength Stelometer (bundle fibre strength tester) was used with ASTM D1445 standard. A bunch of fibers was put into two jaws. The length between two jaws was 1/8 inch. The jaws were moved until the fibers break. The breaking load at break was noted. An average of 5 readings was taken and bundle fibre strength was calculated with following formula:

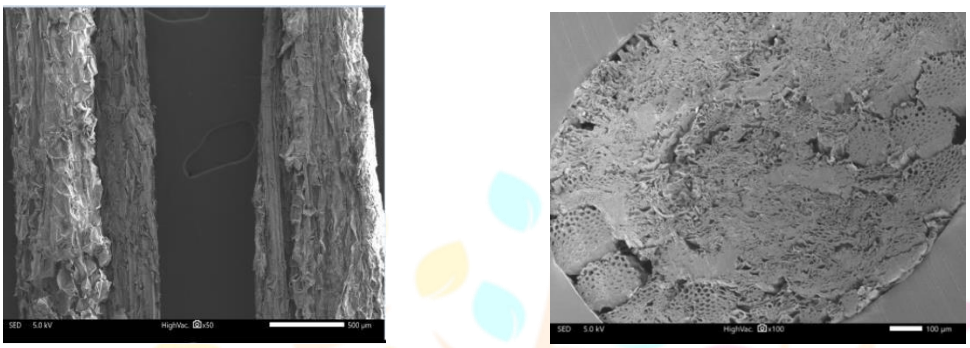
$$\text{Tensile strength/tenacity of fibers in gms/tex} = \frac{\text{Breaking load in kg X length of sample in mm}}{\text{Mass of fibers in mg}}$$

III. RESULTS AND DISCUSSION

Ultra Structural view

Fibre specimen was examined at an accelerating voltage of 10kV. In the SEM image, it was observed that the raw banana fibre surface was covered with overlapping scales, much more irregular, striations on the surface and appeared dull. SEM micrographs of longitudinal view [Fig (a)] show that the individual cells are packed together by lignin and Cross sectional view [Fig (b)] shows that the shape is to some extent circular.

Longitudinal view **Cross Sectional View**



Untreated Banana Fibre

The percentage of different physical constituents of banana and jute fibre is summarized in following table 1.

Table 1. Comparative study on physical constituents of banana and jute fibers

Physical Constituents	Banana Fibre	Jute Fibre
Fibre Length	92 cm	3.3 m
Fibre Diameter (µm)	227.9	168.7
Fibre Fineness (tex)	9.007	3.8
Bundle Fibre Strength (g/tex)	18.25	27

From table 1, depicted that banana fibre has great length with 92 cm as well as diameter (227.9 µm) and fineness (9.007 tex) is also good as compared to jute fibre which was valued 168.7 µm and 3.8 tex. Whereas the tenacity of jute fibre is much higher (27 **g/tex)** than banana fibre (18.25 **g/tex)**.

it was found in previous studies that if fibre fineness is below 7 tex than it is graded as extra fine fibre, if 7 tex to 10 tex than fine fineness, 10 tex to 14 tex than medium fineness and if above 14 tex than it is coarse fineness of fibre. Therefore, in the fig 1 shows that the fineness of banana fibre was observed as fine.

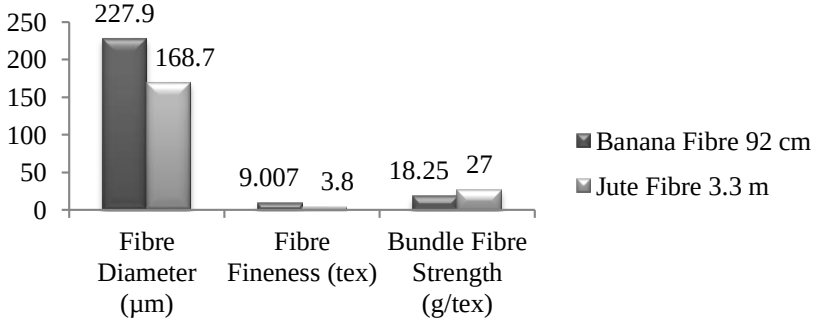


Fig 1

IV. CONCLUSION

This research was conducted to search the suitability of banana and jute fibre for using in textile fibre purpose. For using in textile purpose, fibers require a good amount of tenacity with diameter and fineness. Banana and

jute both provide good amount of tenacity with average fineness due to its cellulose and lignin content which hinders the flexibility properties of fibers. From result and discussion, it is found that banana fibre has lowest lignin content with highest cellulose content. So, banana fibre can be used for textile purpose or it can be blended with cotton fibre for cost reduction and to get good textile properties.

There is a big opportunity for small scale entrepreneurs for venturing into banana pseudostem processing and value addition sectors. It will also help the rural people to earn by creating employment in the fibre extraction.

V. REFERENCES

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