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A study on properties of pseudostem fibers from banana fabrics

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Abstract
Mankind has been strongly dependent on plant fibers for all kind of purposes. The usage of natural fibers has been reported from earlier days and they have served a wide range of uses (Preethi and Balakrishna Murthy, 2013). Apart from being food fruit crop, banana plant also serves as a source of various commercial products with respect to its utilities due to its versatility. Banana fibers are made of cellulose (43.6%), hemicellulose (14%), lignin (11%) and other substances (such as pectin, wax, and 31.4%) (Kumar and Kumar 2011). These fibers can be explored to develop various technical textiles which are the need of the hour. This study aims in developing technical textiles that can serve multipurpose uses like soundproof, fireproof and antimicrobial at the same time.

Keywords: banana fabric, cellulose

Introduction
Industrial textiles are now more often viewed as a subgroup of a wider category of technical textiles. These mainly involve those textile products used in the course of manufacturing operations such as filters, machine clothing, conveyor belts, abrasive substrates etc. or which are incorporated into other industrial products such as electrical components and cables, flexible seals and diaphragms, or acoustic and thermal insulation for domestic and industrial appliances. Nowadays natural fibers form an interesting alternative for the most widely applied fiber in the composite technology, glass.

The use of natural fibers such as flax, hemp, jute or sisal in this industry so far is small due to unavailability of a durable semi-finished product with constant quality. Advances in recent research and development have shown that these aspects can be improved significantly with the technology. Rapid interest has grown in the natural fiber sector due to the cheap availability of raw materials and their property of better stiffness per weight than glass, which results in lighter components. Yet another reason for the sudden attention to this area is that the environmental impact is smaller as the natural fiber can be recycled thermally and these fibers come from a renewable resource (Rijswijk *et al.,* 2001).

Objectives
- To extract the fibers from Banana pseudostem.
- To characterize the banana fibers.
- To develop fibers to fabrics.
- To analyse the physio-chemical properties of banana fabrics.

Methodology
Procurement of Raw Materials
Banana fabric was purchased from Ecostar unit, TNAU, Coimbatore, India. Polyester (200 GSM), Polyurethane (100 GSM) and Polypropylene (300 GSM) were purchased from PSG COE, Neelambur, Coimbatore, India.

Pretreatment of Fibers (Banana Fibers)
Treatment of Banana Fibers
The procured banana fibers were pretreated with Na OH at various concentrations ranging between 0.5% to 7.5% at 100ºC for one hour at a pH of 12. Later the samples were cooled and rinsed 8-10 times with distilled water and dried at 50°C for 45 min in oven. The procedure was repeated if the fibers were not processed properly.

From Fibers to Fabrics Handloom Weaving
Weaving is done by intersecting the longitudinal threads, the warp, i.e. "that which is thrown across", with the transverse threads, the weft, i.e. "that which is woven". The major components of the loom are the warp beam, heddles, harnesses or shafts shuttle, reed and take up roll. In the loom, yarn processing includes shedding, picking, battening and taking-up operations which are the principal motions.

Banana fabric were processed in handloom weaving, Erode, India.

Characterization of the Synthesized Fabrics
Physical Testing Of Banana Fabric
Measurements of Twist per Inch (ISO 2061: 1995)
In the microprocessor twist tester, the twisting and untwisting jaws are driven by a fractional H.P single phase motor. A speed control device is provided on the left hand side of instrument by which the motor speed can be varied while conducting the twist tests. The gauge length of the specimen can be selected up to a minimum of 25cm (10 inches) by moving the non-rotating jaw assembly. A scale is fixed on the

instrument to read the actual gauge length. A direction reverse switch and two counters are fixed on the instrument for testing the twist of the yarns. An average of 15 readings was taken at random and the mean was calculated.

Table 1: TWIST per Inch (ISO 2061: 1995)

S. No.	Twist Per Inch of Yarn Removed from Fabric	
1.	Warp	13.8
2.	Weft	36.8

Tensile Strength (Is 1969:1985)

Tensile strength is the measure of the resistance of the fabric load or stress in either warp or weft direction. It is the strength shown by a specimen subjected to tension distinct from torsion, compression, or shear. Elongation defines the length to which a fiber may stretch before breaking. A sample of 12” X 2” was taken for the test. The tensile strength of the fabric was determined by cloth tensile strength tester. Tensile strength is performed using cut strip method. This test is used for coated or heavily sized strength is performed using cut strip method. This test is used for coated or heavily sized fabric. Four readings for every sample were taken and the average was calculated.

Table 2: Tensile Strength (IS 1969: 1985) (5 X 20Cm) (Kgs)

S. No.	Tensile Strength	CV %
1.	Warp	3.2
2.	Weft	6.7

Measurement of Fibre Strength and Elongation (IS 1670:1991(RA 2007)

Vibroscope & Vibrodyn was used to calculate the strength and elongation of fibres using IS 1670:1991(RA 2007) standards. Measuring range of force 0-1000 cN, measuring range of elongation max. 1000% at 10 mm gauge length, gauge length 5-50mm, tension weight 100 mg and testing speed of 0.5 to 300 mm/min. An average of 30 readings were taken at random and the mean value was calculated.

Table 3: Single Strength (IS 1670: 1991(RA 2007)

S. No.	Strength	CV %
1.	Single Thread Strength	53.2
2.	Elongation at break	12.5

Result and Discussion

The fabrics and fibers used for the study were procured and processed before the use. The obtained banana fibers were pre-treated with various concentration of sodium hydroxide for removing the components that hinder is activity. Among, various concentrations used 5 % of NaOH showed better yield and better processed fibers. The pretreated fibers were then weaved using handloom weaving and it was done at Erode, which was used for the study. Weaved fabric was characterized physically and chemically. The physical parameters such as twist per inch measurement, tensile strength, measurement of fiber strength and elongation and scanning electron microscopy were performed and the results are as follows. The twist per inch of the fabric was measured and was found that the warp count was 13.8 and weft was 36.8 TPI. Measurement of Tensile strength was observed to 3.2 and 6.7 in case of warp and weft CV% respectively. Strength and elongation of fibers were measured in which the Single Thread Strength was about 53.2 % CV and elongation was 12.5 % CV.

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