INVESTIGATION ON THE FEASIBILITY OF MESTA BLENDS

P-2507

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project titled
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is the bonafide work of

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30/4
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30/4/09
EXTERNAL EXAMINER

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ABSTRACT

Over the years cotton has been spun blended with various other fibers with a view to improving the strength, for imparting the unique property of the blend fiber in the resultant yarn, to reduce the yarn cost by reducing cotton content in the yarn etc., Moreover some end uses of the yarn need more than the properties of cotton to suit the end uses required of them.

Our project investigates the possibilities and as a result the properties of blending *MESTA* with cotton. Mesta is a natural Bast fiber obtained from the stalk of a plant of the species *Hibiscus Cannabinus* and *Hibiscus subdariffa.* The fiber is obtained by retting and scotching the stalk of the plant. This fiber has high lustre, tenacity and wet strength modulus but it is stiff, crisp and rough to skin.

The Mesta fiber has been taken and subjected to softening treatment. After which we have blended Mesta with cotton and have obtained the resultant yarns. The yarns have been produced using three spinning systems. They are Ring, Rotor and the DREF spinning systems. The resultant properties of these yarns have been carried out and the results have been analyzed.

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LIST OF ABBREVIATIONS

TPI	:	Twist per Inch
TPM	:	Twist per Meter
RPM	:	Revolutions per Minute
Gf/tex	:	Gram Force per Tex
Mm	:	Millimeter
N	:	Newton
Sec	:	Second
Lbs	:	Pounds
U	:	Unevenness
CV	:	Co-efficient of Variation
SD	:	Standard Deviation
Ne	:	English Count
M	:	Meter
JTRC	:	Jute Technological Research Center
Mpm	:	Meter per minute
SEM	:	Scanning Electron Microscope
KM	:	Kilometre

Chapter 1
INTRODUCTION

Currently, one of the major challenges in the textile industry is related to environmental problem. This drives textile manufacturers to seek new approaches to producing environmentally friendly products, such as recyclable and biodegradable textile materials. More and more attention has been drawn to agricultural products, wastes, and derivatives because of their renewability. One of the crops with such properties is *mesta*, an old crop with plenty of uses.
The Mesta plant has two fiber types

- outer bark or bast portion (40% of the plant)
- Inner woody core material (60% of the plant).

There are many advantages of using Mesta fiber. Because a technology of separating Mesta core and bark has been developed, there is a possibility of using the entire Mesta plant or its separated parts. The bast fibers offer the advantage of renewability and biodegradability that is essential for making environmentally friendly textile products. Mesta production is less costly and less time-consuming than other raw crops, given that it produces a high yield with minimal use of chemicals.

1.1 Statement of Purpose

The purpose of the project is to investigate the effects of

- Softening Treatment on fiber properties
- Blend proportion on yarn spinnability
- Staple length of mesta fiber on yarn spinnability

Hence analyze the above effects with respect to yarn production in Ring, Rotor and DREF spinning systems. The properties of the resultant yarn produced are also analyzed.

1.2 Project Objectives

- Determine the impact of the softening methods on the properties of Mesta fiber.
- Determine the impact of the blending percentage on the properties of the yarns that contain Mesta.
- Analyze and characterize Mesta fiber and yarns that contain Mesta fiber in terms of physical properties.
- Accomplish the above by conducting various tests such as tensile strength, elongation, and surface characteristics tensile strength, elongation, and surface characteristics.

1.3 Justification for blending with cotton:

The procedures for yarn production are well developed for cotton but the physical properties of Mesta differ from those of cotton. For example Mesta fibers are coarser and more brittle than cotton hence they tend to break between the various rollers of the spinning system. Moreover they have a tendency to lap around the rollers. Therefore cotton is blended to make Mesta more spinnable in the conventional methods of yarn production.

1.4 Definitions of terms used

Mesta -- an annual plant considered to be an alternative fiber crop. It resembles jute, but it is more lustrous and has greater tensile strength and greater resistance to rot.

Retting – a wet process by which the bundles of cells in the outer layers of the stalk are separated from nonfibrous matter by the removal of pectin's and other gummy substances.

DREF Spinning -- It is a frictional spinning system that makes use of two perforated cylinders rotating in the same direction to form the yarn. It operates on the basis of mechanical/aerodynamic spinning system with an internal suction.
Spinning -- the process of obtaining a yarn, using the rotation movement and the difference in spin velocity of several shafts.

Twisting – the process for refining. Depending on the nature of the application, the emphasis is on an improved symmetry of the yarn, a specific yarn structure, an increase in the strength of the yarn or a combination of different colors and materials.

Tenacity --a unit used to measure the strength of a fiber or yarn, usually calculated by dividing the breaking force by the linear density.

Yarn Tex -- yarn fineness. It is the weight in grams of 1000 meter of yarn.

Chapter 2
LITERATURE REVIEW

Mesta is a 4000-year-old crop that is native to the tropical regions. It is a member of the hibiscus family (*Hibiscus cannabinus and Hibiscus subdariffa)*) and related to cotton and jute. Mesta is a warm-season annual row crop well suited to the South and Eastern regions of the Indian subcontinent.

Mesta came into prominence after independence due to shortage of jute. Mesta has a single, straight, unbranched stem consisting of two parts: an outer fibrous bark and an inner woody core.

Mesta grows quickly, rising to heights of 12-16 feet (4-5m) in a 4-5 month growing season and 25-35 mm in diameter. The core is the spongy tissue pith below the bark of the plant. Raw Mesta fiber is obtained from the outer bark. To affect Mesta fiber turnout, many agronomic practices can be manipulated; one method to increase the bast: core ratio of Mesta is increasing planting density.

According to Samanta et al [1] from their paper entitled "Enzyme and silicone treatments on jute fibre - Effect on textile related properties" concluded that the treatment of jute fibre with amino silicone under optimum conditions (0.5%-1%) yields much smoother and brighter fibre without change in the bundle tenacity.

According to Gautam Basu et al [2] "Enzyme and silicone treatments in jute fibre – Effect on process performance during yarn making and yarn properties", found that with minimum difficulties at carding and spinning stages yarn is being

formed and it is found that yarn properties are better than untreated conditions of spinning.

According to Bel Berger et al [3] from their research work on "Cotton/Kenaf fabrics: a viable natural fabric", found out that it can be favourably used for yarn and fabric formations.

According to S.B Bandyopadhyay[4] the possible quality of yarn a fiber is likely to produce is always helpful in fiber marketing and in preparing fiber mixtures for spinning.Hence it is given as

$$Y=0.29S-1.02F+2.61$$

Y ⟶ Yarn Tenacity

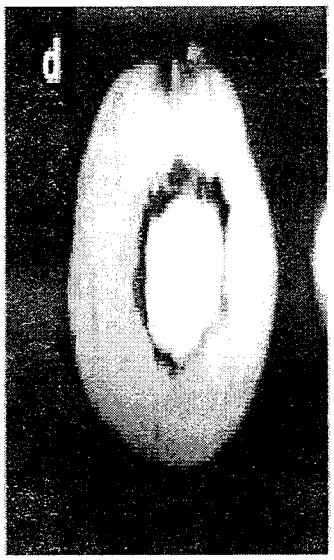
S ⟶ Fibre bundle strength

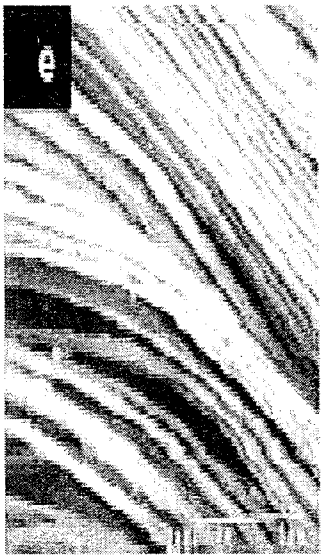
F ⟶ Fibre fineness

According to JTRC Report[5] retted fibers such as Mesta have 3 principal chemical constituents that include alpha cellulose, hemicellulose and lignin. The lignin can be completely removed by chlorination methods in which the soluble chloro-lignin complex is formed and the hemi cellulose then dissolved out of the remaining holocellulose by treatment with dilute alkali. The final insoluble residue is the alpha cellulose constituent which invariably contains traces of sugar residues other than glucose.

Composition	Range
Lignin	12-14%
a-Cellulose	38-63%
Hemi-Cellulose	21-24%

According to G.N. Ramaswamy et al[6] bacterial retting is done first by decorticating the Mesta with a splitting machine, then retting the Mesta stalk in open troughs. Water temperature is monitored and maintained at 30 ± 2 °C throughout the process. Staggered retting is the best method for obtaining uniform fibers with immersion of the bases of stalks initially and then the whole stalks. The retting process takes from 5 to 22days. Then the stalks are washed in hot tap water to remove the remaining shiny, slippery, and green slime residue. And the product is air dried and combed with a soft brush to obtain fibers





MESTA FEATURES

a. Mesta Stem Showing Bark, Mesta Bast Fiber and Core Fiber
b. Mesta Stem: Bark, Bast & Core Fiber x10
c. Cross Section: Bast & Core x30
d. Mesta Core Cross Section, Stem without Bark and Bast Fibers
e. Mesta Bast Fiber x40

CHAPTER 3

AIM AND SCOPE

The demand for cotton worldwide in 2008 was roughly 20 million ton and is growing by about 200,000 ton annually. Therefore to cut short cotton use to optimal level new fibres like Mesta are being explored and their applications are studied. Hence when such fibres are used along with cotton there are multiple benefits to be obtained.

The project aims at producing yarns made by blending Mesta and Cotton fibres. The yarns are going to be made using different spinning systems such as Ring, Rotor and Friction. The pros and cons of the yarns produced and producing the yarns in the various spinning systems will be analyzed. Moreover the optimal blend ratio in producing the yarns is also investigated.

Since Mesta is abundant and at present it is being used less there are great opportunities to be discovered. Moreover they save on costs when used to substitute a small percentage of cotton. They also have high luster, tenacity and wet strength modulus which can be used for a wide range of applications.

The project also explores the future scope for Mesta fibre and the various applications for Mesta are also briefly discussed in the conclusions.

Chapter 4

MATERIALS AND METHODS

4.1 Fibre Processing Sequence:-

Raw Mesta fibre

↓

Bacterial Retting

↓

Softening and Crimping

(Amino silicone softener used)

↓

Cutting of fibre

(Staple length: 30-35mm)

4.1.1 Bacterial Retting:

Bacterial retting was found to produce better fibres compared to chemical retting since the inherent properties of the mesta fibres were not affected in bacterial retting. Bacterial retting also can be called natural retting. This is done first by decorticating the mesta with hand splitting, and then retting the mesta stalk in open troughs. Water temperature is monitored and maintained

at 30 ± 2 °C throughout the process. Staggered retting is the best method for obtaining uniform fibers with immersion of the bases of stalks initially and then the whole stalks. This method is used to prevent over retting of the upper stalk portion. The retting process takes 20 days. Then the stalks are washed in hot water to remove the remaining shiny, slippery, and green slime residue. And the product is air dried and combed with a soft brush to obtain fibers.

4.1.2 Softening and Crimping:

Softening was done using amino silicone softener. It was found to give the best properties compared to other softeners like castor oil, Turkey red oil, Solusoft and NaOH. This was carried out in a mechanical softening machine where the fibres were passed through knurled rollers.The softener is sprayed from an overhead sprayer on the fibre.

The knurled rollers impart crimp as the fibres pass through them during softening.

4.1.3 Cutting:

The softened fibres are then cut into staple length of 30-35mm cut length .This is done manually by hand.

4.1.4Conditions used for Softening:

- ✓ Concentration : 10 gpl
- ✓ Temperature : Room temperature
- ✓ PH : 5.5 - 6.5
- ✓ Buffer : Acetic acid(maintains PH)

* Gpl = grams per litre

4.2 Yarn Production Sequence:

The yarn is produced using three spinning systems. The systems of spinning used are

- Ring Spinning
- Rotor(Rotor) spinning
- DREF II(Friction) Spinning

4.2.1 Ring Spinning Sequence:

Carding

↓

Draw Frame

↓

Fly frame

↓

Ring Frame

4.2.2 Carding:

Carding removes the impurities present in the fibres and performs longitudinal splitting of the tangled fibres. Hence we obtain a web that is free of impurities and that has fibres aligned parallel to each other. It is important that the speed and settings are slightly altered so as to suit Mesta fibre (i.e. lower speed of cylinder, doffer, and wider settings of flats)

The carding was also used to blend the Mesta and cotton fibres in various required proportions by weight.

Carding parameters:

Licker in	:	0.380 rpm
Cylinder	:	419 rpm
Doffer	:	2.1 rpm
Web Hank	:	0.011

4.2.3 Draw Frame:

The drawing was carried out in two stages. In drawing the fibre parallelization is improved further. The hank must be appropriately adjusted in draw frame itself to suit the count of yarn to be spun.

i.)Breaker Drawing:

The web is drafted into the sliver of required hank but the slivers are very high in variation hence they have to be processed in the finisher draw frame.

Breaker Drawing Parameters:

Draft	:	9.6
Hank Delivered	:	0.12
Front Roller	:	50 rpm
Back roller	:	860 rpm

ii.)Finisher Drawing:

Variation among the natural fibers is a primary difficulty to spin them into yarns. In order to reduce the variation, several slivers are combined

together. This is done in Finisher drawing. Six slivers are combined to obtain one sliver in finisher drawing.

Finisher Drawing Parameters:

Draft	:	6
Hank Delivered	:	0.12
Front Roller	:	50 rpm
Back roller	:	1350 rpm

4.2.4 Fly Frame:

In fly frame the sliver is thinned down to the roving. The fly frame does both drafting and twisting. The drafting is done by apron drafting system. Twist is inserted between front roller nip to the bobbin. A compact package of roving with required hank is obtained.

Fly Frame Parameters:

Spindle Speed	:	300 rpm
Twist	:	40 TPM
Roving count	:	1.4 Ne.

4.2.5 Ring Frame:

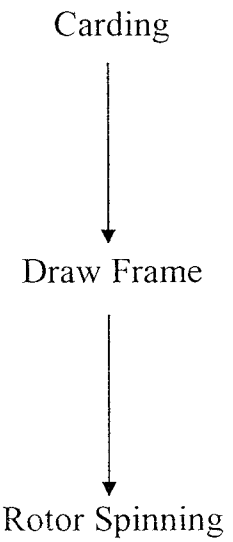
In ring frame, the roving is further drafted into yarn of required count and wound on cops. The required amount of twist is inserted in the yarn depending on the yarn count, strength and the length of fibers. The ring and traveler is the key part of ring spinning system. The traveler and ring must be chosen such that it suits the type of yarn and yarn count.

The drafting is done by apron drafting system and twist is inserted between front roller nip and traveler.

Ring Frame Parameters:

Spindle Speed	:	7500 rpm.
Yarn count	:	20 Ne.
TM	:	4
TPI	:	17
Twist direction	:	Z
Break Draft	:	1.5

4.3 Rotor Spinning Sequence:



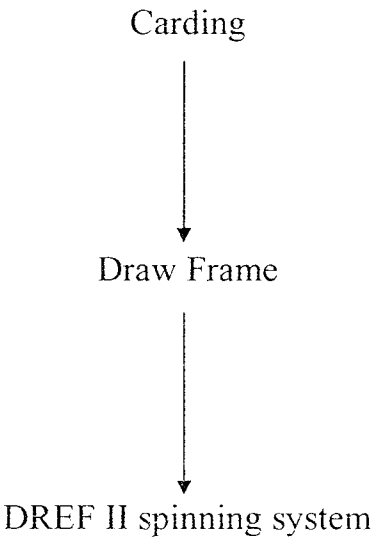
4.3.1 Rotor Spinning:

In this spinning, the individualized fibres carried by air current are deposited continuously on the internal peripheral surface of a rapidly rotating drum, called the rotor. The rotation of rotor imparts twist to the fibrous ring, which is then peeled off and withdrawn along axis of the rotor.

Rotor Spinning Parameters:

Make	:	Elitex
Model	:	BD 200 SN
Rotor Dia	:	53 mm
Opening roller wire	:	OK 40
Rotor speed	:	45000 RPM
Opening roller speed	:	8500 RPM
TPI	:	19.7
Count	:	15 ne

4.4 DREF Spinning Sequence:



DREF II SPINNING:

It is a frictional spinning system that makes use of two perforated cylinders rotating in the same direction to form the yarn. It operates on the basis of mechanical/aerodynamic spinning system with an internal suction. Drafted slivers are opened into individual fibres by a rotating carding drum covered with

saw tooth type wire clothing. The individualized fibres are stripped off from the carding drum by centrifugal force supported by an air stream from the blower and transported into the nip of two perforated friction drums where they are held by suction. The fibres are sub-sequentially twisted by mechanical friction on the surface of the drums. Suction through the perforations of the drums assists this process besides helping in the removal of dust and dirt, thereby contributing to production of cleaner yarn. The low yarn strength and the requirement of more number of fibres in yarn cross-section (minimum 80-100 fibres) were restricted the DREF-2 spinning with coarser counts (0.3-6s Ne).

DREF SPINNING PARAMETERS:

Inlet Speed	:	4.5 mpm
Outlet Speed	:	100 mpm
Drum Speed	:	1000 mpm
Count	:	2 Ne

4.5TESTING:

4.5.1FIBRE TESTING:

The fibre was tested to analyze the effects of the treatment given to the fibre. Hence a sample of raw Mesta fibre and a sample treated with amino silicone solution were tested. The fibre was tested according to the following standards.

1.) Moisture content — **ISO**
2.) Moisture regain — **6741-1:1989**
3.) Fibre denier — **ASTM D-3822-01**
4.) Single fibre tenacity — **&**
5.) Elongation % at break — **BISFA 1998**

Testing Parameters:

Gauge length	:	20 mm
Tension Weight	:	500 mg
Testing Speed	:	12 mm/min

Conditions of Test:

Relative Humidity	:	65% (±2%)
Temperature	:	21°c (±1°c)

4.5.2 YARN TESTING:

The yarn was tested using INSTRON for tensile properties, while PREMIER was used to analyze the yarn irregularities. The yarn was also checked for CSP and elongation at break in the lea strength tester.

The various parameters tested in INSTRON were

1.) Load at break
2.) Extension at break
3.) Time taken for break
4.) Tensile elongation
5.) Tensile Strain
6.) Tensile Stress
7.) Tenacity at break.

Testing Procedure parameters:

Gauge length	:	0.5 meter
Load cell	:	5 Newton
Speed	:	15 mm/min

Various parameters tested using PREMIER 7000 V3.0.2 are

1.) Unevenness (U %)
2.) Co-efficient of variation
3.) Thin Place
4.) Thick place
5.) Neps
6.) Imperfections per KM

Parameters of Test:

Speed	:	400 mpm
Test Duration	:	1 minute

Conditions of Test:

Relative Humidity	:	65% (±2%)
Temperature	:	21°c (±1°c)

CHAPTER 5
RESULTS AND DISCUSSION

5.1 Results obtained:

The various aims that have been accomplished during the course of this project are

- Cotton/Mesta blend yarns of two proportions namely (75/25 and 85/15) of count 15Ne.

- The yarns have been obtained using three spinning systems.(Ring spinning, Rotor and DREF)

- The Effect of fibre treatment has been analyzed.

- The Resultant yarn properties have been analyzed and compared.

- The structures of the yarns have been viewed using Scanning Electron microscope.

- DREF Yarn has been produced using Cotton/Mesta (75/25) blend of 2 Ne.

- The future applications of Mesta have been discussed.

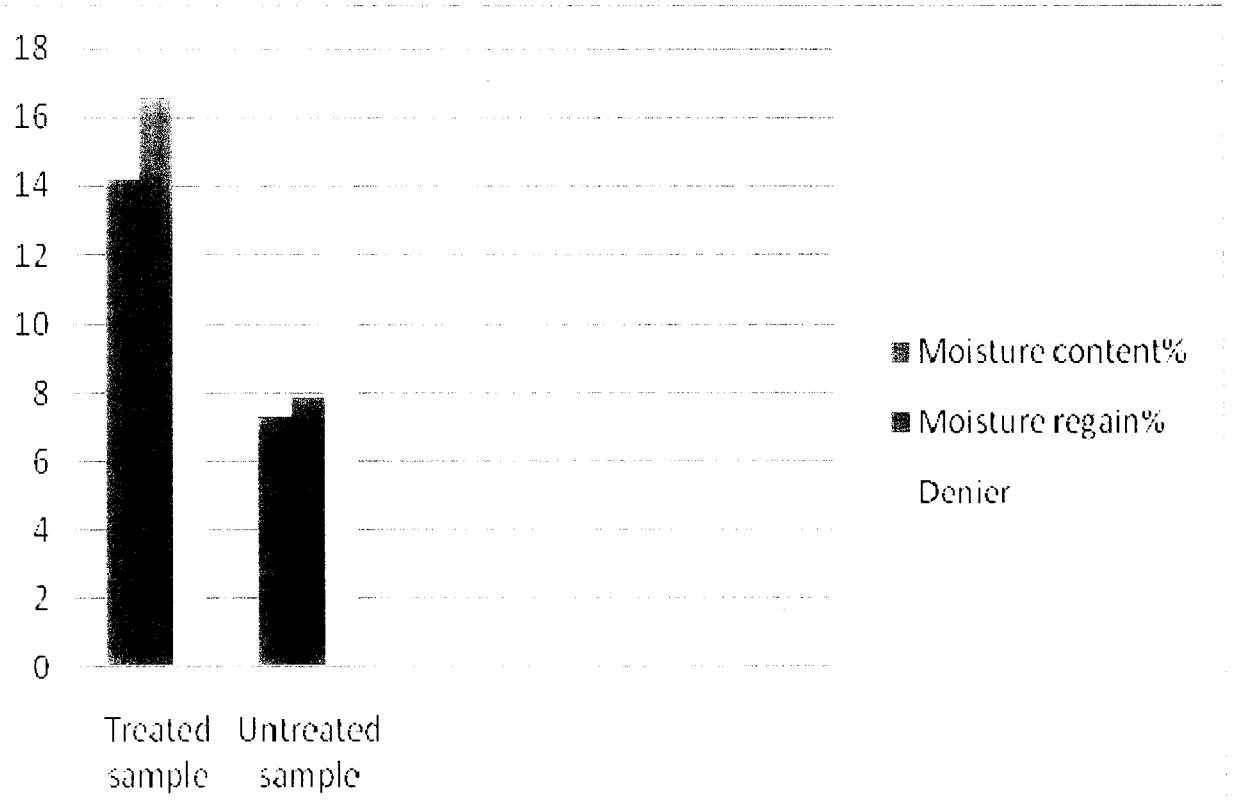
- Various Tests have been conducted on the yarns obtained.

- Comparisons have been made between the ring and rotor spun yarns to see their effectiveness in various functions.

5.2 Analysis of the Effect of fibre treatment:

The variation in properties of thee treated fibre to that of the untreated fibre is elucidated in the table below.

	Moisture content%	Moisture regain%	Denier	Tenacity(g/denier)	Elongation%
Treated sample	**14.18**	**16.52**	**13.12**	**5.12**	**1.9**
Untreated sample	**7.29**	**7.87**	**13.67**	**9.97**	**1.7**



It can be seen from the tests that the mesta fibre is improved massively by **amino silicone treatment.** The amino silicone causes the mesta fibre to become more circular in cross section due to its reaction with ***aldehyde groups(-CHO)*** improving the luster and moreover it removes the unwanted oil matter therefore

vastly improving moisture content and regain values. The brittleness is also reduced to some extent as a result.

5.3 Scanning Electron Microscope images of the yarns:

Image of Rotor Mesta/cotton yarn in SEM:

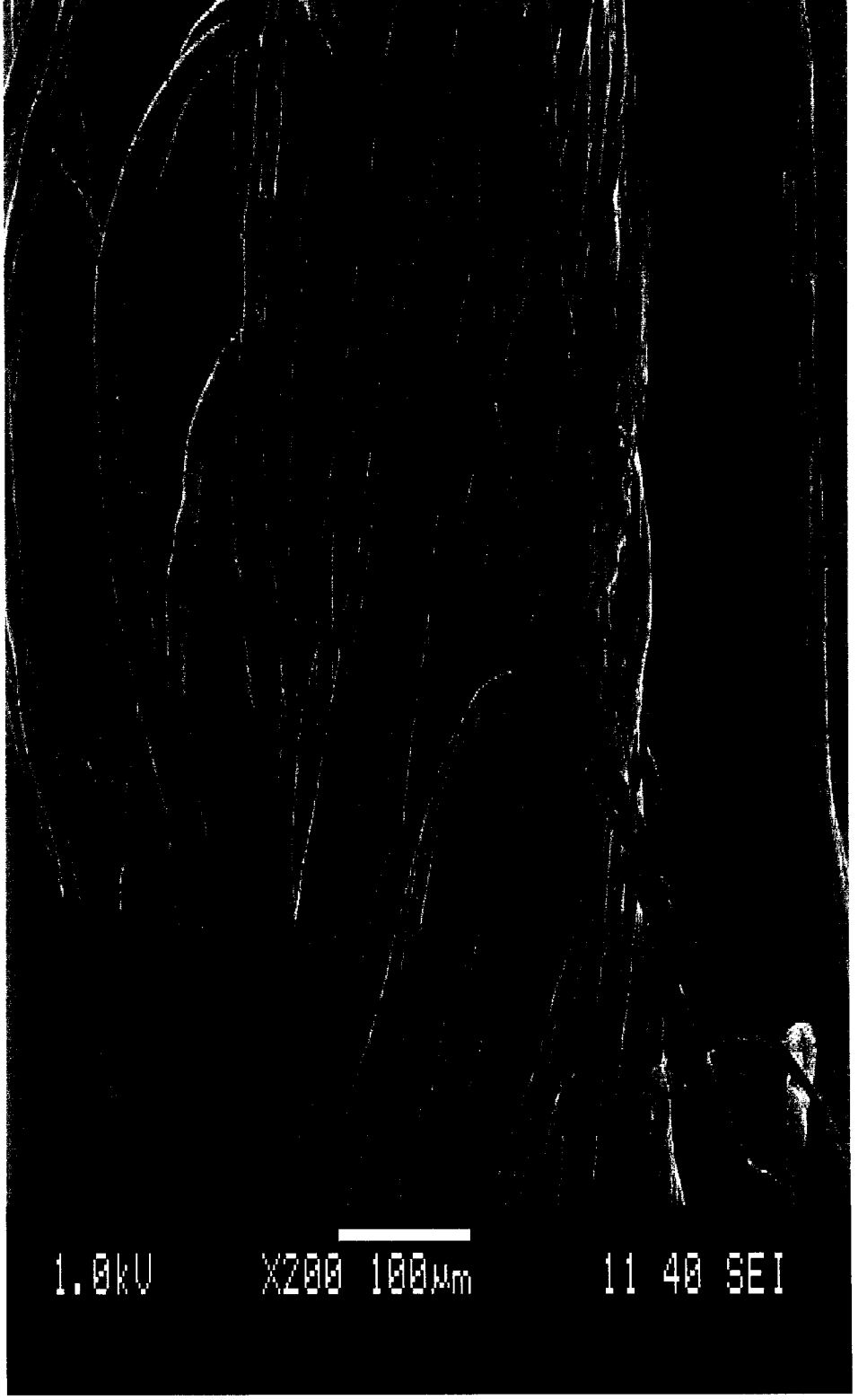
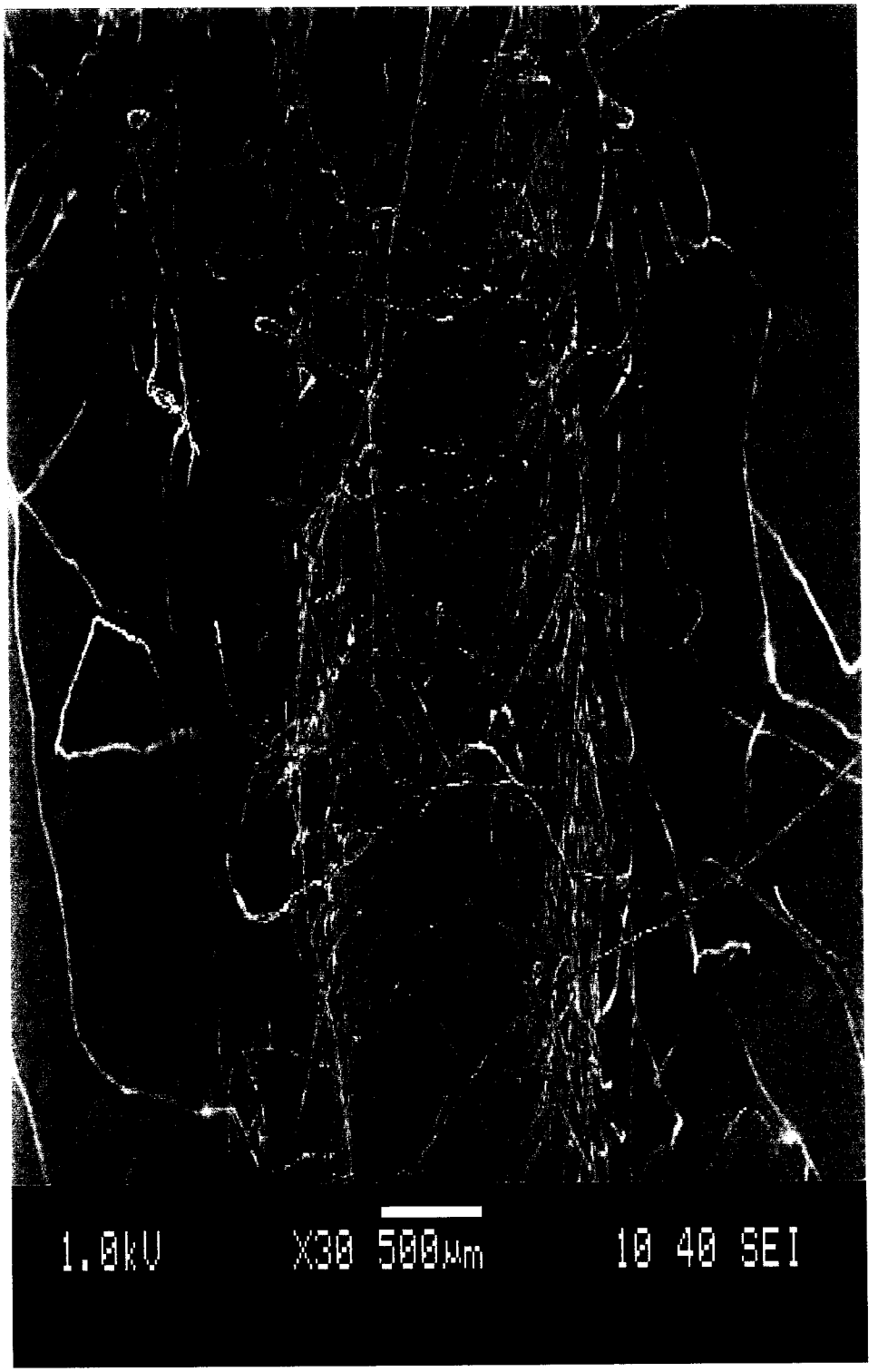
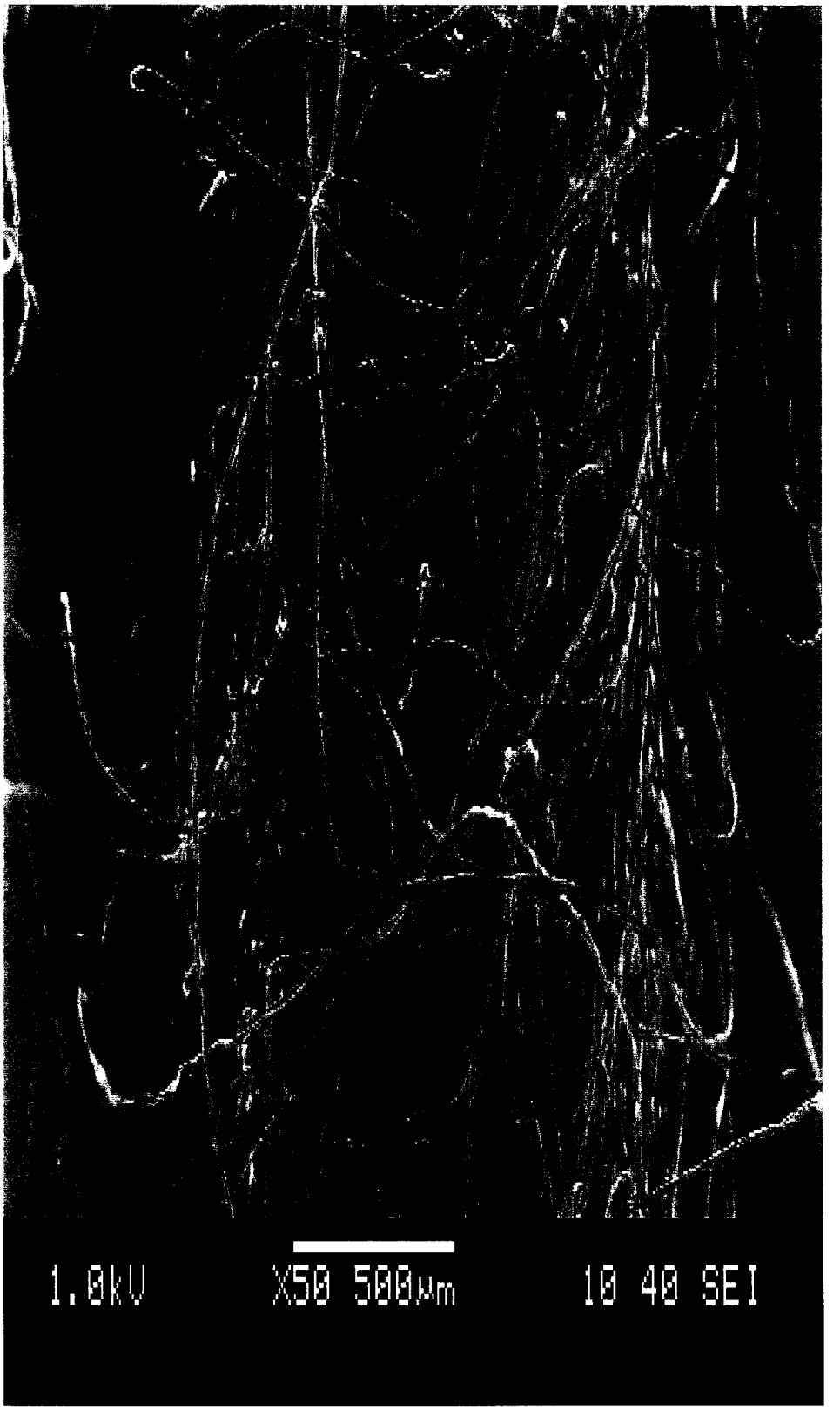
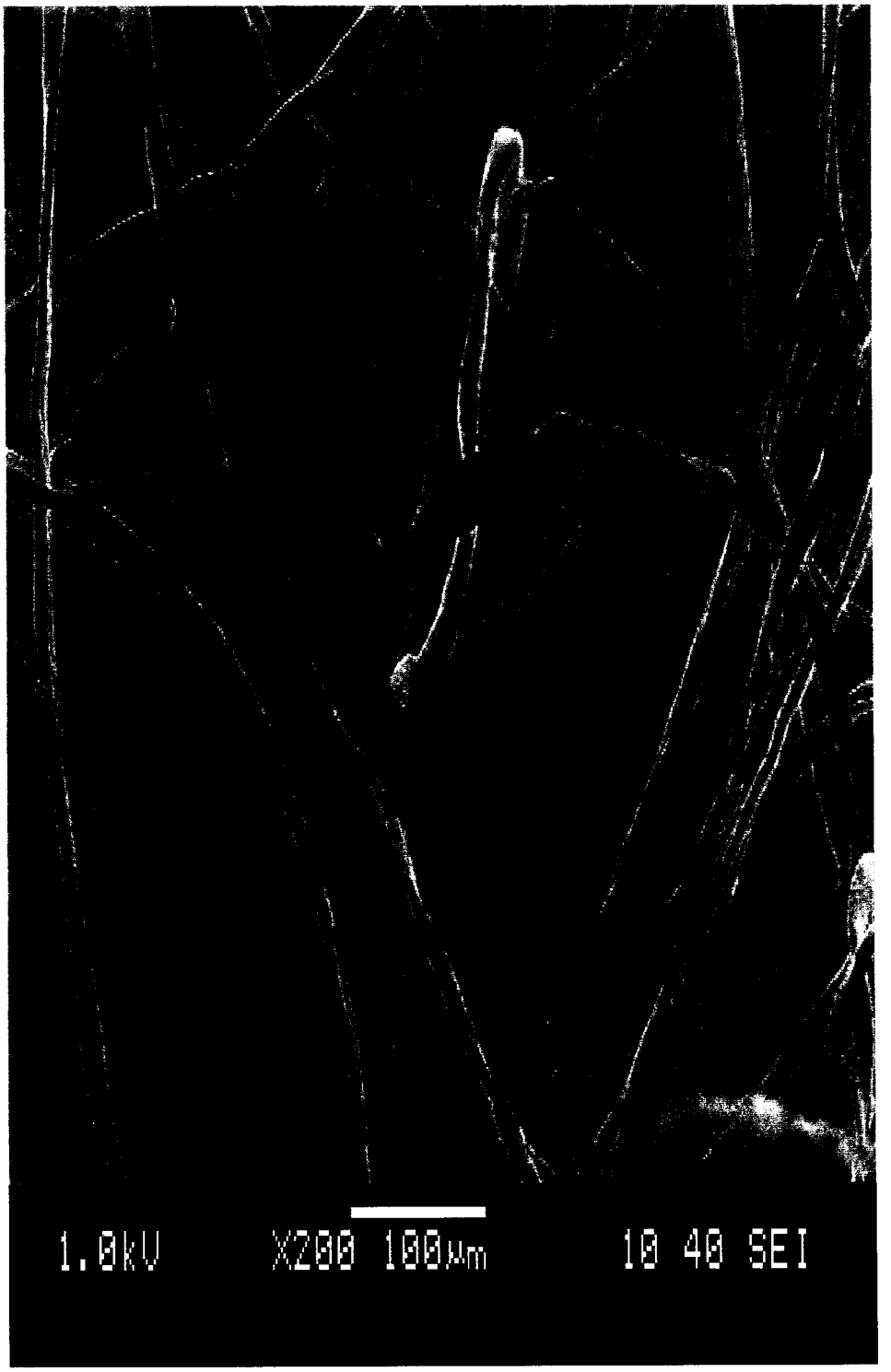

1.0kV
X200 100µm
11 40 SEI

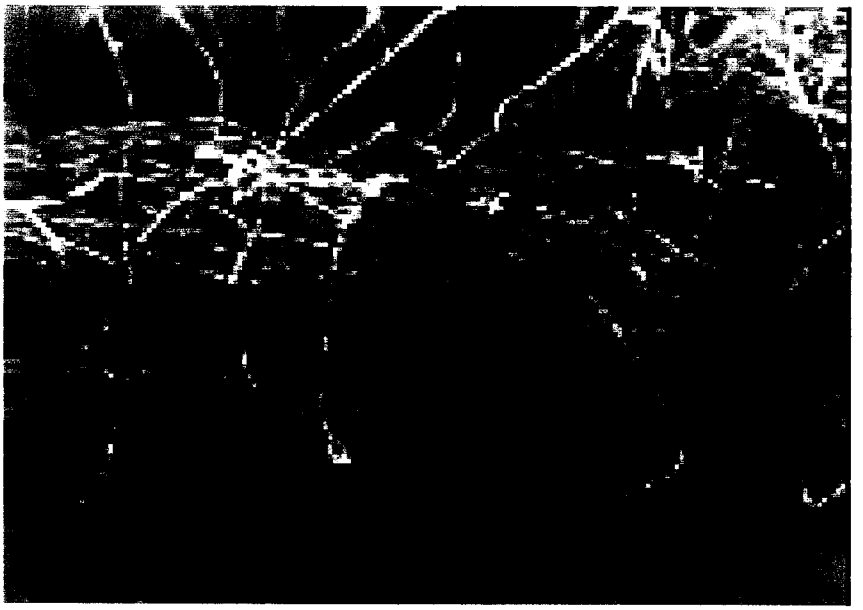
Image of DREF Mesta/cotton yarn in SEM:




1.0kV
X50 500µm
10 40 SEI


1.0kV X200 100µm 10 40 SEI

Images of Ring Spun Yarns in SEM:

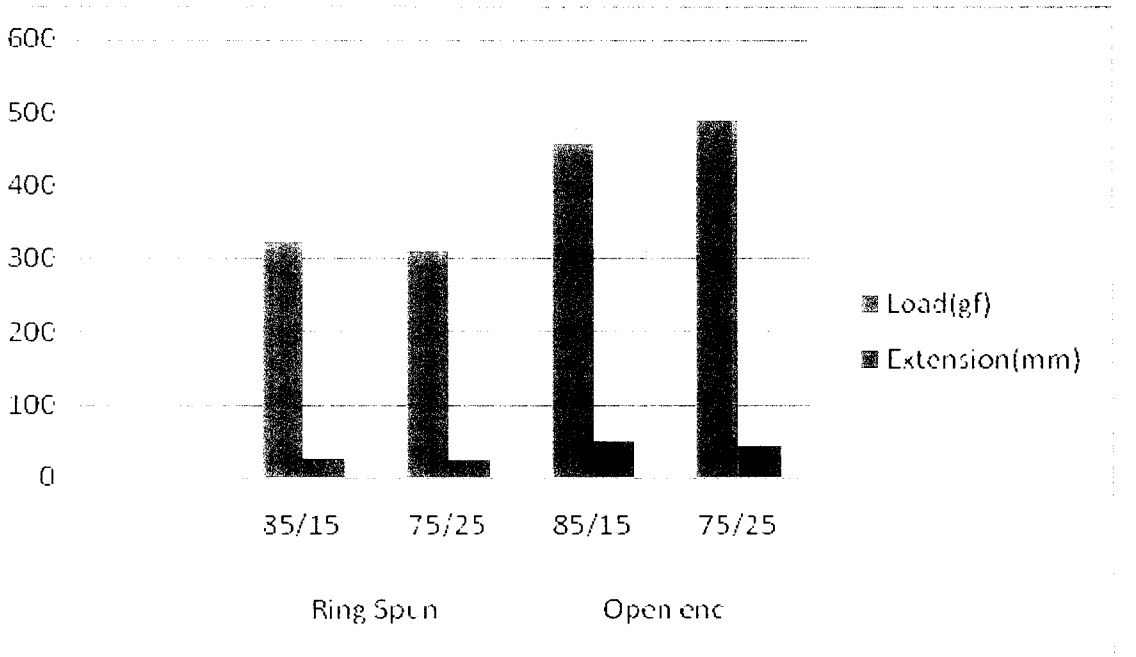


5.4 Tensile properties of Mesta yarns produced:

Load Extension Behaviour:

Comparison between the ring spun and Rotor yarns:

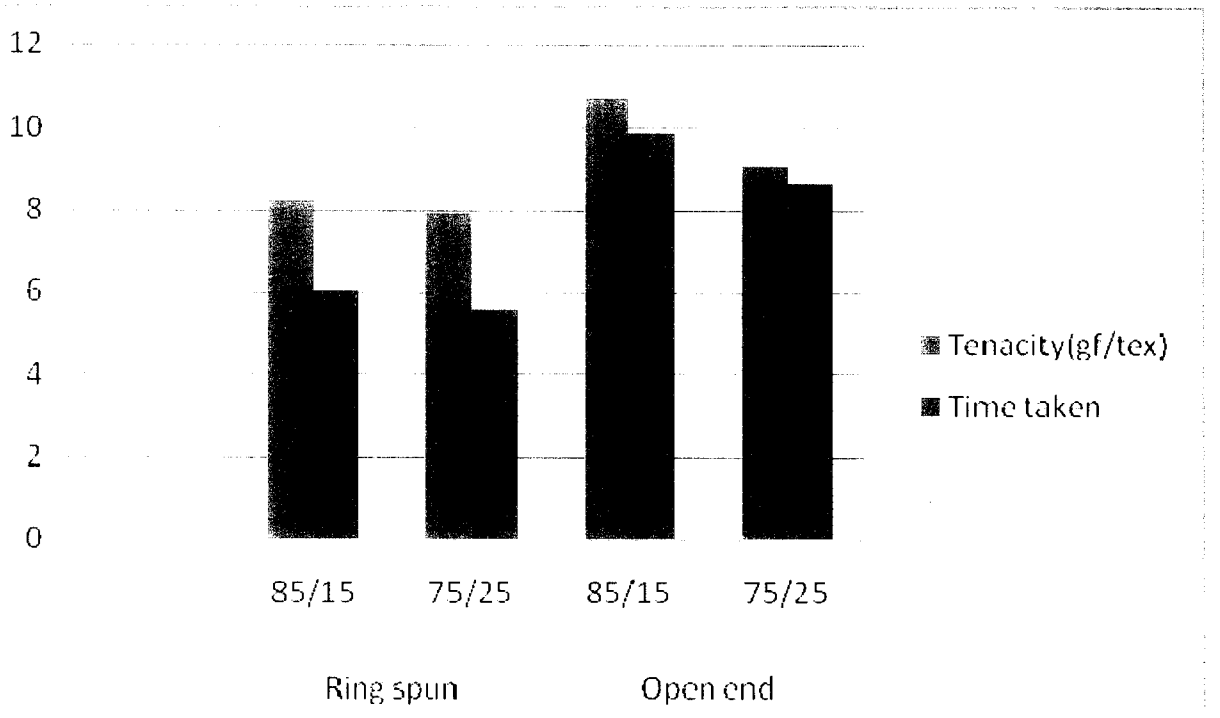
Type	Blend Ratio	Load(gf)	Extension(mm)
Ring Spun	**85/15**	**321.70**	**26.20**
	75/25	**310.09**	**22.89**
Rotor	**85/15**	**456.93**	**49.45**
	75/25	**488.27**	**43.12**



The low extension of the yarns is due to the brittle nature of mesta which resists after the initial stretching. Rotor spun yarns have better load elongation properties because they form more compact yarn and hence the constituent fibres contribute to the high strength characteristics whereas the ring yarns are more hairy resulting in less compact structure.

Yarn Behaviour under Stress:

Type	Blend Ratio	Tenacity(gf/tex)	Time taken
Ring spun	**85/15**	**8.24**	**6.04**
	75/25	**7.89**	**5.57**
Rotor	**85/15**	**10.7**	**9.87**
	75/25	**9.04**	**8.62**



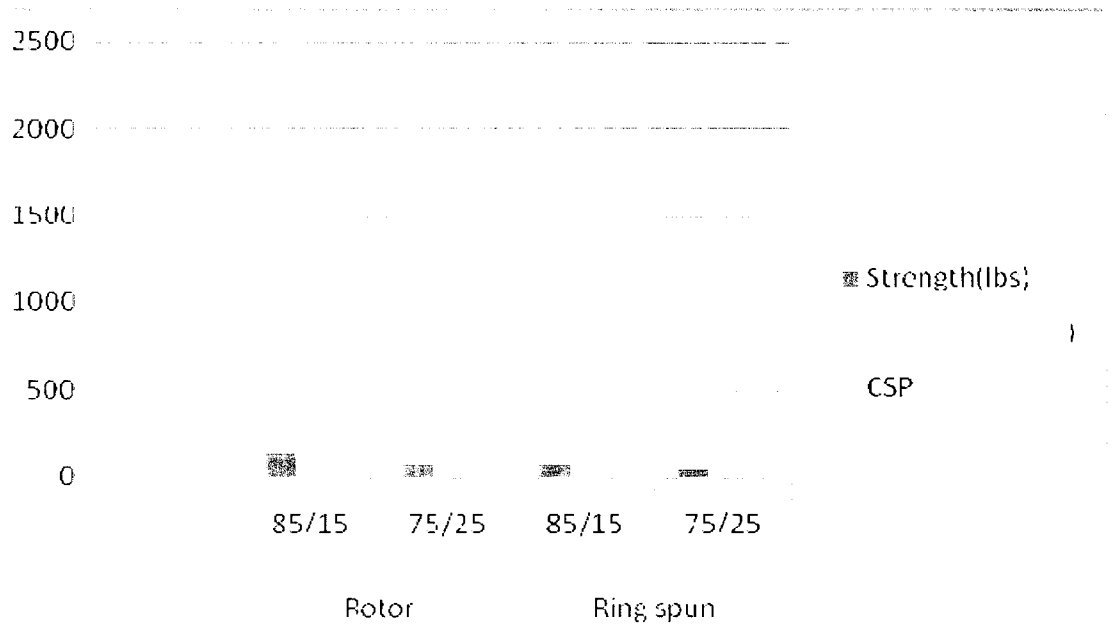
The ring spun yarns can be seen from the graphs that it breaks easily within a short period of time for load applied on it, this is because the mesta fibres are not twisted into the yarn structure due to their high bundle tenacity on the contrary

the rotor spun yarns have good tensile characteristics because the mesta is drawn into the core while the cotton fibres wrap around it hence the structure is Strong.

LEA STRENGTH ANALYSIS:

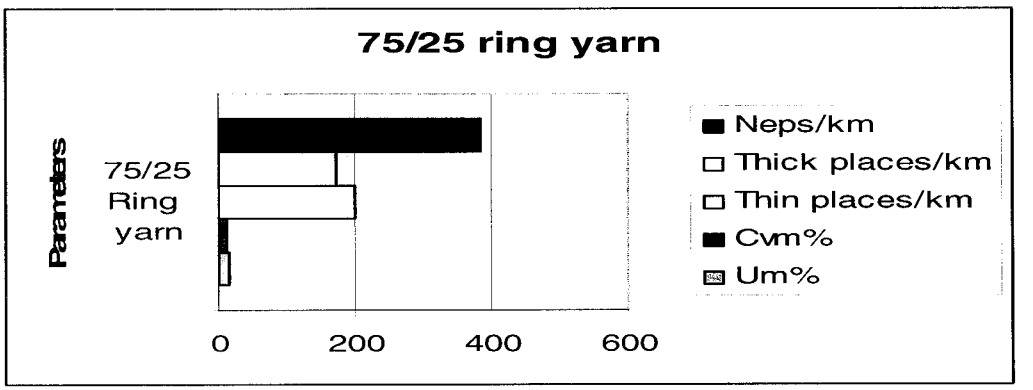
Type	Blend Ratio	Strength(lbs)	Elongation(inch)	CSP
Rotor	85/15	131.6	2.75	1974
	75/25	67.63	2	1014
Ring spun	85/15	62.7	1.25	941
	75/25	40.08	1	601

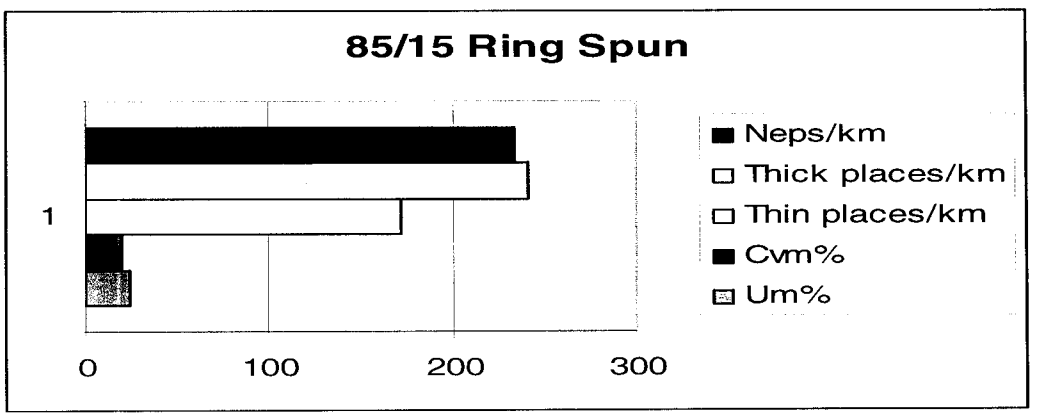
CSP CHART:



Analysis of Yarn Irregularities(Ring Spun Yarn):

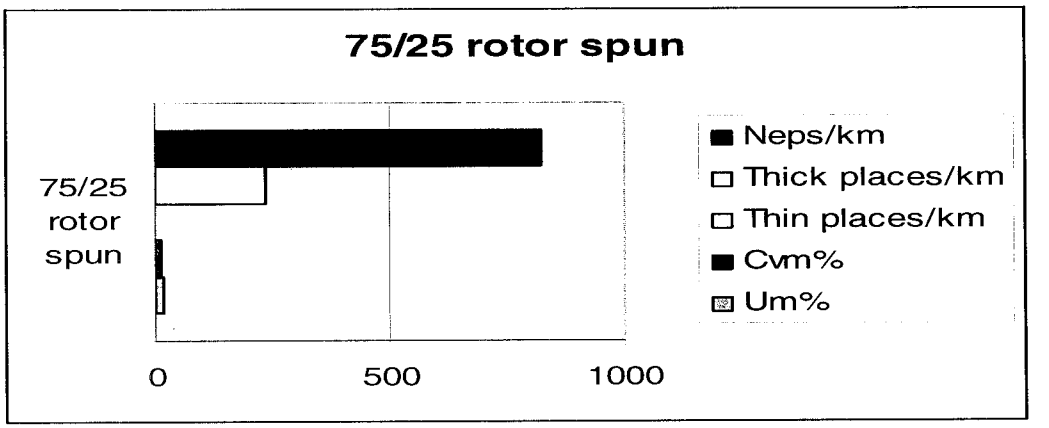
Parameters	75/25 RF	85/15 RF
Um%	15.32	24.68
CVm(1m)%	10.94	19.03
Thin/km (-50%)	198	172
Thick/km (+50%)	170	241
Neps/km (+200%)	385	233

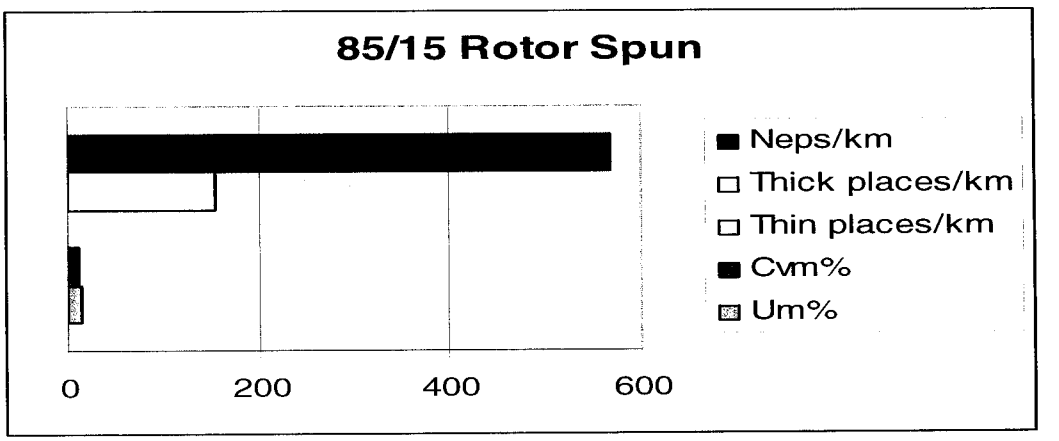




Analysis of Yarn Irregularities(Rotor Spun Yarn):

Parameters	75/25 OE	85/15 OE
Um%	15.48	14.20
CVm(1m)%	14.31	12.06
Thin/km (-50%)	2	2
Thick/km (+50%)	238	154
Neps/km (+280%)	184	86





very low thin places in their structure. Due to the reduced variation in the rotor spun yarns we have high strength property. This is because only after a considerable amount of fibre is drawn the yarn formation takes place in rotor spinning whereas in ring spinning the yarn formation takes place even when there is less fibre at a given time as long as the withdrawal tension is not too great for the fibre mass. The thick places or more or less similar in both type of yarns. The uneveness is slightly higher in ring yarn due to hairiness resulting due to less compact structure.

Moreover when the content of mesta fibre is increased due to the inherent variation in fibre fineness, the imperfections are found to increase. This is why the (75/25) blends have more imperfections.

Chapter 6
Conclusions

- The Amino Silicone Treatment has been found to be the most suitable softener for mesta as it improves the moisture regain value of mesta by about 100% (from 7.87 to 16.52) but leaving the bundle fibre tenacity vastly unchanged.

- Through Scanning Electron Microscope analysis it is found that the rotor spun yarn has the least hairy surface followed by ring and then DREF spun Yarn.

- As the concentration of cotton is decreased the resultant yarns tend to have a decrease in strength and elongation while yarn irregularities such as neps increase.

- Among the yarns manufactured the rotor spun yarn with blend proportion (85/25) has the highest CSP of about 1974, whereas the yarn with the least CSP is ring spun yarn of proportion (75/25). It has CSP 601.

- The ring spun yarns have been found to have poor breaking strength of 321.70 and 310.10 for 85/15 and 75/25 respectively while the rotor spun yarns possess reasonable strengths of 456.30 and 488.57 respectively.

Chapter 7
FUTURE SCOPE OF WORK

- To perform woollenizing treatment to Mesta/cotton yarn and fabrics and studying its suitablity for making warm clothes.

- To find various end applications of Mesta/cotton fabrics like hand bags, purses, curtains and wall hangings.

- To find the suitable functional finishes to Mesta/cotton and 100% Mesta fabrics.

- To blend the Mesta/cotton dref yarn with polyester dref yarn by doubling and studying the characteristics of yarn suitable for producing mops which is used in cleaning (mop sticks).

- To use non woven techniques to manufacture fabrics and materials using Mesta which can be applied for making upholstery, mats and composite structures.

- To increase proportion of mesta and obtain yarns from cotton/mesta blends.

- To study the effect of fibre migration in mesta/cotton blended yarns.

- To investigate on better treatment processes for mesta so as to improve its spinnability further than that achieved by currently applied methods.

Chapter 8
REFERENCES

1) A.K. Samanta, G.Basu and P. Ghosh, "Enzyme and silicone treatments on jute fibre: Part I Effect on textile related properties" *Journal of Textile Institute, 2008, Vol.99, pp. 295 - 306.*

2) Gautam Basu, A. K.Samanta and P.Ghosh, "Enzyme and silicone treatments in jute fibre: Part II Effect on process performance during yarn making and yarn properties", *Journal of Textile Institute, 2008, Vol.99, pp.307-316.*

3.) P. Bel Berger, T.Von Hoven, G.N. Ramaswamy, L. Kimmel and E. Boylston, "Cotton/Kenaf fabrics: a viable natural fabric", *Journal of Cotton Science, Vol. 2(3), 1999.*

4.) C.R. Debnath and S.B. Bandyopadhyay, "Jute-Viscose Blending: Some Optimum Conditions", *Textile Research Journal, May 1975; Vol. 45: pp. 404-408.*

5.) Jute Technological Research Report.

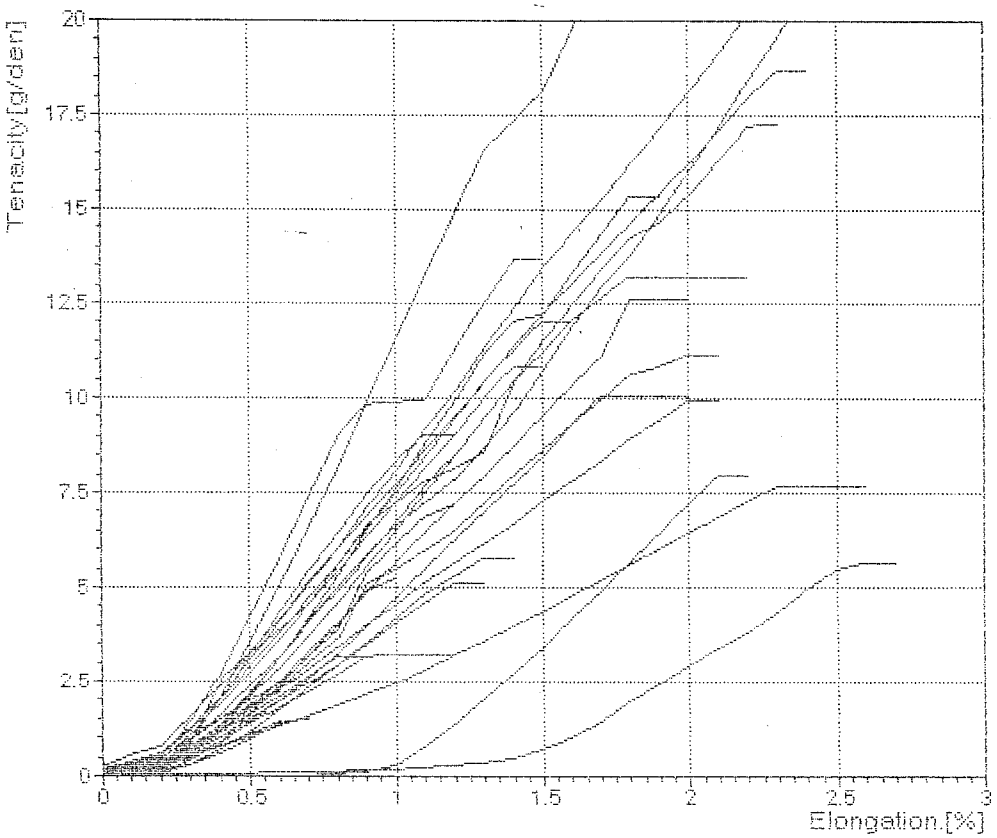
6.) Gita N. Ramaswamy, Cynthia G. Ruff and Catherine R. Boyd, "Effect of bacterial and chemical retting on Kenaf fibre quality", *Textile Research Journal, May 1994; Vol.64: pp. 305-308.*

APPENDICES

File Name : F-18819
Particulars: SAMPLE-2
Comment : UN TREATED
Longterm Code : FIB
Gauge Length [mm] : 20
Tension Weight [mg] : 500
Testing Speed [mm/min]: 20
Procedure ASTM D-3822 & BISFA'98:

	Titer [den]	Tenacity [g/den]	Elong. [%]	Force [g]	Tenacity [g/den] 10.0%
001	14.10	7.19	1.2	101.41	0.000
002	15.19	12.61	2.0	191.60	0.000
003	14.12	1.43	0.6	20.20	0.000
004	15.59	1.50	0.7	23.39	0.000
005	15.59	5.25	1.0	81.87	0.000
006	12.78	20.16	2.3	257.72	0.000
007	16.06	9.96	2.1	160.01	0.000
008	8.52	13.67	1.5	116.50	0.000
009	13.22	17.28	2.3	228.51	0.000
010	14.63	3.15	0.9	46.10	0.000
011	13.96	20.82	2.5	290.73	0.000
012	16.18	11.14	2.1	180.30	0.000
013	15.98	15.38	1.9	245.85	0.000
014	15.17	2.20	0.6	33.39	0.000
015	11.59	12.03	1.6	139.47	0.000
016	11.17	27.42	3.0	306.37	0.000
017	13.90	10.05	2.0	139.74	0.000
018	9.76	8.53	1.2	83.28	0.000
019	11.02	10.83	1.5	119.38	0.000
020	15.83	5.09	1.3	80.60	0.000
021	13.66	13.21	2.2	180.50	0.000
022	8.36	7.68	2.6	64.22	0.000
023	14.92	5.75	1.4	85.82	0.000
024	11.87	9.02	1.2	107.10	0.000
025	13.74	3.19	1.2	43.85	0.000
026	15.64	7.99	2.2	125.00	0.000
027	15.50	5.66	2.7	87.76	0.000
028	14.87	2.22	0.6	33.02	0.000
029	13.64	18.72	2.4	255.42	0.000
Minimum	8.36	1.43	0.6	20.20	0.000
Maximum	16.18	27.42	3.0	306.37	0.000
Range	7.82	25.99	2.4	286.17	0.000
Mean	13.67	9.97	1.7	132.04	0.000
Std.dev	2.22	6.50	0.7	83.50	0.000
Cv [%]	16.2	65.2	41.2	63.2	0.0
Confid. Interv.	12.83 14.52	7.50 12.44	1.4 1.9	100.28 163.80	0.000 0.000

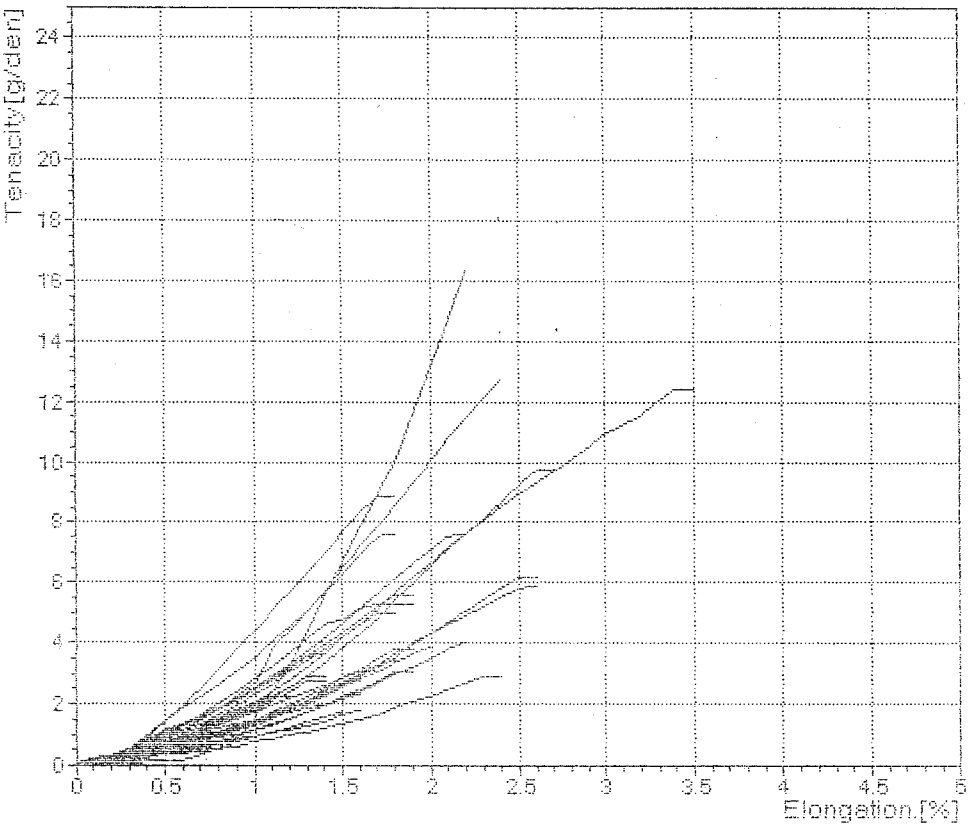
File Name : F-18819
Particulars: SAMPLE-2
Comment : UN TREATED
Longterm Code : FIB
Gauge Length [mm] : 20
Tension Weight [mg] : 500
Testing Speed [mm/min]: 20
Procedure ASTM D-3822 & BISFA'98:



File Name : F-18818
Particulars: SAMPLE-1
Comment : TREATED
Longterm Code : FIB
Gauge Length [mm] : 20
Tension Weight [mg] : 500
Testing Speed [mm/min]: 12
Procedure ASTM D-3822 & BISFA'98:

	Titer [den]	Tenacity [g/den]	Elong. [%]	Force [g]	Tenacity [g/den] 10.0%
001	3.20	16.36	2.2	52.37	0.000
002	14.12	1.80	1.6	25.43	0.000
003	16.44	1.70	1.5	27.96	0.000
004	8.18	2.87	1.3	23.48	0.000
005	15.31	3.81	1.9	58.35	0.000
006	16.26	6.14	2.6	99.87	0.000
007	11.87	7.56	2.2	89.76	0.000
008	15.47	3.64	1.4	56.33	0.000
009	11.11	2.23	1.2	24.78	0.000
010	12.39	5.61	1.9	69.53	0.000
011	13.82	5.02	1.8	69.40	0.000
012	15.96	1.88	1.0	30.02	0.000
013	13.92	3.86	2.0	53.75	0.000
014	10.42	12.71	2.4	132.48	0.000
015	14.31	5.88	2.6	84.17	0.000
016	13.54	2.87	2.4	38.87	0.000
017	9.36	2.78	1.6	26.03	0.000
018	8.65	4.03	2.2	34.87	0.000
019	13.12	2.30	1.6	30.19	0.000
020	14.50	3.08	1.9	44.67	0.000
021	14.18	2.73	1.4	38.72	0.000
022	16.13	1.93	1.3	31.14	0.000
023	12.55	5.31	1.9	66.66	0.000
024	12.24	8.89	1.8	108.85	0.000
025	15.19	2.70	1.5	41.03	0.000
026	15.05	9.71	2.7	146.18	0.000
027	16.39	3.41	1.8	55.91	0.000
028	13.82	2.91	1.4	40.23	0.000
029	11.74	7.58	1.8	89.02	0.000
030	14.44	12.44	3.5	179.69	0.000
Minimum	3.20	1.70	1.0	23.48	0.000
Maximum	16.44	16.36	3.5	179.69	0.000
Range.	13.24	14.66	2.5	156.20	0.000
Mean	13.12	5.12	1.9	62.32	0.000
Std.dev	2.93	3.68	0.5	39.20	0.000
Cv [%]	22.3	71.8	28.5	62.9	0.0
Confid.	12.03	3.75	1.7	47.69	0.000
Interv.	14.22	6.50	2.1	76.96	0.000

File Name : F-18818
Particulars: SAMPLE-1
Comment : TREATED
Longterm Code : FIB
Gauge Length [mm] : 20
Tension Weight [mg] : 500
Testing Speed [mm/min]: 12
Procedure ASTM D-3822 & BISFA'98:



Fibre Test Report No.:3712 Kumaraguru College of Technology,

Samples Tested at : R.H. 65% +/- 2% and Temp. 21 Degree C +/- 1 Degree C

Lab Code No.	F_18818	F_18819
Sample Particulars.:	SAMPLE-I TREATED	SAMPLE-II UNTREATED

Moisture Test Fibre/Yarn/Cloth/ S. F.

ISO 6741-1:1989

Moisture Content %	14.18	7.29
Moisture Regain %	16.52	7.87

Fiber Denier & Single Fibre Tenacity

(As per BISFA 1998 & ASTM D-3822-01)

Denier		
Mean Denier	13.12	13.67
CV% of Denier	22.30	16.20
Single Fibre St. & Elongation		
Tenacity g/Denier	5.12	9.97
CV% of Tenacity	71.80	65.20
Elongation %	1.90	1.70
CV% of Elongation	28.50	41.20

End of Report

SINGLE/OVERALL RESULTS

Article Number:2 S
Department :Ring Frame
Machine Number:601
Count :2 Nec
Material :TEST BT
Test Duration :1 min
Comments :STUDENT (75/25 MESTA)

Operator :KM
Test Number :380
Test Date :17/04/2009
Test Speed :400 m/min
Test Time :3:25:44 PM

Fib Type :Short Staple
Fib1 Value:4.5 µg/inch
Fib1 Prop :65%
Fib2 Value:3.99µg/inch
Fib2 Prop :35%

Test No.	Um (%)	CVm (%)	CVm (1m) %	Thn/Km (-30%)	Thn/Km (-40%)	Thn/Km (-50%)	Thk/Km (+35%)	Thk/Km (+50%)
1/1	15.32	19.25	10.94	5333	1373	198	1025	170
Mean	15.32	19.25	10.94	5333	1373	198	1025	170

Test No.	Thk/Km (+70%)	Neps/Km (+140%)	Neps/Km (+200%)	Neps/Km (+280%)	Rel.Cnt (%)
1/1	28	3060	385	30	100.00
Mean	28	3060	385	30	100.00

SINGLE/OVERALL RESULTS

Article Number	:11 S	Operator	:KN	Fib Type	:Short Staple
Department	:Ring Frame	Test Number	:381	Fib1 Value	:4.5 µg/inch
Machine Number	:601,601	Test Date	:17/04/2009	Fib1 Prop	:65%
Count	:11 Nec	Test Speed	:400 m/min	Fib2 Value	:3.99µg/inch
Material	:TEST BT	Test Time	:3:31:38 PM	Fib2 Prop	:35%
Test Duration	:1 min				
Comments	:STUDENT (75/25 OE MESTA)				

Test No.	Um (%)	CVm (%)	CVm (1m) %	Thn/Km (-30%)	Thn/Km (-40%)	Thn/Km (-50%)	Thk/Km (+35%)	Thk/Km (+50%)
1/1	14.76	18.87	12.67	2565	248	0	1013	220
1/2	16.19	21.31	15.96	2725	290	3	1055	255
Mean	15.48	20.09	14.31	2645	269	2	1034	238

Test No.	Thk/Km (+70%)	Neps/Km (+140%)	Neps/Km (+200%)	Neps/Km (+280%)	Rel.Cnt (%)
1/1	45	3475	780	168	93.56
1/2	50	3510	868	200	106.44
Mean	48	3493	824	184	100.00

Article Number	:14 S	Operator	:KN	Fib Type	:Short Staple
Department	:Ring Frame	Test Number	:383	Fib1 Value	:4.5 µg/inch
Machine Number	:601,601	Test Date	:17/04/2009	Fib1 Prop	:65%
Count	:14 Nec	Test Speed	:400 m/min	Fib2 Value	:3.99µg/inch
Material	:TEST BT	Test Time	:3:40:38 PM	Fib2 Prop	:35%
Test Duration	:1 min				
Comments	:STUDENT (85/15 RF MESTA)				

Test No.	Um (%)	CVm (%)	CVm (1m) %	Thn/Km (-30%)	Thn/Km (-40%)	Thn/Km (-50%)	Thk/Km (+35%)	Thk/Km (+50%)
1/1	23.06	29.90	15.98	9598	4338	1105	4260	2218
1/2	26.31	33.68	21.08	10453	5983	2338	4600	2613
Mean	24.68	31.79	19.03	10026	5161	1722	4430	2416

Test No.	Thk/Km (+70%)	Neps/Km (+140%)	Neps/Km (+200%)	Neps/Km (+280%)	Rel.Cnt (%)
1/1	1045	5905	2430	870	97.95
1/2	1203	5890	2235	790	102.05
Mean	1124	5898	2333	830	100.00

SINGLE/OVERALL RESULTS

Article Number	:14 S	Operator	:KK	Fib Type	:Short Staple
Department	:Ring Frame	Test Number	:082	Fib1 Value	:4.5 µg/inch
Machine Number	:601,601	Test Date	:17/04/2009	Fib1 Prop	:65%
Count	:14 Nec	Test Speed	:400 m/min	Fib2 Value	:3.99µg/inch
Material	:TEXT ET	Test Time	:3:36:01 PM	Fib2 Prop	:35%
Test Duration	:1 min				
Comments	:STUDENT (85/15 OE MESTA)				

Test No.	Um (%)	CVm (%)	CVm (1m) %	Thn/Km (-30%)	Thn/Km (-40%)	Thn/Km (-50%)	Thk/Km (+35%)	Thk/Km (+50%)
1/1	14.39	18.36	12.63	2252	240	3	732	150
1/2	14.01	17.66	11.53	2098	126	0	802	158
Mean	14.20	18.00	12.08	2175	183	2	767	154

Test No.	Thk/Km (+70%)	Neps/Km (+140%)	Neps/Km (+200%)	Neps/Km (+280%)	Rel.Cnt (%)
1/1	23	2736	565	88	95.31
1/2	13	2915	570	83	104.69
Mean	18	2825	568	86	100.00