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PROPERTIES OF RAMIE AND ITS BLENDS

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Abstract— Ramie is recognized as the strongest of all natural bast fibres in the world which is known as riha in Assam. It is a perennial shrub of the urticacease family yielding fibre from the bark of the canes which provides excellent raw material for blending with the natural and synthetic fibres. It was found that the full grown plant attains a height of about 5-8 feet and diameter of stem 5.0-3.0 cm at three different levels, viz. bottom and top. The morphological characteristics and chemical analysis showed their suitability as good textiles materials. The physical properties of Ramie fibre exhibited high tenacity, high luster and brightness. It has resistance to heat, light, acid and alkali etc. The fibre materials were capable of producing excellent blended fabrics and its position as substitute for cotton is unchallenged. Ramie blended with different types of silk showed good results, but 50:50 blends showed the best result than 60:40 blends. The breaking laod of 50:50 blends ranged from 131.75 – 189.16 lb for different type of silk. Therefore, blending of ramie with different silk with different blend proportions offers excellent scope for producing a variety of materials for different uses.

Keywords— Ramie, Synthetic Fibers, Cotton, Textiles Materials

Introduction

Ramie, one of the oldest textile fibre of plant origin ruled the textile world as king of natural fibres. Its popularity in the textile world is limited due to the difficulty in degumming and lack of knowledge of mechanical processing. Increasing ecological consciousness has accelerated interest in ramie originating from plants that are safe, biodegradable and recyclable. Ramie is highly adorned for its luster, strength, excellent microbial resistance and valuable hygienic properties. Some of the demerits are encrusting gummy materials and its cohesiveness. If the apparent demerits can be masked, an excellent diverse range of product can be engineered by exploiting the intrinsic properties of ramie.

The demand for ramie fiber is mainly felt in the fields of blending with other fiber. Ramie can be blended with cotton, flax, wool, polyester, acrylic and silk of all types.

Based on the demand of the ramie fiber, a detail study were made on possibility of utilizing ramie fibre with different silk waste with the following objective:

To establish the feasibility of blending ramie with different silk waste.

To assess the desired physical properties of the blended yarn.

Product development.

Materials & Methods

Decorticated Ramie fiber was collected from Ramie research station, central Research Institute for jute and allied fibers (CRIJAF)Sorhhog, Assam

Fig. 1. Ramie Plant

Methods:

Degumming of Ramie: Decorticated ramie fiber was degummed with four different concentrations (0.5%-2%) at different time period 1-2.5h at 100°. After degumming fibres were washed thoroughly & neutralized with dilute acetic acid. Fibers were than hydro extracted & dried. After degumming, fibres were bleached with 1% hydrogen peroxide.

Fig 2.

A) Bark of ramie

B) Decorticated ramie fiber

C) Degumming ramie fiber

Chemical analysis : The proximate chemical analysis of the fiber was carried out by standard methods of the Technical Association of Pulp & papers Industry, (4).

Fiber Morphology: The bleached fibers were observed under the microscope fitted with micrometer scale for measurement of the length, diameter, wall thickness & lumen width.

Blending: Blending was done in carding stage and yarns were spun on silk spinning machines. Prior to testing, the blended yarns were conditioned to moisture equilibrium and tested in the laboratory following ASTM standards (5).

FINDINGS

Fiber properties:

Table 1: Morphological properties of the ramie fiber

	Properties	
1.	Fiber length (L) mm	
	Maximum	60.40
	Minimum	30.00
	Average	40.00
2.	Fiber diameter (D) μm	
	Maximum	20.00
	Minimum	8.00
	Average	10.00
3.	Cell wall thickness (W) μm	2.80
4.	Lumen width average (d) μm	12.80

The morphological characteristics of ramie fiber were examined & presented in Table 1. The maximum fiber length was found to be 60.40mm, while the average length was found to be 40.00mm. So as the maximum diameter of the fiber was observed 20μm and average diameter was found to be 10μm. cell wall thickness & lumen width were (2.80 & 12.80μm) respectively.

Table 2. Chemical constituent of the ramie fiber

	Particulars	Decorticated ramie	Degummed ramie	Bleached ramie
1.	Moisture content(%)	6.97	7.51	8.3
2.	Ash content (%)	1.25	0.69	0.46
3.	Lignin (%)	9.25	-	-
4.	Pentosan (%)	4.80	1.01	0.9
5.	Cellulose (%)	70.10	84.1	87.2
6.	Fat & wax(%)	0.6	0.4	0.2
7.	Hemi cellulose	9.8	3.4	2.3

The chemical constituent of ramie fiber was analyzed and data were presented in Table 2. The moisture content of bleached fiber was more (8.3%) where as ash content of raw fiber was found to be more in case of decorticated fiber. It was interesting to note that the lignin was completely removed in case of degummed and bleached fiber which may be due to proper degumming of the fiber (6). From the table it was seen that the pentosan contents were decreased in case of degummed and bleached fiber, while the percentage of cellulose contents was increased.

Scanning electron microscopic study of ramie fibre:

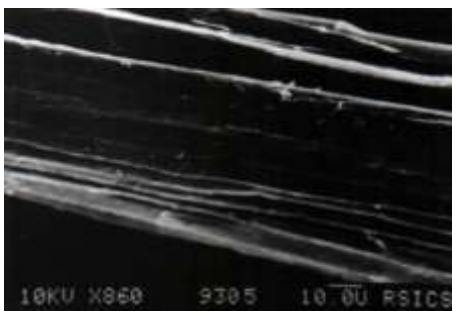


Fig. 3. Decorticated ramie fibre

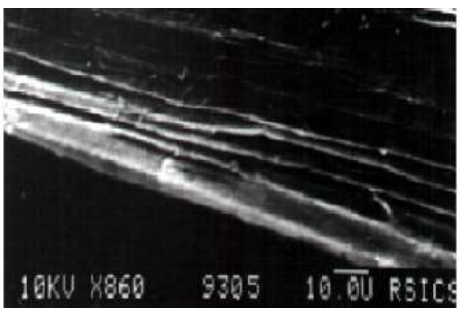


Fig. 4. Degummed ramie fibre

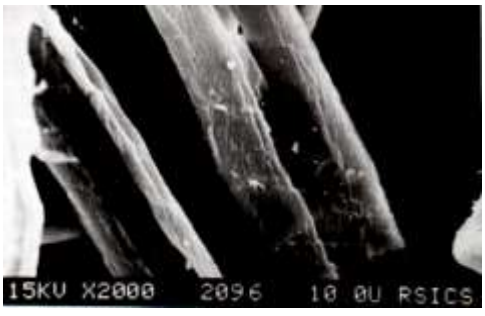


Fig. 5.Bleached ramie fibre

Scanning electron microscopic study of ramie fibre :

The surface morphology of ramie fibre was examined under a scanning electron microscope and are shown in fig 3, 4, 5. The gummy substance was seen in the raw decorticated ramie fibre, where as the surface of the degummed and bleached ramie was found smooth.

Table 3. Physical properties of the fiber

Property	Ramie	Muga	Eri	Mulberry
Denier	3.0	4.30	5.10	1.02
Average fiber length (mm)	40	80.00	90.0	98
Mean breaking load (g)	30.09	15.48	15.50	4.10
CV% of B load	9.0	13.0	10.8	20.0
Tenacity (g/d)	10	3.60	3.10	3.6
Mean breaking elongation (%)	4.5	29	24	20.0
CV% breaking elongation	20.5	18.4	11.2	30.4
Moisture regain (%)	17.5	13.2	15.18	18.2
Density(g/cc)	1.5	1.8	1.38	2.3

Fiber properties of ramie, muga, mulberry and eri silk used for the blended yarns were studied and presented in the Table 3. the highest denier was found for eri silk, which was 5.1 and the lowest denier for mulberry silk which was 5.1 and the lowest filament denier for mulberry silk which was 1.02 the lowest breaking load was found (4.1g) for mulberry silk and highest breaking load for ramie fiber (30.09) followed by eri and muga silk (15.50 and 15.48 g) respectively.

It was observed from the Table that breaking elongation of muga was more (29%) as compared to other three fibers. Tenacity of the fiber was also calculated from its breaking load and denier and presented in the Table. The tenacity of the ramie fiber was found to be the highest (10g/d) followed by eri, muga and mulberry (3.1 g/d, 3.6 g/d and 3.6 g/d) respectively.

Yarn Properties

Count and TPI of ramie blended yarns:

The count and TPI of ramie blended yarns are presented in Table 4. The highest yarn count (12) was found in case of yarns blended with ramie/mulberry. The count of other blended yarns was (6.22 and 8.15) for ramie/muga and (5 and 5.72) for ramie/eri respectively. From the Table, it is clear that as the ramie proportion is increased in the blends, the count of yarn decreases, which makes the yarn thick. This is due to the highest denier of ramie fiber.

The lowest TPI was found in case of ramie/eri blend, which was (16 and 18.5). This may be due to the highest denier of raime and eri fiber. The TPI of ramie/mulberry blend (23.75 and 25.45) was found to be the highest followed by ramie/muga blend (20.39 and 17.75) respectively.

Breaking strength, elongation per cent of ramie-blended yarns:

The breaking strength and elongation per cent of ramie-blended yarns are also given in Table 4. It is clear from the Table that the sample of 60:40 blends showed higher breaking strength than 50:50 blends, which is due to the higher content of ramie fiber in the blend. As the ramie proportion in the blend is increased breaking strengths of the fiber increases. The breaking strength of ramie/eri blends were found to be (189.16 and 210.75) followed by ramie/muga (131.75 and 186.3) and ramie/mulberry (120.50 and 167.45) respectively. The higher breaking strength of ramie/eri blend may be due to higher denier of ramie and eri fibres.

The elongation per cent of ramie/mulberry blended was found to be higher than other two blends, (9.3 and 10) and (7.9 and 8.6) for ramie/muga and ramie/eri respectively. The lower elongation per cent of the blended yarn may be due to the stiffness and the higher denier of ramie/muga and ramie/eri fibres.

Evenness of ramie-blended yarns:

The unevenness of yarns in the three blends was observed and and recorded in the Table 4. The unevenness per cent of blended yarns was found to be higher (16.10%) in case of ramie/eri blends and lowest (8.50) for ramie/mulberry blended yarns. The 50:50 blend shows less U% than 60:40 blended fiber. The unevenness of silk depends on the hand of the reeler as well as the removal of sericin during cooling and reeling. If the cocoon gets uniform temperature in cooking, then less unevenness can be expected.

Table 4 : Physical properties of Ramie blended yarn

Properties	**Blend composition**					
	R.Mu*		**R.Mul***		**R.E***	
	60-40	**50-50**	**60-40**	**50-50**	**60-40**	**50-50**
Count	8.15s	6.22s	10.95s	12.0s	5.72s	5.0s
TPI	17.75	20.39	23.75	25.45	18.50	16.00
Breaking load (lb)	186.30	131.75	167.45	120.50	210.75	189.16
CV% of breaking strength	9.10	8.34	10.75	11.53	10.04	7.34
Breaking elongation (%)	9.30	10.00	10.00	12.00	7.90	8.60
CV% of elongation	8.00	11.30	15.00	9.30	10.40	13.20
Unevenness (U %)	14.00	12.10	10.10	8.80	16.10	13.98
CV%	9.30	8.40	8.50	8.60	8.00	10.20

*** R.Mu –** Ramie/Muga, **R.Mul**- Ramie/Mulberry, **R.E**. – Ramie/Eri

Fig. 6

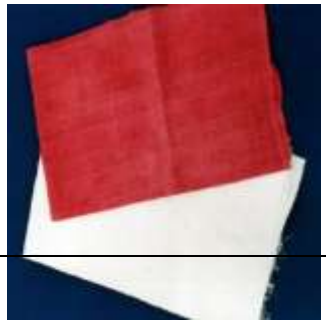
A) 100% ramie yarn

B) Ramie/mulberry blended yarn

C) Ramie/muga blended yarn

Preparation of fabric:

Plain weave fabric were prepared by using different blended yarns and based on fabric texture some of the garment were prepared.



Product of ramie blended fabric Fig-7

Conclusion

Both degummed and bleached ramie shows a definite improvement of fibre characteristics, which can be used to blend with different fibres in different processing system. Considering all the physical tests, the 50:50 blend proportion shows better result than 60:40 blends, which is required for clothing materials. From the aforesaid, it can be inferred that both proportions can be used for producing the blended yarn. Blending of ramie with different silk fibres offers excellent scope for producing a variety of materials for different uses. Apart from these blend proportions, different blend proportions can be tried with silk & other fibers for different end uses.

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