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Properties of Roselle and its Blends

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A B S T R A C T

One of the most noticeable bast fibre crops is roselle, which is widely grown in Assam. The scientific name for Roselle is *Hibiscus sabdariffa* L., and the plant is from the Malvacea family. Roselle found abundantly in tropical areas. It is a perennial shrub yielding fibre from the bark of the canes which provides excellent raw material for blending with the natural and synthetic fibres. It is an annual, erect, bushy, herbaceous sub shrub that can grow up to 8 ft (2.4m) tall and diameter of stem 2.0-4.0 cm at three different levels, viz. bottom and top, with smooth or nearly smooth, cylindrical, typically red stems. The morphological characteristics and chemical analysis showed their suitability as good textiles materials. The physical properties of Roselle 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. Roselle blended with different types of other cellulosic fibres showed good results, but 50:50 blends showed the best result than 25:75 blends. The tensile strength of 50:50 blends ranged from 20-30 g/tex for different blends. Therefore, blending of roselle with other cellulosic fibres in different proportions offers excellent scope for producing a variety of materials for different uses.

Introduction

Roselle plant is classified in hibiscus group and the scientific name is *Hibiscus sabdariffa* L. The advantages of roselle plant is not only in fruit, but it is also has bast fibre that can produced and used as a rope, jute and textile. Its popularity in the textile world is limited due to the difficulty in degumming and lack of knowledge of mechanical processing. Over the last few decades, roselle fibres have been used for heavy-duty cables and composite materials due to their sustainability and lack of decay for a long duration. Increasing ecological consciousness has accelerated interest in roselle originating from plants that are safe, biodegradable and recyclable. Roselle 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 roselle. The demand for roselle fiber is mainly felt in the fields of blending with other fiber. Roselle

can be blended with cotton, flax, wool, polyester, acrylic and silk of all types. Based on the demand of the roselle fiber, detail studies were made on possibility of utilizing roselle fibre with cellulosic fibre with the following objectives includes To establish the feasibility of blending ramie with cellulosic fibres. To assess the desired physical properties of the blended yarn and Product development.

Materials and Methods

The roselle plant utilized for the present study was AS73, CP 560 variety, collected from the farmer's field of Potya gaon, Jorhat, Assam.

Degumming of roselle

Water retted roselle fiber was degummed with four different concentrations (0.5%-3%) at different time period 1-2.5h at 100°C. 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.

Fiber morphology

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

Chemical analysis

The proximate chemical analysis of the fiber was carried out by standard methods of the Technical Association of Pulp & papers Industry, (1).

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 (2).

Findings

Fibre properties

The morphological characteristics of roselle fiber were examined & presented in Table 1 and Fig. 1. The fiber length was found to be 2-2.5m. So as the maximum diameter of the fiber was observed 2.90cm. Weight & moisture (220-300g & 7.31%) respectively (6) (Fig. 2).

Table.1 Morphological properties of the roselle fiber

Parameter	Measurements
1. Length (m)	2-2.5 (7-8ft)
2. Diameter (cm)	
a) Bottom	2.90
b) Middle	2.35
c) Top	2.23
3. Weight (g)	
a) Core	300
b) Bark	220
4. Moisture (%)	73.1

Table.2 Chemical constituent of the roselle fiber

Constituent	Retted RF (%)	Degummed RF (%)	Bleached RF (%)
Cellulose	56.25	58.63	64.50
Alpha cellulose	20.23	18.00	17.55
Hemicellulose	11.50	9.70	8.15
Pectinous matter	2.30	0.70	0.50
Ash	2.08	1.03	1.25
Lignin	7.25	3.00	1.00
Wax	0.50	0.30	0.20
Moisture	7.40	8.21	8.76

Table.3 Physical properties of the fiber

Properties	Roselle fibre	Ramie fibre
Length(mm)	122	120
Diameter(µm)	14.10	10
wall thickness(µm)	3.50	2.50
Fibre fineness (g/tex)	3.90	3.5
Wicking height (cm)	13	13
Moisture regain (%)	8.40	8.5
Tensile strength (g/tex)	30.00	40.00
Elongation (%)	1.59	1.6
Density (g/cc)	1.49	1.5
Brightness index (µm)	20	20

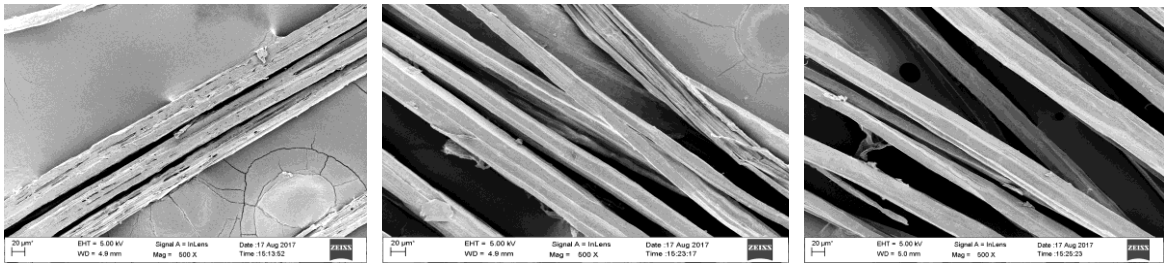
Table.4 Physical properties of Ramie blended yarn

Properties	Roselle	Ramie	Blend composition		
	100%	100%	25:75	50:50	75:25
Count (s)	40	40	40	40	40
TPI	18	17.5	19	20	18
Tenacity (g/tex)	15.50	20.87	17.35	14.01	12.99
Elongation (%)	2.94	1.29	1.71	1.77	2.73
Wicking height (cm)	6.0	6.5	5.0	5.5	6.0
Density (g/cm^3)	1.35	1.30	1.46	1.30	1.38

Fig.1 Roselle plant

Fig.2 a). Degumming of roselle fibre b). Degummed roselle fibre

Fig.3 SEM of roselle fibre



(a) Raw roselle fibres **(b) Degummed roselle fibres** **(c) Bleached roselle fibres**

Fig.4

The chemical constituent of roselle fiber was analyzed and data were presented in Table 2. It was seen that the alpha cellulose, hemicellulose, pactinous matter, wax content decreased in case of degummed and bleached fiber, while the percentage of cellulose contents was increased. The moisture content of bleached fiber was more (8.76%) where as ash content of raw fiber was found to be more in case of retted 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 (3).

Scanning electron microscopic study of roselle fibre

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

Fiber properties of roselle and ramie used for the blended yarns were studied and presented in the Table 3. The highest length, diameter, wall thickness and fibre fineness was found for roselle fibre whereas, wicking height of both the fibre were similar (13cm). The lowest moisture regain was found (8.40) in roselle fibre. It was observed from the Table that tensile strength, elongation and density was more in ramie fibre (40g/tex, 1.6%, 1.5 g/cc). The brightness index of both the fibre was similar (20 μm) (7).

Yarn properties

Physical properties of roselle blended yarns

The count and TPI of roselle blended yarns are presented in Table 4. The same yarn counts (40s) were maintained for the entire samples. Among the controlled yarns highest twist (18tpi) was registered in roselle yarn. In terms of blended yarn, maximum twist per inch (20tpi) was exhibited in blended roselle and ramie blended at 50:50. The roselle posed more density (1.35g/cm^3) followed by the controlled ramie yarn (1.30g/cm^3). Among the blended yarns the roselle and ramie blends 25:75 yarn showed maximum density of 1.46g/cm^3. Ramie showed highest tenacity (20.87g/tex) and lowest elongation (1.29%) while lowest tenacity (15.50g/tex) and highest elongation (2.94%) was observed in roselle yarn respectively (4). In case of blended yarn maximum tenacity (17.35g/tex) and minimum elongation (1.71%) was recorded in roselle and ramie blended at 25:75 ratio while lowest tenacity (12.99g/tex) and highest elongation (2.73%) was observed in roselle/ramie blended at 75:25 ratio (5).

Preparation of fabric and textile products

Plain weave fabric were prepared by using different blended yarns and based on fabric texture some of the garment were prepared (Fig. 4).

In conclusion both degummed and bleached roselle 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 25:75 and 75:25 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 roselle with ramie fibre 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, natural and synthetic fibers for different end uses.

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