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Research Paper Textile

Extraction, fabrication and evaluation of Sansevieria Trifasciata Fiber

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ABSTRACT

Sansevieria trifasciata fibers are the essential alternative in the ever expanding horizon of textile fiber. These fibres are non toxic in nature besides the disposal of fiber wastes is easier as they are necessarily biodegradable. The fiber was extracted by stagnant water retting method. It was blended with cotton and fabricated into plain weave using handloom. The woven fabric was analyzed for its mechanical and tensile properties.

Key word : Sanseveria Trifasciata, Extraction, Stagnant Water Retting

Introduction

Eco consciousness is playing a vital role in the selection of consumable products all over the world. Industrialization and advancement in technology increased the rate of pollutants both to the product and to the environment. These pollutants cause an adverse effect on the environment that affects the quality of life of human beings which leads to the boom of green consumerism. Eco friendliness in textiles is one of the important issues in recent years because textiles are in continuous contact with skin. Eco friendly, biodegradable and recyclable products are gaining importance in the market which has brought natural fibres into the focus. Nature is blessed with invaluable fiber yielding plants which has wide potential for use in diversified fields but they still remain in the background. So this study mainly focuses on the exploration of Sansevieria trifasciata fibre for textile applications.

Sansevieria trifasciata Fig.1 is a xerophytic shrubby succulent perennial plant with 8 12 leaves in a clump and the leaves have a dull green colour with whitish bands Sundarraj and Thulasidas (1993). The leaves have a sandwich structure which includes fibre, cuticle, dry matter and water Sreenivasan etal., (2011). It is used predominantly as an ornamental plant outdoors in warmer climates, and indoors as a house plant in cooler climates. During winter it needs only one watering every couple of months. It will rot easily if overwatered. It does not require any special care for its growth and also available in abundance. Hence the Sansevieria plant was selected.

Methodology

Selection of plant

Plants of Sansevieria trifasciata belongs to the family Ruscaceae were collected from in and around Coimbatore district, Tamilnadu. The leaves were used to obtain the fibres.

Fibre extraction

The fibre is extracted from the leaves by retting method. Pilot study was conducted using different retting methods such as stagnant water retting, running water retting, chemical retting and enzymatic retting Pandey and Dayal (2003). After analyzing various fibre parameters, the stagnant water retted fibres showed good results hence that method was selected.

Stagnant water retting

The leaves were pounded and made into bundles. These bundles were immersed in stagnant water by placing stones over it to keep the entire leaves submerged for about 7 10 days Fig.2. The leaves were then removed, washed thoroughly in fresh water to clean the pulp and finally dried in sunlight Fig.3.

Figure 1: Sansevieria trifasciata

Figure 2: Stagnant water retting

Steps involved in yarn preparation

Attempts were made to spin Sansevieria in various spinning systems. Finally 100% Sansevieria yarn was produced using jute spinning system. Sansevieria : cotton in 50 : 50 and 30 : 70 ratio were spun in ring spinning system. The various steps under yarn preparation are combing, roving and hand spinning.

Combing of the fiber

The extracted fiber has been combed to remove the short fibers Doraiswamy etal., (2007). In this process the fibers were combed using nails that were fixed to a wooden board thus making the fiber parallel as indicated in Fig.4. The combed fibers were softened by spraying mineral oil thus imparting cohesion to fibers.

Roving and spinning

The combed fibers were roved into sliver. The sliver is reduced to the required size by drafting and twisted to the required yarn size. The yarn is fully wound onto a cone.

Figure.3 Drying of the fibers

Figure.4 Combing

Selection of fabric formation

Due to yarn unevenness it is not possible to use power loom for weaving. Hence the produced yarn was made into a plain woven fabric using a handloom. In both warp and weft direction same yarn was used.

Testing of fabrics

a. Fabric weight and thickness

The weight of the fabric was measured by ASTM test method D 3776. Using GSM cutter the fabric were cut and weighed in a calibrated electronic balance. Fabric thickness was determined in accordance with test method ASTM D 1777 2002. Thickness gauge was used to test fabric thickness. The samples were placed on the anvil plate and the lever of the pressure foot released slowly. Thus the thickness was indicated in the dial.

b. Stiffness and abrasion

The stiffness and abrasion were measured by eureka stiffness tester and Martindale abrasion resistance tester respectively.

Strength and elongation

The breaking strength and elongation were measured by strip method (Angappan and Gopalakrishnan, 1993).

Nomenclature

The nomenclature used for various samples are given in Table I.

Table 1: Nomenclature

Sample	Nomenclature
S	Sansevieria 100%
SC	Sansevieria : Cotton; 50 : 50
Cs	Cotton : Sansevieria; 70 : 30

Result and Discussion

Evaluation of the fabric

The fabric tests like weight, thickness, strength, elongation, abrasion and stiffness were done for the fabric.

Mechanical properties

From the Table 2 it is clear that the mean weight of the cent percent fabric was recorded as 5095.6 mg which indicates that Sansevieria yarn is bulky due to the rough texture of the fibre when compared to the cotton blended fabrics. The GSM of samples SC and Cs have slight variation between them.

The thickness of the samples was shown in Table 2 which reveals that the mean thickness of the samples decreases with decrease in Sansevieria fibre percentage of the fabric. This is due to the fact that Sansevieria fibre has high diameter value of 278 µm when compared to cotton fibre.

Table 2: Fabric weight and thickness

Samples	Weight in mg	Thickness in mm
S	5095.6	2.15
SC	319.8	1.03
Cs	302.3	0.98

The weight loss due to abrasion among the samples after 2500 cycles was minimum for cent percent Sansevieria fabric which was shown in Table 3. As the percentage of Sansevieria starts decreasing in the blends the material resistance to abrasion was also decreasing.

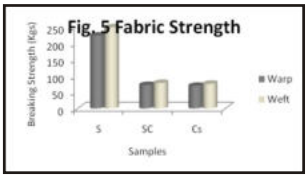
It appears from the results given in Table 3 the bending length of cent percent Sansevieria fibre exceeds the stiffness limit due to low crimp of the fibre. The bending length along both warp and weft direction of the fabrics decrease as the percentage of Sansevieria fibre was reducing.

Table 3: Abrasion and stiffness

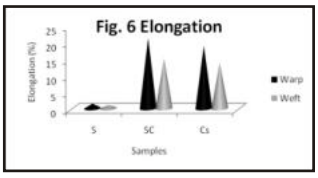
Samples	Abrasion loss (%) 2500 cycle	Stiffness (cm)	
		Warp	Weft
S	0.04	0	0
SC	0.08	1.5	3.3
Cs	0.09	1.3	3.0

Tensile properties

From Fig.5, it is seen that, the mean strength of 100 % Sansevieria fabric was found to be more both in warp and weft direction when compared to blended fabrics. This is due to the reason that Sanseveria fibre are stronger than cotton fibre because of high hemicellulose content present in the fibre. Both the Sanseveria blended fabric has nominal strength.



The mean elongation of the samples S, SC, Cs along warp direction were 1.46, 21.37 and 19.01% respectively which depicts that the elongation increases for SC sample when compared to S sample since 100 % Sanseveria fibre lacks elongation when compared to other samples. The sample Cs has medium elongation when compared to all the samples Fig.6. The fabric elongation in weft direction shows decrease in the reading when compared to the warp direction for all the samples.



Conclusion

The fiber was extracted from natural source [Sansevieria trifasiata]. The stagnant water retted fiber was rated as the best method among the different methods of retting. The results of both mechanical and tensile properties reveal that 100 per cent Sansevieria fibre showed the best result in performance qualities. Thus Sansevieria fabric has a wide range of applications in geo textiles, agro textiles as mulching and automobile textiles as composites for acoustic purpose, etc. The blends of Sansevieria cotton showed better performance qualities which can be used in home textiles such as table mat, curtains, door mat, runners and as furnishing materials. Due to its greater strength, cost effective and renewable nature Sansevieria fabric can also be used in sacks, ropes, handicrafts, bags, mattress for bedding which has more demand at present.

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