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Experimenting with Jute and silk-waste nonwoven for creating new textures

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Abstract
Jute, the golden fiber of India has been explored for its usage in different areas and has been successfully utilized as transport textiles and packaging textiles. Its exploration for creating different texture will help in increasing its utility in household textiles. The present work was undertaken to combine silk waste with jute. The reason for utilizing silk waste was to get silk finish with cost effectiveness and at the same time to find out optimum usage of the waste. 50/50 Jute silk waste non-woven fabric was developed and was compared with 100%Jute and 100% silk waste. The developed non-woven fabrics were tested on fiber bundle strength, thickness, bursting strength, air permeability, water absorbency and weight/ square meter for further recommendation of its usage. A combination of cationic and non-ionic softener was applied on to the non-woven fabrics and was tested again on its bursting strength, air permeability and water absorbency. It was concluded that the fabrics thus produced can be utilized for household textiles.

Keywords: waste fibers, softener, non-woven fabrics, household textiles, jute, silk waste

1. Introduction
Textile industry has been one of the major polluting industry in the world. There is a need to assess, prevent and reduce the cause of pollution at different stages. Wastes during manufacturing also add to the pollution. To reduce that it is necessary to find out ways to minimize or utilize the waste in our country. Jute on the other hand is abundantly available in our country. Many researches and experiments have been carried out and it has been successfully utilized for packaging textiles and transport textiles. There is a need to research, to expand its usage in other areas of textiles. Though it has been utilized for making some household products but not has been fully exploited for its use. For household textiles texture plays an important role. One of the method of changing its texture is by blending it with any other fiber. The present study was undertaken to combine silk waste and jute to produce new texture and to use the fabric thus produced for household textiles.

2. Objectives
1. To develop non-woven fabrics of 100% jute, 100% silk waste and 50/50 jute/silk waste blend fabrics.
2. To compare the developed non-woven fabrics with 100% jute, 100% silk waste fabrics.
3. To evaluate the effect of softeners on to the developed non-woven fabrics.
4. To find suitable end uses of the developed non-woven fabrics

3. Methodology
Methodology was divided into 2 parts-
3.1. Material Procurement
3.2 Experimentation

3.1 Material procurement
a) Processed jute fibers- NIRJAFT, Kolkata, West Bengal
b) Silk waste fibers- Central Silk Board, Sawed, Pune
c) Gauze- cotton count of 7/16-TATA mills, Mumbai
d) Chemicals- Non-ionic and cationic softeners- Rosary Biotech, Vikroli, Mumbai

3.2 Experimentation

3.2.1 Development of non-woven fabrics

Non-woven fabrics were developed at TATA mills. Needle punching methods was used for making non-woven fabrics. The fabrics that were made were of varied thickness. During needle punching gauze was applied from one side in order to give support to the jute fibers and its blend. The web was given light needling with the depth of the needle punching being half inch and speed of strokes being 600-700 rpm. Thus, 100% jute, 100% silk-waste and 50/50 jute/silk-waste blend fabrics were developed.

3.2.2 Testing of developed non-woven fabrics

Testing was done at CIRCOT and Texan lab. Following tats were done to determine the suitability of the manufactured fabrics

1. Fiber bundle strength
2. Thickness
3. Weight/square meter
4. Bursting strength
5. Air permeability
6. Water absorbency

3.3 Softening of developed non-woven fabrics

Based on the ratings for the feel of the developed non-woven fabrics softening finish was applied using cationic and non-ionic softeners/ softening agents.

3.4 Product development

From the developed non-woven fabrics (after softening) following products were developed.

Tea coasters (from thin variety jute/silk waste blend non-woven fabric)

Tea cozy (from thick variety jute/silk waste blend non-woven fabric)

Baby Blanket (from 100% thick variety silk waste non-woven fabric)

4. Results and discussion

In this study 100% jute, 100% silk waste fabrics and 50/50 jute/silk waste blend fabrics were developed and tested. The results of the tests were as follows-

4.1 Fiber bundle strength

Table 1

Fibers	Load(kg)	Weight(mg)	Extension (%)	Tenacity(gm/d)
Jute	14.15	5.2	No extension	41.31
Silk-waste	12.802	4.9	51.5	38.78

From table no.1 it can be seen that jute fiber showed good tenacity with no extension as compared to silk waste. This may be due to silk waste being a protein fiber and has good extension property.

4.2 Thickness

Table 2

Fibers	Thin (mm)	Thick (mm)
Jute	2.32	3.06
Silk-waste	1.66	2.3
Jute/silk-waste	1.0	3.35

From the above table it can be seen that thickness of the fabrics varied. This variation occurred due to following reasons

1. Unequal denier of the fibers which was a contributing factor in uneven web and gave variation throughout the fabric.
2. Needles had very fine grooves in all direction, which made it difficult to needle these varied coarse fibers.
3. Machine was quite old, so in their regular qualities the norms were in the range of ±10.
4. The needle groove was too thick for thin variety fibers to needle punch evenly throughout the surface of the fabric. Hence two varieties of non-woven fabrics were made.

4.3 Weight/square meter

Table 3

Fabrics	Thickness in mm (thin)	Weight/square meter gm/d (thin)	Thickness in mm (thick)	Weight/square meter gm/d (thick)
Jute	2.32	254.16	3.06	277.48
Silk-waste	1.66	139.2	2.3	186.6
Jute/silk-waste	1.0	164.4	3.35	490.28

The unevenness in the fabric formation could be the reason in the varied weight/square meter values of two varieties of non-woven.

Thin variety of jute showed more values due to the fiber property of adding bulk to the fabric.

Similarly could be the possibility in the increase value of the blend non-woven (thick) fabric.

4.4. Bursting strength of fabrics

Table 4

Fabrics	Bursting strength (kg/cm²) Before softening		Bursting strength (kg/cm²)After softening	
	Thin	Thick	Thin	Thick
Jute	4.8	4.8	5.14.8	
Silk-waste	6	7	5.86	
Jute/silk-waste	4.5	6.8	4	5.6

The loosening of fiber entanglement after softening could be a possibility for low bursting strength except for 100% (thin) jute fabrics

4.5. Air Permeability.

Table 5

Fabrics	Air permeability (cc/sec/cm²) Before softening		Air permeability (cc/sec/cm²) After softening	
	Thin	Thick	Thin	Thick
Jute	203.86	142.70	220.54	155.68
Silk-waste	214.98	88.96	161.24	88.96
Jute/silk-waste	235.3	38.92	202.01	35.21

The varied results may be due to following reasons-
1. In thin and thick variety jute fabrics the air permeability is more due to addition of softener which allowed the air to pass through the fabric.
2. In silk waste, being a fine fiber the air permeability is lessened due to softening.
This might be due to one cellulosic and one protein fiber property and their behavior after applying softeners.
3. Whereas, in the blend thin and thick variety it has been reduced to more than half, this may be due to the non-ionic softener applied.

4.6. Water absorbency

Table 6

Fabrics	Amount of water absorbed in one minute (in mm)				Time required in reaching 5 cm mark (in mm)				Time required in reaching 10 cm mark (in mm)		
	BS		AS		BS		AS		BS		AS
	H	TK	TH	TK	TH	TK	TH	TK	TH TK	TK	TH
Jute	5	5	1	1	mt60	mt60	mt120	mt120	Mt 120 180	mtmtmt120	180
Silk-waste	3	2	1	1	mt60	mt60	mt120	mt120	Mt 120 200	mtmtmt120	200
Jute/Silk-waste	3	4	1	1	mt60	mt60	mt120	mt120	Mt 120 180	mtmtmt120	180

BS=before softening, AS= after softening, TH= thin, TK= thick, mt= more than

Water absorbency of all non-woven fabrics decreased after softening. This could be due to softening finish applied which did not allow the water droplet to penetrate easily into the fabrics.

5. Conclusion

Based on the above results, it can be concluded that silk waste can be combined to produce non-woven fabric. This non-woven fabric can be used for innovative household and textile products. The study can be further taken to determine its applicability in automobile textiles for linings and sound proofing.

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