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Effect of Finishing Treatment with Softeners on Performance properties of Deccani Woollen Blanket

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ABSTRACT

The present study was focused on impact of softening treatment on performance properties of Deccani woollen blanket procured from Medleri village. Optimization process for softening was carried out by varying the concentration of softeners, pH and temperature of bath, and treatment time. Tensile strength and GSM of the treated sample was considered as a factor for optimization process. Deccani woollen blanket was treated as per the optimized process and performance properties *i.e.,* bending length, crease recovery, drapability. The result revealed that there was an improvement in performance properties of the softener treated sample. The decrease in bending length, increase in drapability and crease recovery was observed for the Deccani wool samples treated with softeners. Among the three different softeners, silicon softener treated Deccani wool blanket sample attained better performance properties.

Key Words: Silicon softener, Cationic softener, Non ionic softener, Drapability, Drape coefficient, Crease recovery.

INTRODUCTION

In India, woollen textile and clothing industry is relatively small compared to the cotton and manmade fibre based industries. However, the woollen sector plays an important role in linking the rural economy with the manufacturing industry, represented by small, medium and large scale units. The product portfolio is equally divergent from textile intermediaries to finished textiles, garments, knitwears, blankets, carpets and an incipient presence in technical textiles.

Fabric tactile properties are important criteria for the consumer acceptance. The properties namely bending length, crease recovery and drapability are an indicator of fabric handle. Crease recovery angle can be treated as an index to predict the pressing performance of the fabrics. According to Hearle (1969) the major mode of deformation in draping is fabric bending. Treloar (1965) investigated the dependence of drape of the fabric on bending stiffness and shear stiffness. Hence, the present investigation was undertaken to know the influence of the softening treatment on performance properties of the Deccani wool blanket.

MATERIALS AND METHODS

The present study was carried out at College of Rural Home Science, University of Agricultural Sciences, Dharwad, Karnataka during the year 2013-15. The plain weave Deccani wool blanket of size 3½ ft × 9½ ft woven in a pit loom was used for the present investigation. The sample was procured from Medleri village of Haveri district.

Procedure of softening treatment

Softening treatment was carried out at Bombay Textile Research Association, Mumbai Maharashtra. The woollen blanket test specimen of size 1m×1m was conditioned for 24 hrs at standard atmospheric condition i.e., 27±2°C and 65±2% relative humidity. The woollen blanket was treated

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with selected softeners viz., cationic, non ionic and silicon of 1 per cent concentration, keeping pH of bath 6, temperature 40ºC treatment time 30 min and MLR 1:6.

Evaluation of bending length

The specimen was placed on the platform with the scale on the top of it lengthwise and the zero of the scale coinciding with the leading edge of the specimen. The specimen along with the scale was pushed slowly and steadily when the leading edges project beyond the edges of the platform. A protruding part of the specimen overhangs and starts bending on its own weight. When two inclined lines (inclined plane making an angle of 41.5° with the horizontal) of the tester coincide, the length of the overhanging portion from the scale was recorded. The test sample were tested as directed in BS test method 3356:1961

Evaluation of crease recovery angle

Fabric crease recovery was measured in order to examine the pressing performance. Small samples of treated and control sample were folded and crease pressed using standard cycle on crease recovery tester. The samples were trimmed back leaving one centimeter of fabric on one side of the fold. The creases were then allowed to recover for about 30 min and the angle of the crease measured. The angle was measured after recovery under standard conditions (65% RH, 25ºC).

Evaluation of Drape coefficient

Drape is the fabric's ability to deform in space when bent under its own weight. A specimen was cut by means of circular template, sandwiched between two horizontal discs of smaller diameter and the unsupported annual rings of fabric was allowed to hang down on drape meter. On switching the lamp, it gives a circular parallel beam of light and falls on the cloth. The ammonia sheet (printing paper) of known dimension was placed on the base platform with sensitive side up, laying flat. The line of vision was kept along the baseboard and the height of the lower fringes of specimen was adjusted to 4 min, the green pilot lamp lit up, when buzzer alarm rings, the ammonia paper was removed, rolled and placed in the developing box where strong ammonia solution was kept. The lid was shut airtight. After 4 minutes the drape pattern was ready. The statistical tool ANOVA and correlation was used to draw valid conclusions.

RESULTS AND DISCUSSION

It was observed (Table 1) that, untreated and treated samples possessed higher warp way bending length compared to weft way bending length. Irrespective of softener treatment, all the treated samples exhibited decrease in bending length for both warp and weft way. Among the treated samples, silicon softener treated Deccani wool blanket sample indicated least bending length both on warp way and weft way. The reduction in bending length of all treated samples is attributed to decrease in inter fibre and inter yarn forces which leads to the formation of polymer film on the fibre surface due to softener treatment. These results were at par with the results of *Shakyawar and Behera (2007)*.

Table 1. Effect of softeners on bending length (cm).

Sr. No.	Treatment	Bending length (cm)	
		Warp	Weft
1.	Control	1.61	1.27
2.	Cationic softener	1.22	1.07
3.	Non-ionic softener	1.24	1.23
4.	Silicon softener	1.18	0.84

Source		SeM± 5%	CD		CV%
			1%		
Cationic	Warp	0.03	0.52	0.72	0.02
	Weft	0.03	0.54	0.76	0.03
Non ionic	Warp	0.03	0.53	0.74	0.03
	Weft	0.03	0.81	0.58	0.04
Silicon	Warp	0.03	0.57	0.79	0.03
	Weft	0.03	0.59	0.82	0.05

It was noticed (Table 2) that all the softener treated samples showed greater crease recovery angle over treated samples. Silicon treated samples attained higher crease recovery (170°). The higher crease recovery can be correlated with the lower bending length of treated samples. Softener treatment leads to the formation of elastic polymer on the surface of the fibres which aids in increase in the elastic property of the fabric and may have contributed for increase in crease recovery and the fabric becomes more pliable.

Table 2. Effect of softeners on cloth recovery angle (degree).

Sr. No.	Treatment	Crease recovery		Cloth recovery(°)
		warp	weft	
1.	Control	137.75	142.25	139.96
2.	Cationic softener	155.13	161.87	158.45
3.	Non-ionic softener	148.25	150.50	149.35
4.	Silicon softener	168.00	172.75	170.34

Source	SeM±	CD		CV%
		5%	1%	
Crease recovery(°)	1.22	3.41	4.78	1.77

Drapability

Drapability is expressed in terms of drape coefficient and number of nodes i.e., higher the drape coefficient, poorer the drapability or greater the number of nodes, better the drapability. It means, that drape coefficient and the fabric drape are inversely related. It was observed (Table 3) that all treated samples exhibited lower drape coefficient than the control. It means treated samples were more pliable. The decrease in drape coefficient of all treated samples may be because of the removal of dirt materials. Decrease in bending length and increase in cloth recovery indirectly indicated an improvement in the drapability. This can be proven with the existence of higher correlation between drape coefficient and crease recovery (Table 4) and between drape coefficient and bending length (Table 5 and 6a &b). Behera and Mishra (2006) in their investigation also reported that crease recovery and bending length is correlated with drapability of the fabric.

Table 3. Effect of softeners on drape coefficient .

Sr. No.	Treatment	Drape coefficient (%)
1.	Control	60.48
2.	Cationic softener	57.84
3.	Non-ionic softener	59.05
4.	Silicon softener	56.94

Source	SeM±	CD		CV%
		5%	1%	
Drapability (%)	0.01	0.30	0.42	0.04

Table 4. Correlation between fabric thickness (mm) and thermal resistance (K.m2/W).

Sr. No.	Treatment	Fabric thickness (mm)	Thermal resistance (K.m2/W)
1.	Control	2.23	0.063
2.	Cationic softener	2.82	0.087
3.	Non-ionic softener	2.46	0.088
4.	Silicon softener	2.83	0.099

Correlation = 0.8547

Coefficient of determination R2 = 73.06%

Table 5. Correlation between crease recovery angle (degree) and drape coefficient.

Sr. No.	Treatment	Crease recovery (°)	Drapability (%)
1.	Control	139.96	60.48
2.	Cationic softener	158.45	57.84
3.	Non-ionic softener	149.35	59.05
4.	Silicon softener	170.34	56.94

Correlation = -0.987

Coefficient of determination R2 = 97.445%

Table 6a. Correlation between warp bending length (cm) and drape coefficient.

Sr. No.	Treatment	Bending length (cm) Warp	Drapability (%)
1.	Control	1.61	60.48
2.	Cationic softener	1.22	57.84
3.	Non-ionic softener	1.24	59.05
4.	Silicon softener	1.18	56.94

Correlation = 0.890

Coefficient of determination R2 = 79.226%

Table 6b. Correlation between weft bending length (cm) and drape coefficient.

Sr. No.	Treatment	Bending length (cm) Weft	Drapability (%)
1.	Control	2.58	60.48
2.	Cationic softener	2.19	57.84
3.	Non-ionic softener	2.40	59.05
4.	Silicon softener	1.72	56.94

Correlation = 0.929

Coefficient of determination R2 = 86.35%

Among three softeners, silicon softener treated sample showed better performance properties. It may be because of Silicon which forms a stable covalent bond with carbon leading to a class of materials known as organosilanes, when combined with chlorine and water, forms silanols. Condensation of silanols results in siloxane linkages. Dimethyl dichlorosilane will form linear polysiloxanes which are water clear oils having good lubricating properties. Due to silicones Inorganic – Organic structure and the flexibility of the silicone bonds, silicones show some unique properties including thermal oxidative stability and high compressibility. Hence, resulted in the improvement in aforementioned properties of silicon treated Deccani wool sample.

CONCLUSION

The softening treatment increases pliability of the Deccani wool blanket. The bending length and Drape coefficient of the softener treated samples to certain extent decreased. The crease recovery angle of the Deccani wool blanket sample was also exhibited more when compared with control sample. Overall the performance properties of the softener treated samples were improved compared to untreated sample. The further studies can be carried out in this arena with different blends.

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