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Effect Of Resin Finishing On Stiffness And Drape Of Khadi Fabric

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ABSTRACT

Effect of two synthetic polymer based resins, silicone and acrylic on stiffness and drape of cotton khadi fabrics has been reported in this study. Parameters like concentration of finishing agents and thickness of fabric were varied to study the effect discretely. It was found that stiffness and drape of cotton khadi fabric is affected by amount and type of finishing agent. Maximum increase in stiffness and drape was seen in fabric treated with acrylic and minimum in silicone treated fabric. Significant difference in stiffness and drape of fabric of different thickness was also found.

Keywords : Resin, percent drape coefficient, stiffness

Introduction

Khadi, a hand spun and hand woven fabric, is made of cotton, wool, silk and their blends. There are many attributes associated with khadi particularly with cotton khadi. It keeps wearer warm in winter and cool in summer. Its weave structure allows ample amount of air to pass over and around the body. It has capacity to absorb moisture. It is 100% natural and therefore, not harmful to skin. Moreover, its texture provides unique look and feel to the khadi.

Earlier it was considered poor men's clothing and politicians' garment. Today it is beginning to emerge as fashion fabric. It has become synonymous with designer wear. However, khadi's hand limits its use in designing of garment of particular styles only.

Pattern and styles of garment keep on changing from time to time with changing fashion trends. As ultimate appearance of garment is influenced by stiffness vs. softness and draping quality of fabric, these are utilized for creating new styles in garment.

Ability of fabric to fall under its own weight into wavy folds is called drapability. This unique behavior provides graceful aesthetic effects in garments. It has been a device of adornment in costumes. The drape relieves monotony of shape and enhances the beauty of garment and its appreciation.

Drape of garment is governed by draping quality of fabric used. Drape of fabric depends on fabric properties like stiffness, flexural rigidity, weight and thickness etc. Stiffness, an attribute of fabric hand, is one of the important factors determining draping quality (Booth, 1968). Stiffness of fabric itself depends upon components of textile fabric like fiber type, yarn structure and fabric structure (Joseph, 1986). Finishing agents may also be used to modify fabric stiffness (Pant and Chaulker, 2004). If stiffness vs. softness and drape of khadi fabric is changed by application of finishing agents, its use can be multiplied in designing garment of different styles. Present study is a step in this direction.

Starch is the traditional material to provide stiffness, firmness & smoothness to fabric. Now-a-days thermoplastic synthetic polymers are also being used. Acrylic and silicones are thermoplastic polymers, influencing stiffness of fabric in different ways. Change in stiffness and drape can be utilized to create different designs or change look of khadi garments.

It is on the basis of above context that present work was planned. Cotton khadi was treated with different stiffening agents such as starch and resins to modify stiffness and drape of fabric. Concentration of finishes was varied to study the effect discretely.

Methodology

Material

Fabric:

Commercially available three types of cotton khadi fabrics varying in thickness and weight were used (table 1).

Table 1: Preliminary data of fabrics used

Cotton khadi	Thread count (per square inch)		Thickness (mm)	Weight/unit area (gm/sq mt)
	No. of warp yarns	No. of weft Yarns		
Thick	33	23.6	1.7	1224.70
Medium	67	41.4	1.5	847.05
Fine	77	64.8	0.47	365.8

Chemicals:

Commercially available two thermoplastic resins were used- Silicone polymer emulsion and Acrylic emulsion

Method

Desizing and scouring of khadi fabric:

Commercially available khadi fabrics were used in this study. Cotton khadi fabric is finished with starch to impart smoothness and luster in final finishing treatment, so in the first step fabrics were desized to remove starch. Acid desizing5 technique was used to remove size and after that fabrics were scoured, rinsed and dried.

Application of finishing agents and determination of percent add on of the finish:

Finishes were applied on fabric samples by pad-dry-cure method. The fabrics were immersed in the finish solution for 10 minutes and then passed between two rollers to squeeze

out air and to force liquor inside material. Acrylic and silicone resin treated fabrics were dried and then cured at 120ºC in oven for 5 minutes. Finishes were applied individually with three concentrations of each finish viz. 20%, 30% and 40%. Material liquor ratio was 1:30. After the application of resins in different concentration, add on % of finishing agents was calculated.

Determination of properties of fabrics

Stiffness: (IS: 6490-1971) Stiffness was measured by employing "Eureka stiffness tester"

Percent drape coefficient: (IS: 8357-1977) Circular drape meter was used for determining percent drape coefficient of fabric. Number and shape of nodes were also assessed.

Result and discussion

Effect of Acrylic emulsion on stiffness and drape of cotton khadi fabrics

Stiffness of the fabrics was assessed by measuring bending length. Bending behavior is also an important factor affecting drapability. As is evident from table 2, stiffness of thick and fine cotton khadi fabric increased with increase in concentration of acrylic finish up to 20%. After that it decreased whereas in case of cotton khadi fabric of medium thickness, increase in stiffness was observed up to 30% concentration of acrylic finish. After that decrease in stiffness was found on increasing the concentration up to 40%.fine fabric.

This increase in stiffness has been due to additive and adhesive nature of polymer finish resulting in rigidity of fabric structure. Bonding of fibers and yarns together by surface resin leads to stiffness of fabric (Lynn, 1961).

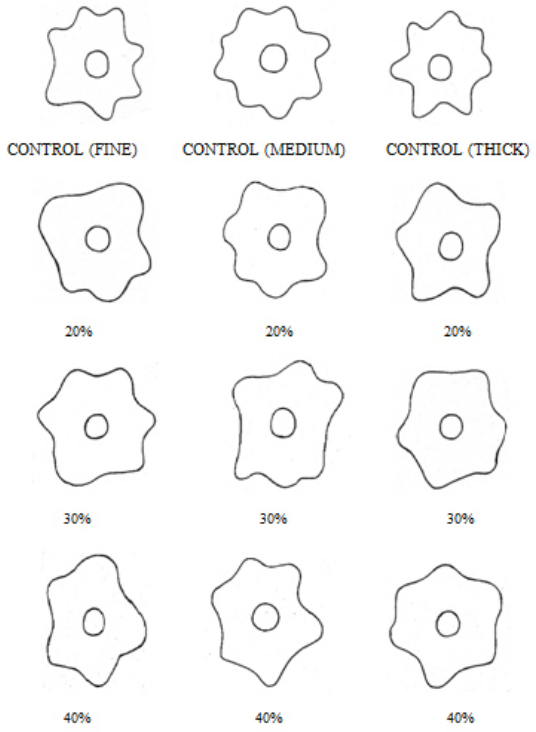
Table 2 shows that drape coefficient of thick fabric increased progressively with increase in concentration of finish however, increase in drapability was very considerable up to 20% concentration of acrylic finish after that it was gradual. Whereas drape coefficient of fabric of medium thickness increased sharply up to 30% and after that it decreased. In case of fine cotton fabric also trend similar to medium weight cotton khadi fabric was found. Increase in stiffness resulted in increase in % drape coefficient. There is a significant correlation between stiffness and drape. As stiffness increases drape coefficient also increases. The result is also supported with number of nodes, another mode of subjective expression of drapability. Number of nodes decreased on increasing the concentration and draped area increased as compared to control sample. Nodes became irregular (fig.1). Outward drape means more drape coefficient. Increase in stiffness (i.e. lower bending) caused outer drape.

Effect of thickness on stiffness was significant at 1% level (F=210.59). Effect of concentration of acrylic on stiffness was also found significant at 1% level (F=1569.85). Interaction between thickness and concentration was also found significant. Thus both the factors significantly affected the stiffness. Effect of thickness on drapability was significant at 1% level (F=82.21). Effect of concentration of acrylic on drapability was also found significant at 1% level (F=2063.01). Thus both the factors significantly affected the drapability

Table: 2 Stiffness and drapability of cotton khadi fabrics treated with varying concentration of acrylic finish

Type of khadi	Concentration of finish	%Add on	Stiffness Bending length(cm)		Drapability	
	W/W		Warp	Weft	% Drape coefficient	No. of nodes
Thick	Control 20% 30% 40%	0 8.13 10 4.01	1.59 2.09 1.98 1.92	2.0 1.94 2.05 2.03	46 78 85.29 89.4	7 5 6 6
Medium	Control 20% 30% 40%	0 16 9.15 6.46	1.45 2.01 2.23 2.07	1.47 1.78 1.89 1.94	39 67 70.4 66	8 6 6 6
Fine	Control 20% 30% 40%	0 4.0 3.03 4.0	1.63 1.82 1.80 1.77	1.56 1.81 1.79 1.94	46 65 67 63	

FIG.1.DRAPE PROFILE OF COTTON KHADI FABRIC AFTER APPLICATION OF ACRYLIC FINISH



Effect of Silicone on stiffness and drape of cotton khadi fabrics

Table 3 shows that stiffness of thick and medium weight khadi fabrics increased slightly when they were treated with silicone finish. On the contrary, stiffness of fine cotton fabric reduced .So far as drapability is concerned, increase in drape coefficient is highest in medium fabric where as it is lowest in fine fabric.

Silicone is a softening agent. Silicone polymer has long fatty acid chains. It lubricates the surface by coating the fabric's fiber with a thin elastic film (Brooks et. al., 1989).

In case of thick and medium cotton khadi fabrics the drape coefficient increased at 20% of concentration of finish and on further increasing the concentration to 30%, drape coefficient decreased and again increased on increasing concentration to 40% concentration. In case of silicone finish slight increase in percent drape coefficient was seen. No. of nodes and draped area was found almost similar to the control sample on different cotton khadi fabrics. Nodes were regular and deep which was similar to control sample (fig.2). Another observation is that increase in percent drape coefficient of silicone treated fabric is not as high as in case of other finishing agents.

ANOVA calculated exhibited significant effect of thickness on stiffness at 1% level (F=209.31). Effect of concentration of silicone on stiffness was also found significant at 1% level (F=1173.73). Interaction between thickness and concentration was found significant. Effect of thickness on drapability was significant at 1% level (F=330.38). Effect of concentration of silicone on drapability was also found significant at 1%

level (F=1523). Thus both the factors significantly affected stiffness and drapability of khadi fabrics.

FIG.2.DRAPE PROFILE OF COTTON KHADI FABRIC AFTER APPLICATION OF SILICONE FINISH

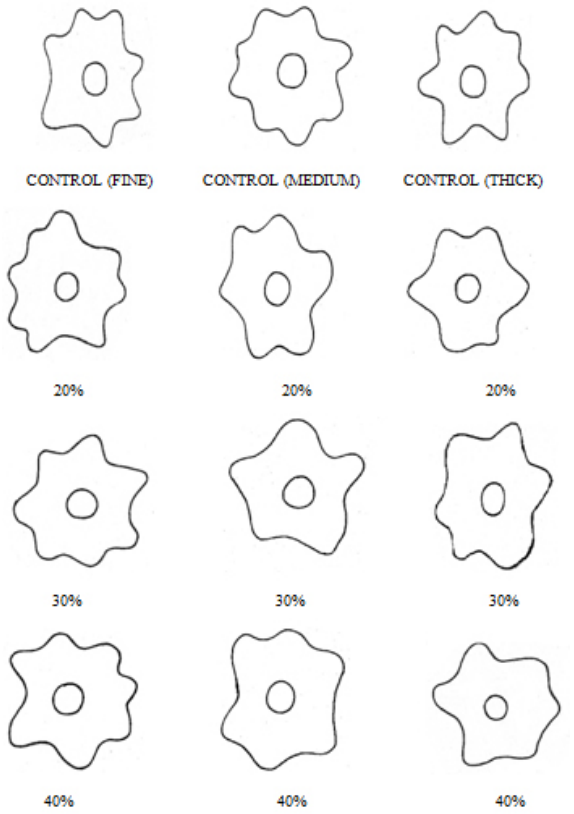


Table 3: Stiffness and drapability of cotton khadi fabrics treated with varying concentration of silicone finish

Type of khadi	Concentration of finish	%Add on	Stiffness Bending length(cm)		Drapability	
	W/W		Warp	Weft	% Drape coefficient	No. of nodes
	Control	0	1.59	1.65	46	7
	20%	2.43	1.72	1.63	64	6
	30%	3.0	1.66	1.65	60.81	6
	40%	3.33	1.71	1.62	62	6
Medium	Control	0	1.45	1.47	39	8
	20%	2.20	1.66	1.56	64	6
	30%	2.25	1.67	1.58	62.15	6
	40%	3.0	1.67	1.59	63.03	6
Fine	Control	0	1.63	1.56	46	7
	20%	2.8	1.50	1.48	51.13	8
	30%	3.0	1.45	1.51	53	7
	40%	3.0	1.46	1.51	50	7

Conclusion

On comparing the effect of two finishing agents on stiffness and drape of khadi fabrics, it can be said that acrylic caused highest increase in stiffness and percent drape coefficient whereas effect of silicone was lowest. Fine cotton khadi became soft on application of silicone finish. In addition effect of varying concentration of finishing agents and varying fabric thickness on stiffness and drape was found.

Special look fashion garments can be prepared on the basis of the work, by designers and also by fashion industry as can be seen in plates 1-2. Result showed that finishing agents can be successfully used to change drape, number, shape and size of nodes/folds in garments. Silhouette of garment can be changed according to change in fashion trend through application of finish.

Plate 1: Unfinished umbrella skirt



Plate 2: Umbrella skirt finished with silicone



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