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Effect of embroidery on strength of fabric

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ABSTRACT

Effect of embroidery on tearing strength and tensile strength of cotton fabrics has been assessed. Embroidery was done with cotton thread using six types of embroidery stitches viz. satin, stem, chain, fly, running and herringbone. Placement of motifs was also varied. It is found that tearing strength of embroidered samples increases whereas tensile strength decreases. Parameters like type of embroidery, placement of motif and fabric type affect strength of fabric.

Key Words : Tearing strength, Tensile strength, Embroidery stitches

INTRODUCTION

Strength refers to the load bearing property and consequent change in dimension. It is commonly regarded as criteria of quality as it influences durability of fabric. Strength of fabric is evaluated in terms of tensile strength, tearing strength and bursting strength.

The tensile strength deals with the force required to break a large number of yarns simultaneously in either warp or weft direction. It is a measure of coherence of a fabric and without a useful degree of coherence other properties are of little value. On the other hand, the tear strength is usually a measure of the force required to propagate a tear. Tearing is one of the common causes of failure in textile fabric and often terminates useful life of an article.

Studies have shown that parameters like fiber, yarn, construction of fabric and finish affect strength of fabric. Extensive research work has been reported on these aspects. However, effect of embroidery on fabric strength has not been reported anywhere.

Embroidery is a thread work done on a variety of fabrics which makes the fabric more attractive. Embroidery is done on articles of personal wear like kurta, dupatta, veils, blouse/top, saris and dress materials of all kinds. In addition, household articles such as bed sheet, table linen, and curtain are also embroidered. It can be done on different type of fabrics varying in thickness, weight and compactness. Motifs may be placed all over the fabric, scattered or localized. A great variety of stitches are used. Embroidery can be done by hand or by machine.

Embroidery incorporates extra threads in fabric which binds yarns together. The binding of yarns may affect tensile or tearing strength of fabric. Present investigation was conducted to find out effect of embroidery on strength of fabric.

METHODOLOGY

Two types of commercially available cotton fabrics varying in constructional parameters were used- poplin and mulmul. Construction details of fabric used have been given in Table 1.

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Table 1 : Construction details of fabrics					
Name of fabric	Weight (Ounce/sq. yard)	Thickness (mm)	Fabric count		Weave
			Warps/inch	Weft/inch	
Mulmul	1.30	0.14	63	48	Plain
Poplin	3.24	0.28	86	57	Plain

Six types of embroidery stitches were selected- satin stitch, stem stitch, chain stitch, fly stitch, running stitch and herringbone stitch. Stitches were selected keeping in view their characteristics such as flexibility, tightness, looseness, firmness, compactness. Embroidery was done with two threads Placement of motifs was varied – all over and scattered. Cotton thread of anchor was used for embroidery. Embroidery was done by hand using two threads. Tearing strength and tensile strength of embroidered and unembroidered samples were determined using standard procedures.

RESULTS AND DISCUSSION

Tearing strength of embroidered fabrics :

Data in Table 2 shows tearing strength of embroidered fabrics with all over placement of embroidery stitches. Considerable increase in tearing strength of embroidered poplin fabric was found. Increase in tearing strength is more in warp direction than in weft direction. Maximum increase in tearing strength was found in the fabric in which chain stitch was used followed by the fabric embroidered with fly stitch and satin stitch respectively. Least increase in tearing strength was seen in the fabric with herringbone stitch. It seems embroidered fabric resisted tearing action. Extra force was required to break the embroidery stitches in addition to tearing warp or weft threads. Moreover, binding of yarns by embroidery stitches grouped the yarns together. More force is required to break group of yarns than to break single yarn.

Table 2 : Effect of embroidery stitches in all over placement on tearing strength of fabrics				
Embroidery stitch	Tearing strength in g			
	Poplin		Mulmul	
	Warp wise	Weft wise	Warp wise	Weft wise
Control	2064	2400	2480	2576
Running	3056 (48%)	2528 (5.33%)	2776 (11.93%)	2652 (2.65%)
Stem	2976 (44.18%)	2720 (13.33%)	2516 (1.45%)	2600 (0.9%)
Herringbone	2304 (11.62%)	2848 (18.66%)	3908 (57.41%)	3136 (21.73%)
Satin	3760 (82.17%)	2896 (20.66%)	3680 (48.38%)	3008 (16.77%)
Chain	4656 (125.58%)	4752 (98%)	4224 (70.04%)	4432 (72.04%)
Fly	4064 (98.89%)	3552 (48%)	3872 (56.12%)	3472 (34.76%)

Figure in parenthesis show percentage increase in tearing strength

On comparing the tearing strength of control samples (without embroidery) of poplin and mulmul it was found that tearing strength of mulmul is higher than that of poplin. The reason is that mulmul is loosely woven and flexible. Yarns can easily slip and bunch together under load thus load is taken by groups of yarns together instead of single yarn that is why mulmul is showing more tearing strength.

It is evident from data given in Table 2 that tearing strength of mulmul also increased when embroidery was done all over the fabric. However, percentage increase in strength of mulmul is less than that of poplin fabric. Binding of yarns by embroidery stitches might have affected flexibility and elasticity of mulmul fabric that is why it is showing comparatively less improvement. Increase in strength is because of more force required to tear embroidery threads or stitches in addition to yarns of fabric

Table 3 shows effect of embroidery on tearing strength of poplin fabric when motifs were placed randomly on fabric. It is clear that tearing strength improved. Trend was almost similar to that obtained with all over placement except that extent of increase was less in scattered placement of motifs compared to all over placement. Number of stitches was more in all over arrangement because of close placement of motifs whereas density of stitches was less in scattered arrangement. This aspect affected extent of increase in tearing strength of fabric with different placement of embroidery motifs.

Table 3 shows that scattered arrangement of motifs also improved tearing strength of mulnul fabric. Significant increase in strength was observed in fabric embroidered with chain stitch followed by fly stitch and satin stitch.

Tensile strength of embroidered fabrics :

Fabric in use is liable to rupture by straight pull. Effect of allover placement of embroidery on tensile strength of poplin has been shown in Table 4. Tensile strength of poplin is higher in warp direction than in weft. This is because there is more number of yarns in warp direction to bear pulling force.

Tensile strength decreased in both the directions after embroidery. Embroidery stitches were binding some of the yarns together but this binding action was unevenly distributed throughout the sample. As binding of yarns by embroidery stitches was not uniform, it caused great stress in the fabric which led to decrease in tensile strength. Visual observation of broken samples showed that fabric (yarns) broke down from the regions nearby embroidery. Unembroidered portion of fabric did

Table 4 : Effect of all over placement of embroidery stitches on tensile strength of poplin fabric

Embroidery stitch	Tensile strength			
	Warp wise		Weft wise	
	Load (kg)	Elongation (mm)	Load (kg)	Elongation (mm)
Control	29.75	32.00	13.75	22
Running	25	20.25	10.00	13.25
Stem	28.25	24.50	12.75	20.50
Herringbone	29.25	30.00	11.00	18
Satin	27.50	22.50	9.5	12.75
Chain	25.00	23.50	9.0	18.25
Fly	22.25	16	8.5	14.50

Table 5 : Effect of scattered placement of embroidery stitches on tensile strength of poplin fabric

Embroidery stitch	Tensile strength			
	Warp wise		Weft wise	
	Load (kg)	Elongation (mm)	Load (kg)	Elongation (mm)
Control	29.75	32.00	13.75	22
Running	24	16.25	11	14.25
Stem	28	28.25	12.50	20.50
Herringbone	30.50	31.00	12.50	22.75
Satin	24.50	16.50	10.00	13.75
Chain	26.75	14.25	10.75	14.50
Fly	24.80	15.00	9.25	13.25

Table 6: Effect of all over placement of embroidery stitches on tensile strength of mulmul fabric

Embroidery stitch	Tensile strength			
	Warp wise		Weft wise	
	Load (kg)	Elongation (mm)	Load (kg)	Elongation (mm)
Control	9	13.25	5.5	13.50
Running	6.05	7	2.63	7.4
Stem	9	6	4.25	12
Herringbone	8.75	6.50	4.25	13.50
Satin	3.25	7.25	4.5	12.25
Chain	8.50	11	3.75	10.50
Fly	5.17	11	2.33	8.75

Table 7 : Effect of scattered placement of embroidery stitches on tensile strength of mulmul fabrics

Embroidery stitch	Tensile strength			
	Warp wise		Weft wise	
	Load (kg)	Elongation (mm)	Load (kg)	Elongation (mm)
Control	9	13.25	5.5	13.50
Running	6.67	6.75	4.25	10.25
Stem	8.50	14.75	5.75	12.75
Herringbone	8.75	13.50	5.75	10.25
Satin	7.75	9.75	2.17	5.75
Chain	5.75	9.75	3.75	9.75
Fly	6.63	10	2	7

not break when tensile force was applied. This means there was high stress at the border of embroidered and plain area of the fabric. Another observation was that decrease in elongation of fabric was found after embroidery. Thus embroidery affected stretchability/extensibility of fabric. The change in extensibility of the fabric may be another reason for decrease in tensile strength.

Almost similar trend was observed in mulmul fabric (Table 6). Tensile strength of mulmul fabric is less than poplin due to open construction (low fabric count). It decreased in warp as well as in weft direction when fabrics were embroidered. Table 5 and 7 show impact of random placement of embroidery stitches on tensile strength of poplin and mulmul fabrics. Loss in strength was observed in both the fabrics but reduction in strength was in general less in random placement of motifs.

Conclusion:

It can be concluded that the tearing strength of poplin and mulmul fabrics increased after embroidery. Effect of variation in embroidery stitches on tearing strength was found. Placement of embroidery motifs also influenced tearing strength. In general tearing strength of fabrics with all over placement of motifs was higher than that of scattered placement. On the other hand tensile strength of fabrics decreased after doing embroidery.

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