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Effect of loop length on the dimensional properties of silk and model union knitted fabric

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Abstract

This paper deals with the dimensional stability of silk and model union knitted fabric as also the effect of loop length on the knitting of silk and modal yarn in plaited structure. Silk material has exceptional lustre and good tenacity among the natural fibres. Silk knitted fabric is regarded as a special product that can hold its own and survive in the competitive and diversified global textile market. With regard to silk-filament yarn knitting, it has been observed that the number of plies in the yarn and the yarn twist are interrelated and their effect on fabric properties is significant.

Keywords: Silk filament, loop length, WPI, CPI, stitch density, loop shape factor, wales constant.

Abbreviations: CPI-Course per inch, WPI-Wales per inch, K_c-Course constant (CPI x loop length), K_w-Wale constant (WPI x loop length), N-Stitch density (CPI x WPI), K_s-Stitch constant (K_c x K_w), K_c/K_w – Loop shape factor.

Introduction

Knitting technology has advanced considerably during the past two decades with the introduction of various knitted structures, the use of new and modified yarns and the versatility of modern knitting equipment. The successful use of yarns in knitting depends upon the knitting yarn characteristics and the selection of the knitting process parameters. The yarn quality requirements for knitting extend beyond those expected of yarns for weaving (Keshkari, 2002). For *e.g.*, yarns would do well in knitting if they possess better evenness, good elasticity and elongation, low hairiness and low coefficients of friction, soft feel and lower variation in count. Further, good fabric performance can be expected with yarn properties such as high work of rupture, loop strength and knot strength, yarn twist, reasonable tenacity, low flexural rigidity and adequate torsional rigidity.

A silk knitted fabric has a smooth surface and provides a pleasant feel when worn next to the body (Oglakcioglu & Marmarali, 2007). Such a fabric would be especially suitable for ladies garments because it is wrinkle-free, soft, light weight and has aesthetic feel. Modal is a cellulose fiber made by spinning reconstituted cellulose from beech trees. It is about 50% more hygroscopic (water-absorbent) per unit volume than cotton. It takes dye just like cotton, and is colour fast when washed in warm water. Generally, knitted fabrics tend to mould easily to body shapes and adapt themselves easily to body movements (Cheikhrouhou *et al.,* 2001). Knitted fabrics possess a high degree of elasticity and recovery, unlike woven fabrics that posses a low degree of elongation and recovery from stretch (Dias & Lanarolle, 2002). The unique property of a knitted fabric is that of stretch (Ozdil *et al.,* 2007). This is because of its inherent intermeshed loop arrangement. A knitted fabric is essentially a highly elastic material (Ceken & Eylul, 2001).

A major finding of this work is that the selection of silk filament denier, number of plies, twist level, machine gauge and fabric structure are important factors in the commercial knitting of silk filaments.

Methodology

For a study of the dimensional properties of silk/model knitted fabric, single jersey plain knitted fabric samples with three different loop lengths were produced. The fabrics were dry-relaxed by allowing them to remain flat on a horizontal surface for 48 h (Zaghouani *et al.,* 2007).

The fabric parameters evaluated for each of the samples include: Wales per inch, Course per inch, Width of the fabric, Loop length and Fabric thickness. The fabrics were then subjected to wet-relaxation using an industrial washing machine and the above parameters were measured on the dried samples.

Table 1. Effect of loop length on dry-relaxed fabric parameters

Loop length mm (inch)	CPI	WPI	K_c	K_w	N	K_s	K_c/K_w
2.5 (0.098)	52	30	5.09	2.94	1560	14.98	1.73
2.7 (0.106)	43	28	4.56	2.97	1204	13.53	1.54
2.9 (0.114)	35	27	3.99	3.08	945	12.28	1.29

Results and discussion

The test results for the dry-relaxed fabrics are given in Table 1 and those for the wet-relaxed fabric in Table 2. It is clear from Table 1 that the values of CPI, WPI, Kc, Kw, N, Ks and Kc/Kw are influenced by loop length. The CPI, WPI, Kc, N, Ks and Kc/Kw values show a consistent decrease with increase in loop length. The Kw values alone show a marginal increase, with a mean value around 3. The effect of loop length on the CPI and WPI

Table 2. Effect of loop length on wet-relaxed fabric parameters

Loop length mm (inch)	CPI	WPI	K_c	K_w	N	K_s	K_c/K_w
2.5 (0.098)	85	60	8.33	5.88	5100	48.98	1.42
2.7 (0.106)	87	53	9.22	5.62	4611	51.81	1.64
2.9 (0.114)	89	51	10.15	5.81	4539	58.99	1.75

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Fig. 1. Effect of loop length on the CPI and WPI of dry-relaxed fabric

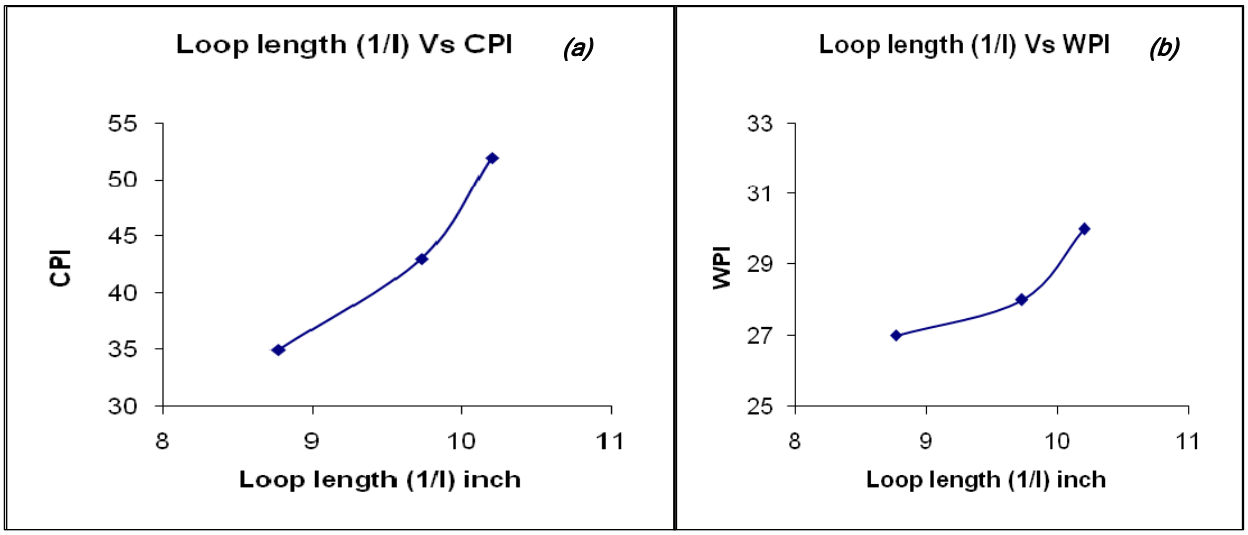


Fig. 2. Effect of loop length on the CPI & WPI of wet-relaxed fabric

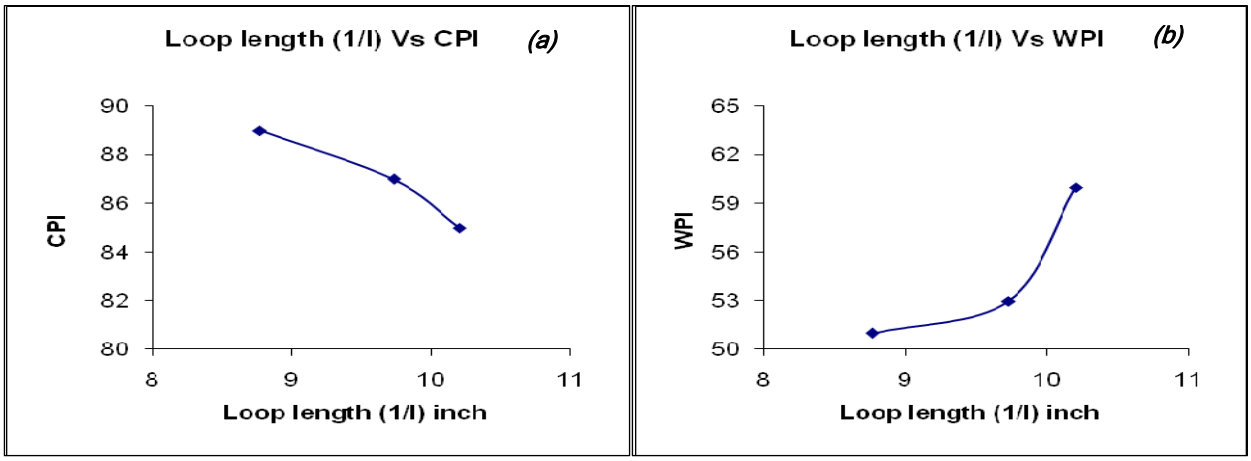
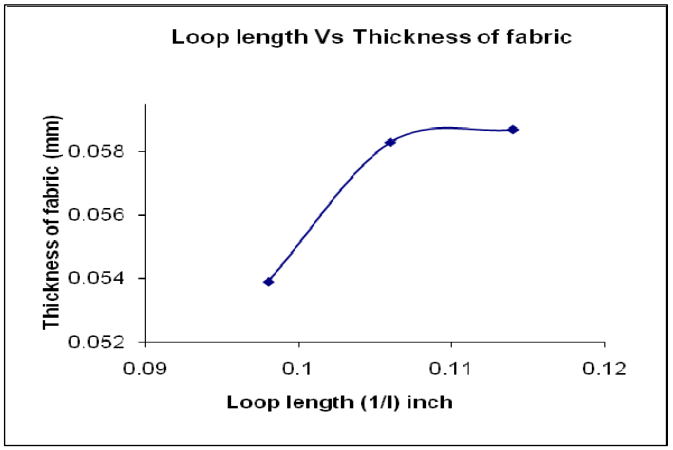


Fig. 3. Effect of loop length on fabric thickness (wet relaxed)



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are shown in Fig. 1(a) & (b).

The results for the wet-relaxed fabric clearly indicate that the values of CPI, Kc, Ks and Kc/Kw increase with increase in loop length. However there is a decrease in WPI and N. The Kw values show only marginal changes with the mean at 5.77. Fig. 2 (a) & (b) show the effect of loop length on the CPI and WPI values. From the above Table, it is been found that courses per inch values varies with respect to loop length and also it is been found that there is a considerable increase in the course per inch after hot washing. From the above Table, it is been found that wales per inch values varies with respect to loop length and also it is been found that there is a decrease in the Wales per inch after hot washing. From the Table 5 it is been found that loop length values varies before and after wet relaxation and also it is been found that there is a minimal change in the loop length after hot washing. From the Table 6 it is been found that width of fabric values varies with respect to loop length and also it is been found that there is a decrease in the width of fabric after hot washing. From the Table 7 and Fig. 3 it is been found that thickness of fabric values varies with respect to loop length and also it is been found that there is a increase in the thickness of fabric after hot washing.

Table 3. Effect of loop length on courses per inch

Loop length mm (inch)	Courses/inch		% change in course/inch
	For grey fabric	After wet relaxation	
2.5 (0.098)	52	85	63.46
2.7 (0.106)	43	87	102.33
2.9 (0.114)	35	89	154.29

Table 4. Effect of loop length on wales per inch

Loop length mm (inch)	Wales/inch		% change in wales/inch
	For grey fabric	After wet relaxation	
2.5 (0.098)	30	60	100
2.7 (0.106)	28	53	89.29
2.9 (0.114)	27	51	88.89

Table 5. Effect of loop length before & after wet relaxation

Loop length (mm)		% change in loop length
For grey fabric	After wet relaxation	
2.3	2.5	8.7
2.5	2.7	8.0
2.7	2.9	7.41

Table 6. Effect of loop length on width of fabric

Loop length mm (inch)	Width of grey fabric (cm)	Width of fabric after hot wash (cm)	% of shrinkage in the fabric after hot wash
2.5 (0.098)	68.3	54.1	20.79
2.7 (0.106)	66.4	55.6	16.27
2.9 (0.114)	65.5	56.2	14.19

Table 7. Effect of loop length on thickness of fabric

Loop length mm (inch)	Fabric thickness		% change in fabric thickness
	Grey state	After wet relaxation	
2.5 (0.098)	1.07	1.37	28.04
2.7 (0.106)	1.13	1.48	30.97
2.9 (0.114)	1.21	1.49	23.14

Conclusions

- Courses per inch increases with an increase in loop length.
- Wales per inch decreases with an increase in loop length.
- Loop length increases after wet relaxation process when compared to that of the value set in the machine.
- Thickness of fabric increases with an increase in loop length.
- From the study, it was found that the dimension of fabric shows considerable change during wet relaxation.
- The CPI increases from 63.46%-154.29% and an average percentage change in CPI is 106.69% after Wet-Relaxation.
- The WPI decreases from 100%-88.89% and an average percentage change in WPI is 92.73% after wet-relaxation.

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