SPIRALITY AND SHRINKAGE PROBLEMS ASSOCIATED WITH LOOSE KNIT PLAIN SINGLE JERSEY COTTON FABRICS

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ABSTRACT

Dimensional stability as a quality parameter bears immense significance for weft knitting fabric manufacturing industries. To meet the dimensional requirements, especially to control Spirality and Shrinkage percentage becomes more challenging when the fabric is loosely knitted. This paper puts an attempt to reveal shrinkage and spirality problems associated with loose knit single jersey fabrics in comparison to regular knit plain fabrics.

Keywords:

Loose knit,
Plain Single Jersey,
Spirality, Shrinkage,
Stitch Length / Loop Length

I. INTRODUCTION

Loose knit fabric as a terminology hasn't been used much in the literature by the academicians, rather in the production floor of the knit factories. In industrial practice, commonly loose knit fabrics for basic single jersey refers to the grey fabric produced through using a stitch length higher 3.5 mm (having a loop length higher than 0.35 cm).

Due to the construction of knitted structure, wales and courses of knit fabrics suffers distortion when relaxed [1]. knit loops tends to change in dimension and causes distortion within fabric and garment [2]. The swelling property of cotton fibre contributes in shape change, eventually causing change in dimensional property [3]. When knitted fabrics are allowed to relax off the knitting machine, relaxation of yarn certainly occurs when the fabric is first unrolled after knitting and fabric will spiral [4]. There is a strong linear correlation between fabric tightness factor and loop shape factor [5].

Aim of this study is to explore the spirality and shrinkage property problems when the loop shape is comparatively larger and also to demonstrate a comparative analysis how this problems go far when the fabrics are knitted with slightly higher stitch length.

II. MATERIALS & METHODS

The Single Jersey knit fabrics were produced from 100% cotton in a same machine (Orizio, Italy) with same machine parameters, using constant yarn count 20's and seven different stitch length to explore comparison between rather compact and loose knit fabrics. After dyeing and finishing the fabrics with proper specifications, spirality and shrinkage were measured for each samples and analysis were done.

Knitting Parameters:

Same machine parameters were used to produce single jersey fabrics from 20's using seven different stitch lengths - 3.0 mm, 3.2 mm, 3.4 mm, 3.6 mm, 3.8 mm, 4.0 mm, 4.1 mm with following machine specification:

Type of the machine	: Single Jersey circular knitting machine
Machine Brand	: Orizio
Manufacturing Country	: Italy
Machine Dia	: 30 inch
Machine Gauge	: 20
No of Feeders	: 90
RPM	: 16

Dyeing Process:

Dyeing was carried out in sample dyeing machine.

Machine Brand	: Dilmenler
Manufacturing Country	: Turkey

Pretreatment Recipe:

Detergent & wetting agent (Fabrivol knn)	: 1.0 gm/L
Sequestering agent (Optavon mex)	: 1.0 gm/L
Caustic Soda	: 2.0 gm/L
H_2O_2	:2.5gm/L
Peroxide Killer	:0.15gm/L
Acetic Acid	:1.0gm/L

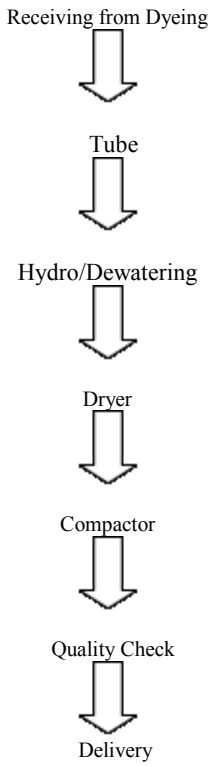
Dyeing Recipe:

Levexust CM (levelling agent)	: 1.0 gm/L
Anti creasing agent (Persotex afc)	: 0.5 gm/L
Nova Yellow S3R	: 0.28% owf (on the basis of weight)
Nova Ruby S3B	: 0.2% owf
Nova Ocean SR	: 0.72% owf
Glauber Salt	: 80 gm/L
Soda Ash	: 20 gm/L

After Treatment:

Oxinol CNW (Soaping agent)	: 0.80 gm/L
Zetesol Fix (Fixing agent)	: 1.0 gm/L
Sofitinen AUS (Cationic Softener)	: 10-20 gm/L

Finishing Process:



Dryer Machine Parameter:

Machine Brand	: Dilmenler
Manufacturing Country	: Turkey
Temperature	: 150-160^0 C
Over feed %	: 30-40
Vibration	: 500
Speed (m/min)	: 20-25
Folder Speed (m/min)	: 2~3

Working Parameter Of Compactor:

Machine Brand	: Lafer
Origin	: Italy
Speed	: 15-18
Over feed	: 25-30
Temperature	: 110-120^0 C
Blanket pressure	: 1.5 – 2 bar
Teflon pressure	: 36 psi
Stretch %	: 8-12

III. ANALYSIS, RESULTS & DISCUSSION

Calculation for Spirality Percentage:

Spirality % = $\frac{X}{Y} \times 100$

X= Average displacement length from the side seam line

Y= Side seam length,

Calculation for Shrinkage Percentage:

Shrinkage percentage = $(L_0-L_1) \times 100/L_0$

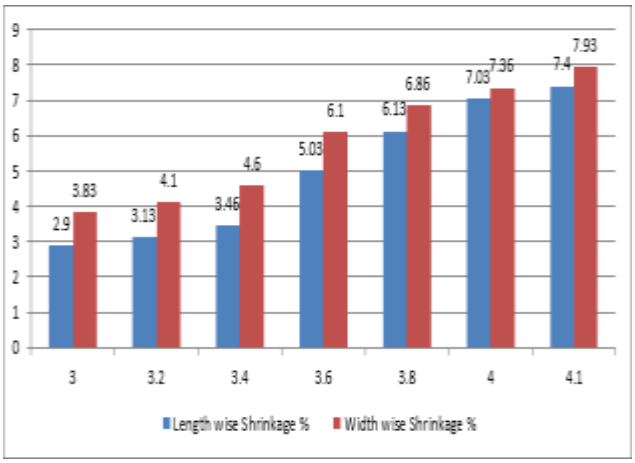
L_0 = the distance between the datum line before washing and

L_1 = the distance between datum lines after washing.

Experimental Data For Shrinkage (Tumble Dry)

Table No 1: Shrinkage for different loop length fabrics : (for 20's cotton yarn)

GSM	Stitch Length	No. of task	Length Wise %	Width Wise %
241	3.0 mm	1	2.8	3.7
		2	3.0	3.8
		3	2.9	4.0
228	3.2 mm	1	3.1	4.0
		2	3.2	4.2
		3	3.1	4.1
210	3.4 mm	1	3.5	4.8
		2	3.2	4.2
		3	3.7	4.8
194	3.6 mm	1	5	6
		2	5	6.2
		3	5.1	6.1
187	3.8 mm	1	6.0	7.0
		2	6.2	6.9
		3	6.2	6.7
181	4.0 mm	1	7	7.4
		2	7	7.5
		3	7.1	7.2
172	4.1 mm	1	7.6	8
		2	7.2	7.7
		3	7.4	8.1



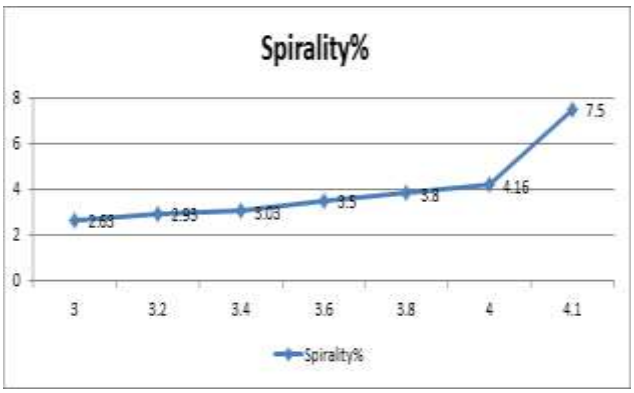
Graph No 1: Lengthwise & Widthwise shrinkage for different loop length fabrics

Result: As the loop length increases, shrinkage percentage (length and width wise) also increases simultaneously and the slope becomes sharper with larger angle for loose knit fabrics (from stitch length 3.6) which represents that the problem also increases to control shrinkage within buyer requirements.

Experimental Data for Spirality (Tumble Dry):

Table No 2: Spirality for different loop length fabrics :(for 20's cotton yarn)

GSM	Stitch Length	No. of task	Spirality %
241	3.0 mm	1	2.7
		2	2.7
		3	2.5
228	3.2 mm	1	3
		2	3
		3	2.8
210	3.4 mm	1	3
		2	3
		3	3.1
194	3.6 mm	1	3.5
		2	3.4
		3	3.6
187	3.8 mm	1	3.9
		2	3.7
		3	3.8
181	4.0 mm	1	4.2
		2	4.0
		3	4.3
172	4.1 mm	1	7.5
		2	7.4
		3	7.6



Graph No 2: Spirality for different loop length fabrics

Result: As the loop length increases, Spirality percentage also increases simultaneously and the slope becomes sharper with larger angle for loose knit fabrics (from stitch length 3.6) which represents that the problem also increases to control spirality within buyer requirements.

IV. CONCLUSION

Spirality and shrinkage problems can be addressed to a certain extent in the finishing units of a industry to get fabrics quality approved; but challenge is more difficult when the fabric loose knit. So back and forth calculation is necessary before producing the grey fabric to have a clear understanding on spirality and shrinkage values and to determine appropriate strategy to meet customer requirements.

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