An Investigation On Change In Physical PropertiesOf 1X1 RibWeft Knitted Fabric Due To Needle Drop

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Abstract—In this research work effect of stitch length, fabric width has been investigated for the needle drop structure in 1X1 rib fabric which made of acrylic yarn. It can be observed that due to needle drops fabrics behaviors and performance are changed. Fabric width decreases for increasing in number of needle drop and stitch length also decreases for more number of needle drops. Fabric width in relaxed state is not same to that in machine due to its tension relaxation in yarns of which it is composed. Changes in Loop shape and stitch length also cause the fabric to shrink.

Keywords—Rib knitted fabric, Needle drop.

I. INTRODUCTION

Day by day production of knitted fabric has been rapidly progressing in the world. In our country knit sector already holds the highest position if compared with weaving or other small sectors related to textile. Knit readymade garments the highest foreign currency earning sector of Bangladesh. The industry is also growing very fast due to strong backward linkage, less capital investment requirement, relatively low labor cost and higher profitable. In view of the potential for cost savings and enhanced mechanical performance, some of these traditional textile technologies have been adopted for manufacturing fabric reinforcement for advanced polymer composites. Knitting is particularly well suited to the rapid manufacture of components with complex shapes due to the low resistance to deformation of knitted fabrics [1]. The development of a fully fashioned knitted perform can prove time consuming and expensive so that this option could still be economically inefficient overall. In such instances, flat knitted fabrics with high amount а of formability/drapability should be used to form over a shaped tool for subsequent consolidation to produce the required composite component [2].

1x1 rib is production of by two sets of needles being alternately set or gate between each other. Relaxed 1x1 rib is theoretically twice the thickness and half the width of an equivalent plain fabric, but it has twice as much width-wise recoverable stretch. In practice, 1x1 rib normally relaxes by approximately 30 per cent

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compared with its knitting width [3]. Rib has a vertical cord appearance because the face loop wales tend to move over and in front of the reverse loop Wales [4]. Acrylic yarns have huge applications in knitted garments. Fabrics made from acrylic yarns are used now a day's specially for producing high bulk and warm fabrics. Like other synthetic fibers, acrylic fibers shrink when heated, which can decrease the possibility of accidental ignition. However, once ignited, they burn vigorously accompanied by black smoke. Thus, many efforts have been devoted to improve the flame resistance of acrylic fibers [5-12]. Wool-like properties are shown by poly-acrylic fibers which are produced by the polymerization of acrylonitrile using the addition route into poly acrylonitrile. They can then be spun into fibers by dry or wet spinning methods. Orlon was produced by DuPont. Knitted fabrics produced from Acrylic yarns have wool like feel and 1x1 acrylic rib fabrics with needle drop structures that are made in Flat knitting machines, have attractive appearances [13]. This research work is basically on the analysis of different parameter variations due to Needle Drop in 1x1 Rib fabrics produced in V-bed Rib machine. Stitch length and fabric width which are important factors in case of knitted fabrics production, need to be checked to observe the variations. Needle drops can make the fabrics to change its behavior and performance.

II. MATERIALS AND METHODS

A. Raw Materials:

Fiber type: Two ply Acrylic Yarn.

Yarn Type: Spun

Two ply yarns are used in this knitting procedure. First yarn and second yarn are plied together. Count of each ply of yarn is measured and the resultant count is determined. Count of First Ply Yarn = 78.73 Tex, Count of second Yarn = 126.3 Tex, Resultant Count in Direct System = 205.03 Tex

B. Machine Used:

Types of Machine: V-Bed Rib knitting machine Total Needle Bed Length: 91 cm. Total no of needle: In Front Needle Bed- 126, and in Back Needle Bed-126,No of Feeder: 1,Gauge: 3.5G Yarn Feeding System: Negative.

C. Equipment Used:

- 1. Measuring Tape
- 2. HATRA Course Length Tester

III. SAMPLE DETAILS:



Sample 05 (4	Needle Drop)			
Face Side of Sample Fabrics	Back Side of sample Fabrics			
Needle Arrangements &C	Cam Set out for sample 5			
$ \begin{array}{c} B \\ F \\ \hline \end{array} \\ \hline \begin{array}{c} & & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ $				
Needle Set Out 1 1 1 1	$\frac{\text{Cam Arrangement}}{\text{Back Bed } \left \begin{array}{c} k \\ F_1 \\ F_1 \\ \hline k \end{array} \right $ Front Bed			



Sample 06(5 Needle Drop)				
Face Side of Sample Fabrics	Back Side of sample Fabrics			
Needle Arrangements & (Cam Set out for sample 6			
$ \begin{array}{c} B \\ F \\ \hline \\ 1x1 \text{ Rib (5 Needle Drop)} \end{array} $				
<u>Needle Set Out</u> 1 1 1 1	Cam Arrangement Back Bed k Front Bed k			



Sample 09 (8 Needle Drop)				
Face Side of Sample	Back Side of sample			
Fabrics	Fabrics			
Needle Arrangements &	Cam Set out for sample 9			
B F Ix1 Rib (Needle Set Out	8 Needle Drop)			
1 1 1	Back Bed k Fri Front Bed k			

Sample 10 (9	Needle Drop)
Face Side of Sample	Back Side of sample
Fabrics	Fabrics
Needle Arrangements & C	am Set out for sample 10
$ \begin{array}{c} B \\ F \\ \hline F \\ \hline Ix1 \\ \hline Needle Set Out \\ 1 \\ 1 \\ 1 \\ 1 \end{array} $	Rib (9 Needle Drop) Cam Arrangement Back Bed Back Bed k Front Bed k



IV. WORKING PROCEDURE:

A. Fabric Production

At first contract a plain weft knitted fabric in a flat bed knitting machine. After knitting Plain about sufficient length to take measurements, the machine settings were changed. 1 needle was raised after every 9 needles in the back bed. The front bed needles were same as previous. Then the carriage was started to move from one side to another. Thus 1x1 Rib fabrics with 9 needles drop was produced.

Then similarly fabrics was produced by 8 needle drop, 7 needle drop, 6 needle drop, 5 needle drop, 4 needle drop, 3 needle drop, 2 needle drop and 1 needle drop. Stitch length was measured by HATRA course length tester for each fabric sample. The fabric was relaxed for 24 hours and then a protractor was placed along course lines, ensuring that a wale line intersects with the bottom of the 90 degree line on the protractor.

B. Statistical Analysis:

Microsoft Excels software used for analyzing all the testing data and statistical comparison.

V. DATA COLLECTION

A. Data collection for measuring stitch length in cm from course length (cm).[Data calculated by using Microsoft Excel]

Table 1	Data fo	r dotormino	the Stite	h longth f	or comple 1
Table L.	. Dala IU		the Suic	nienguni	u sample i

Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
347.75				
348.10	247 772	1 2000	0.2017	0.05900/
347.55	341.112	1.3000	0.2017	0.0000%
347.76				
347.70				

Table 2. Data for determine the Stitch length for sample 2

Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
345.45				
345.55				
344.65	345.26	1.3701	0.4642	0.1345%
344.90				
345.75				

Table 3. Data for determine the Stitch length for sample 3

Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
340.25				
340.45				
339.85	340.19	1.3500	0.4450	0.1308%
339.65				
340.75				

Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
335.50				
335.55				
335.00	335.15	1.3300	0.3553	0.1060%
334.95				
334.75				

 Table 5. Data for determine the Stitch length for sample 5

Course length	Avg. course	Stitch length	Standard Deviation	CV%
(cm)	length (cm)	(cm)		
330.25				
329.95				
330.65	330.11	1.3100	0.4037	0.1223%
330.15				
329.55				

Table 6. Data for determine the Stitch length for sample 6

Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
327.65				
327.80				
328.00	327.65	1.3002	0.2622	0.0800%
327.45				
327.35				

E.

Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
325.45				
325.20				
324.85	325.09	1.2900	0.2382	0.0733%
325.00				
324.95				

Table 7. Data for determine the Stitch length for sample 7

Table 10. D	Data for determine	e the Stitch I	ength f	or sampl	e 10

	Sample10			
Course	Avg.	Stitch	Standard Deviation	CV%
(cm)	length (cm)	(cm)	Deviation	
305.10				
304.95				
304.95	304.92	1.2100	0.1304	0.0428%
304.75				
304.85				

Table 8.	Data for determine the Stitch length for sample 8
	5

	Sample08			
Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
318.05				
317.85				
317.55	317.67	1.2606	0.2683	0.0845%
317.45				
317.45				

Table 9	. Data for determine the Stitch length for sample 9

	Sample09			
Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
308.05				
307.85				
307.95	307.69	1.2210	0.3647	0.1185%
307.25				
307.35				

Table 11	Data for determine the Stitch length for sample 11
Table II.	Data for determine the Stitch length for sample 11

Course length (cm)	Avg. course length (cm)	Stitch length (cm)	Standard Deviation	CV%
303.15				
302.55				
302.85	302.71	1.2012	0.2881	0.0952%
302.45				
302.55				

B. Data collection for measuring fabric width in cm. [Data calculated by using Microsoft Excel].

Table 12. Data for determine the Fabric width for sample 1

	Samp		
Fabric Width (cm)	Avg.Fabric Standard width (cm) Deviation		CV%
45.00			
45.15			
45.10	45.1	0.0791	0.1753%
45.05			
45.2			

Table 13. Data for determine the Fabric width for sample 2				
	Samp			
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%	
42.35				
42.15				
42.35	42.3	0.2121	0.5015%	
42.6				
42.05				

	Samp				
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%		
36.15					
36.05					
36.00	36.05	0.0791	0.2193%		
36.10					
35.95					

Table 14. Data for determine the Fabric width for sample 3				
	Samp			
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%	
39.70				
39.85				
39.80	39.75	0.1275	0.3207%	
39.55				
39.85				

Table 17. I	Data for determine	e the Fabric width	for sample 6
	Sample 06		
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
35.55			
35 35			

Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
35.55			
35.35			
35.45	35.45	0.1581	0.4460%
35.25			
35.65			

Table 15. Data for determine the Fabric width for sample 4		
	Sample 04	

Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
37.60			
37.65			
37.45	37.55	0.0791	0.2105%
37.5			
37.55			

Table 18. Data for determine the Fabric width for sample 7			
	Sample 07		
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
34.25			
34.30	34.25		
34.20		0.0791	0.2308%
34.15			
34.35			

	Sample 08		
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
33.75			
33.50			
33.55	33.6	0.1414	0.4209%
33.75			
33.45			

Table 19. Data for determine the Fabric width for sample 8

Table 20. Data for determine the Fabric width for sample 9

	Sample 09		
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
33.00			
32.80			
32.55	32.75	0.1696	0.5177%
32.65			
32.75			

Table 21. Data for determine the Fabric width for sample 10)
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	Sample 10		
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
32.35			
32.10			
32.05	32.1	0.1458	0.4541%
32.00			
32.00			

Table 22. Data for determine the Fabric width for sample 11

	Sample 01		
Fabric Width (cm)	Avg.Fabric width (cm)	Standard Deviation	CV%
31.80			
31.55			
31.65	31.7	0.1000	0.3155%
31.75			
31.75			

VI. DATA ANALYSIS

A. All the data for determine the stitch length in cm (from table 1 to table 11) can be sumurised as, Table 23. Summarized data for determine Stitch Length due to Needle Drop Structures

No of Needle Drop	Stitch Length (cm)
No drop (1×1Rib)	1.38
1	1.37
2	1.35
3	1.33
4	1.31
5	1.30
6	1.29
7	1.26
8	1.22
9	1.21
10 Needle drop (plain)	1.20



Figure 1. Stitch Length Variation Line for Different Needle Drop Structures.

B. All the data for determine the fabric width in cm (from table 12 to table 22) can be sumurised as,

Fabric width (cm)
45.10
42.30
39.75
37.55
36.05
35.45
34.25
33.60
32.75
32.10
31.70

Table 24. Summarized data for determine fabric width due to Needle Drop Structures



Figure 2. Fabric Width Variation Line for Different Needle Drop Structures.

VII. RESULTS & DISCUSSION

A. Spirality

Spirality were not found because of Double Jersey fabrics did not prone to this characteristics as loops in other side cancel out distortions and two plied yarns were used.

B. Stitch Length Variation

Structures with Needle drops had different Stitch Length values. From Graph-1 Linear Regression showed that with increasing no. of needle drops, the stitch length varies. It followed a gradual sequence of decreasing.

Linear Regression Equation, y = -0.019x + 1.406Co-efficient of Determination, $R^2 = 0.982$. Both table 23 and figure 1 clearly shows that the increasing the no of needle drop causes the reduction of the stitch length.

C. Fabric witdth variation

1x1 Rib with Needle Drop Structures which were produced in Flat Bed Knitting Machine, in relaxed state fabric widths were not same to that in machine due to its tension relaxation in yarns. It was seen that with increasing no. of Needle drops the fabric widths were decreased. From the figure -2 I Regression line was shown.

Regression equation, y = -1.259x + 43.97

Co-efficient of Determination, $R^2 = 0.915$

These values show that result was good enough and fabric widths follow a gradual decrease with increasing no. of needle drops.

VIII. CONCLUTION

The economy of Bangladesh is dependent on readymade garments industries and most of the fabric is knit. A wide range of varieties fabrics are produce in our country to meet the challenges of foreign buyers. 1×1 rib weft knitted structure is mostly used for collar, cuff of polo t-shirt, welts, muffler, sweater etc. In this research work it can be clearly said that there is a relationship between the stitch length and fabric width due to change in needle drop in basic rib weft knitted fabric. Stitch length values were decreasing gradually with increasing no. of needle drops. On the other hand less no. of needles for fixed width, fabrics production, fabric widths decreases. As increasing no. of needle drops allowed less no. of needles to do the production for the fixed width in machine, so fabrics widths were decreased gradually.

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