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Investigation on the Changes of Areal Density of Knit Fabric with Stitch Length Variation on the Increment of Tuck Loop Percentages

Salvia Rahman[1], Shamima Akter Smriti[2]
[1](*Department of Textile Engineering, Bangladesh University of Business & Technology, Bangladesh)*
[2](*Department of Textile Engineering, Daffodil International University, Bangladesh*)

Abstract : *Stitch length and GSM (gram per square meter) are the two major parameters for making a knit fabric. The relationship between stitch length (S.L) and GSM is inversely proportional if the other parameter remain constant. Again the presence of tuck loop in knit fabric structure make the fabric heavier than the plain single jersey fabric having all knit loop because of the accumulation of yarn in the tucking place. In this study, an experimental work was offered to understand the influence of different stitch length on the GSM of knit fabric with respect to the change of tuck loop percentage in the knit fabric structure. Here three fabric (single jersey, single lacoste and polo pique) having different tuck loops percentage with five different stitch lengths were selected where the other parameters were constant. With the increment of tuck loop percentage and descending of stitch length, a measurable increase in areal density was observed, where the GSM increment percentage was maximum at 2.70 mm stitch length for every tuck loop percentage. After that the gradual reduction of stitch length resulted in the lower rate of GSM increment.*

Keywords - *Areal density, Polo pique, Single jersey, Single lacoste, Stitch length, Tuck loop.*

I. Introduction

Knitting is the process of forming fabric by interlooping yarn in a series of intermeshed loops using needles. Knitted fabrics are preferred in many types of clothing because of its extensibility, lightweight, warmth, wrinkle resistance and ease of care [1].The term knitting describes the technique of constructing textile structures by forming a continuous length of yarn into columns of vertically intermeshed loops [2].

Knitted structures are progressively built-up from row after row of intermeshed loops. The properties of a knitted structure are largely determined by the interdependence of each stitch to its neighbors on either side and above and below it [2].As knit fabrics are produced on different machines with various conditions to produce different types of fabric, they bear different qualities [3].

Areal density is the measure of mass per unit area of the fabric. Usually knit fabrics with tuck stitches appear thicker than the fabric having only knit stitches due to accumulation of yarns at the tucking places [4].The effect of knit structures on their areal density has been analyzed by many researchers [5].

Islam M.A [6] studied on the effect of increased tuck and miss loops on spirality of single jersey fabric. Khalil E.et.al[7] was investigated the influence of stitch length on dimensional properties like CPI,WPI,GSM,thickness and tightness factor and also the change of physical properties such as air permeability and water absorbency,shrinkage,spirality. Kumar V.et.al [8] studied on the suitability of cotton elastomeric core spun yarn by analyzing dimensional stability and geometrical attributes of knitted structure. Emirhanova N.et.al [5], [9-10] observed the impact of different knit structure on the dimensional properties of knitted fabric.

Sakthivel J.C.et.al [11-12] also investigated the influence of different fibre on the dimensional properties of knit fabric. Islam M.A.et.al [13] mentioned that the spirality of fabric changed due to the change of stitch length and count variation. To the best of our knowledge, limited numbers of researches were carried out to investigate the effect of knit structure on the areal density of knit fabric with stitch length variation on the increment of tuck loop.

Effect of stitch length on knit fabric structure plays a vital role on its areal density. What kind of changes on fabric areal density of single jersey knit structures will be regulated by various stitch length is the measurement of our research.

II. Materials And Methods

Tuck and miss loops are used to diversify the single jersey knit fabrics. To conduct this work tuck loops were individually increased in wale direction to create single jersey derivatives.

Total three single jersey derivatives; plain jersey, single lacoste and polo pique of five different stitch length (mm) were produced from 100% cotton yarns of count 30 Ne. The fabrics were knitted on a 21”

diameter, 24E gauge knitting machine (Orizio,Italy).Each samples were knitted 3 kgs for five different stitch lengths (mm). The notation diagrams of all the knitted samples are given below:

2.1 Single Jersey Plain

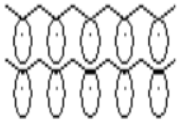


Fig1: Notation diagram of Single Jersey (plain)

2.2 Single Lacoste

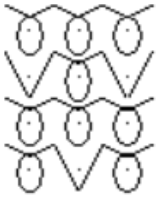


Fig 2: Notation diagram of Single Lacoste

2.3 Polo Pique

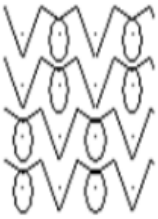


Fig 3: Notation diagram of Polo Pique

2.4 Procedure of area density (GSM) measurement:

After having taken the samples off the machine, they were laid on a smooth and flat surface in atmospheric condition (20°C ± 2 and 65% RH ± 2) for 24 hours to allow for relaxation and conditioning. Then the grey GSM of the fabric samples measured with a GSM cutter by laying them flat on a smooth surface.

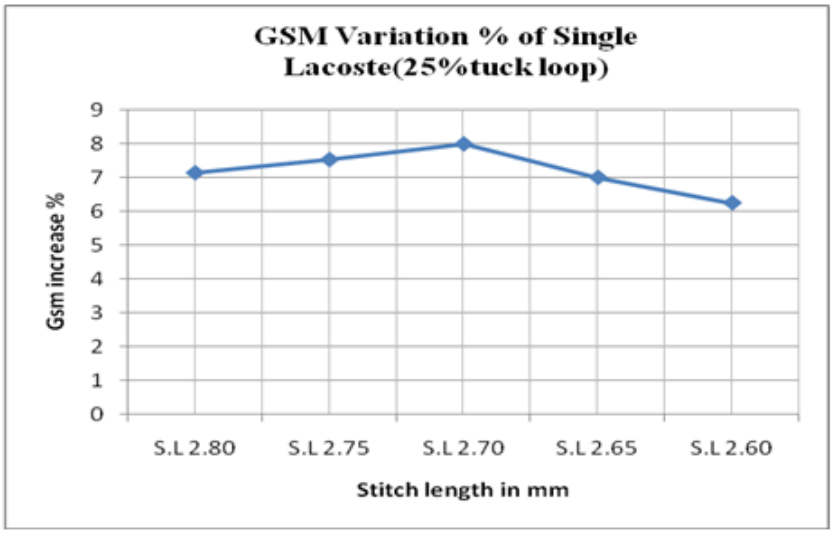
The variation on grey GSM of those fabrics due to the presence of tuck loop percentage for different stitch lengths (mm) are observed and being putted on the table 1.

Table 1 Changes of fabric areal density and with different stitch length due to the presence of tuck loop percentages.

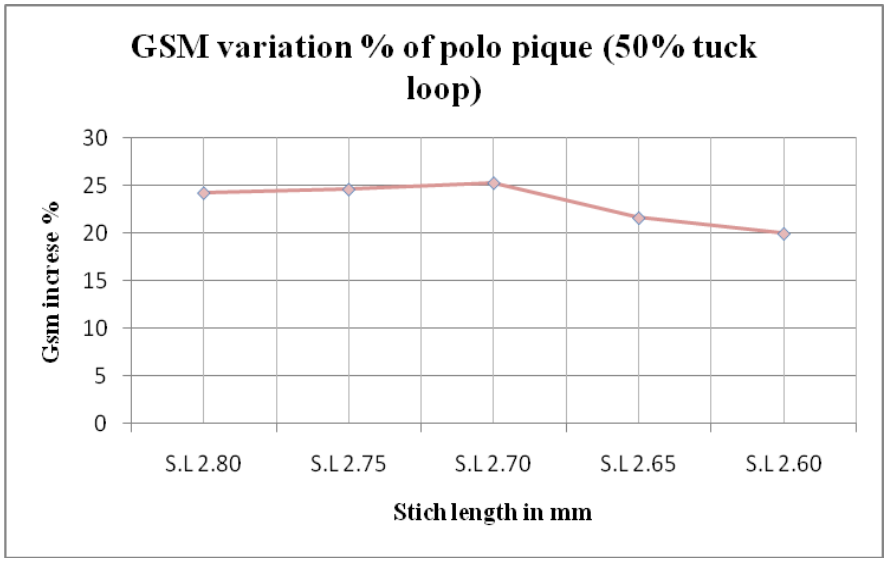
Fabric Type	S.L 2.80 mm	S.L 2.75 mm	S.L 2.70 mm	S.L 2.65 mm	S.L 2.60 mm
Single jersey((0% tuck loop) loop)tuck loop)	140	146	150	157	160
Single lacoste(25% tuck loop)	150	157	162	168	170
Polo pique(50% tuck loop)	174	182	188	191	192

Table 2 The variation percentage on gsm of the fabrics for different stitch length.

Fabric Type	S.L 2.80 mm	S.L 2.75 mm	S.L 2.70 mm	S.L 2.65 mm	S.L 2.60 mm
Single jersey(0% tuck loop)	0	0	0	0	0
Single lacoste(25% tuck loop)	7.14%	7.53%	8%	7.01%	6.25%
Polo pique(50% tuck loop)	24.28%	24.66%	25.33%	21.66%	20%



Graph 1: Effect of stitch length on areal density of single lacoste due to tuck loops.



Graph 2: Effect of stitch length on areal density of polo pique due to tuck loops.

III. Results And Discussion

Knitted structures have pivotal influence on fabric areal density even if the stitch length remains same. From table 1 it can be seen that with the increases of tuck loops in the fabric structure, areal density is increased in grey state of each fabric.

Fabric with tuck loop is thicker than fabric having knit loop due to accumulation of yarn at the tucking place and polo pique has higher number of tuck loops in the repeat than single lacoste fabric. So polo pique fabric shows higher GSM than single lacoste fabric. And similarly single lacoste fabric shows higher GSM than plain single jersey.

Table 2 shows that single lacoste (7.142857%) has more areal density than single jersey and polo pique (24.28571%) has more areal density than single lacoste.

By comparing Table 1 and table 2, it can be conferred that lacoste & pique fabric have higher areal density than single jersey plain designs. It means that presence of tuck loop increases the fabric areal density than all knit loop.

Table 2, graph 1 and graph 2 shows that in all case Maximum increase in GSM percentage is found in 2.70 mm stitch length lacoste and polo pique fabric due to tuck loops compared to single jersey plain knitted fabric. This is the optimum stage. After that in 2.65 mm the GSM increment % is decreased.

Finally it can be discussed that GSM variation percentages increases up to 2.70 mm stitch length for single lacoste and polo pique structures. After that the variation percentages decreased i.e. amount of variation does not increase rapidly.

IV. Conclusion

The transformation of areal density has been investigated with stitch length variation of different knit structures. The effects of tuck loops on the fabric GSM is also observed. From the observation it is apparent that the GSM of all fabric is ascended with descending of stitch length.

Once more observation is that the fabric sample knitted with higher tuck loops percentage show higher GSM than the plain single jersey fabric. The GSM increment percentage is maximum 25.33% for polo pique having 50% tuck loops than single jersey. For all fabric the GSM is increased up to 2.70 mm stitch length, after that at 2.65 mm the GSM increment percentage is decreased with descending of stitch length. Finally it may be concluded that the GSM is greater for both the presence of tuck loop and low stitch length but the GSM increased percentage has an optimum level, after that with the decreases of stitch length decrease the GSM increment percentage.

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