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EFFECT OF SHADE% ON GSM, SPIRALITY, SHRINKAGE AND COLOR FASTNESS PROPERTIES OF THE WEFT KNITTED TWO THREAD FLEECE FABRICS

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Abstract

In this study we have investigated how Shade% influences the weft knitted two thread fleece fabric quality. Required finished GSM (g/m^2), spirality, shrinkage and fastness properties etc are the desired quality of any knitted finished goods. These qualities depend on various factors such as yarn quality, yarn tension, knitting machine setting, Loop length, dyeing finishing parameters. Shade% means amount of dyes absorbed by the fabric surface. Shade matching is the most important factor of dyed fabrics. The aim of this work is to find out effect of shade% on GSM, dimensional stability and fastness properties of a specified weft knitted two thread fleece fabric sample. The work revealed that GSM, light fastness increased and spirality, wash fastness, rubbing fastness decreased with the increasing of shade%. It was also found that lengthwise extension and widthwise shrinkage occured due to increase shade%.

Key words: Two thread fleece fabric, Shade %, GSM, Spirality, Shrinkage, Fastness properties

Introduction

The fleece fabric is similar to jersey and is obtained by inserting one or more additional yarns. Which do not form the stitch but only a sort of binding on the ground pattern (Mazza carmine and zonda paola, 2002).Fleece knits can be made on circular-knit machines in any one of three different types of construction. These are one thread fleece, two thread fleece and three thread fleece. In two thread fleece, one yarn which provides the ground or body is knitted in either a single or double jersey construction. The second yarn, which may be coarser and heavier to accommodate subsequent napping, is the floating or inlay yarn that is tucked at predetermined intervals on selected needles (Corbman, 2010).

The dimensional stability of knitted fabrics is an important area of the knitting industry. Fabric shrinkage and spirality are the ultimate problem if the dimensional stability of the knitted fabrics is not properly taken care. There are various factors influencing the dimensional stability as well as the shrinkage of the knitted fabrics. Though the factors such as fibre characteristics, stitch length, machine gauge, yarn twist, knitting tension and washing, drying methods causes dimensional variations, the first factor mostly responsible is relaxation of internal stress, Since these have been imposed on the yarn during the knitting processes. The second factor is the swelling of the yarn when the

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fabrics are subjected to wet treatments (Anbumani, 2007). The darkness or lightness of color in dyeing known as the depth of shade, is dependent on the quantity of dye used in ratio to the fibre weight being dyed (Price and cohen,1997).The dyed materials have diversified use. Consequently, they are subjected to treatment with several external agents under diversified conditions. The resistance to such external agents is known as fastness properties. Frequently a compromise must be reached between the cost of attaining a particular color of goods and the fastness properties of such goods (Choudhury,2006).The color fastness of a materials a measure of its resistance to the types of changes and is a characteristic of the entire dye fibre system.(Broadbent,2001)

Materials and Method

Materials: Two thread fleece fabric was produced on single jersey circular knitting machine from twenty six count combed yarn and this fabric was dyed at four different shade%, finally these fabrics were finished at the same parameters .Yarn, fabric, machine specification and finishing parameters are given below in Table 1,2,3,4 respectively.

Table 1. Yarn Specification

Nominal count	Actual count	Type of yarn	TPI	Brand Name	Origin
26^s/1 Ne	25.87^s/1 Ne	Combed	19	Square	Bangladesh

Table 2. Fabric Specification

Fabric sample	Type of Fabric	GREY.GSM	Required Finished width	Shade%	Color
A	Two Thread Fleece	190	56" open	0.11	Lt Beige
B	Two Thread Fleece	190	56 "	1.2	Fake Coral
C	Two Thread Fleece	190	56"	7.0	Black
D	Two Thread Fleece	190	56"	7.6	Crimson

Table 3. Machine specification of single jersey knitting machine

Brand Name	Jiunn Long
Country of origin	Taiwan
Machine diameter	26 inch
No of feeder	78
Machine gauge	24
No of needles	1960
Machine Speed	30 rpm

Table 4. Finishing parameters

Finishing Machine	Temperature	Over feed%	Speed	Compacting
Stenter	165^0C	60-80%	40m/min	
Open compactor	110^0C	50%	25m/min	15%

Method

An increase or decrease in the length or width of a fabric is called a dimensional change, decrease in size is referred to as shrinkage and an increase as growth. Dimensional change is usually expressed as a percent of the original size of the specimen. Spirality and shrinkage are measured in degree and percentage respectively. But in the industrial or practical purposes Spirality and shrinkage are measured in percentage . For measuring spirality and Shrinkage samples are marked with scale at 50cm (lengthwise and widthwise). No tension is applied to samples during measuring spirality and shrinkage percentage. After dyeing and finishing, four different shade percentage fabric had been taken. At first it was washed by the ISO:6330 method. We had to wash those sample fabrics at 40°C for 40min. After washing we took four sample for drying with line and tumble system. For line and tumble drying we had to dry those sample fabrics for 4 hours at room temperature and 30 min at 60 °C temperature respectively.

Calculation of Spirality: Spirality of knitted fabric is obtained when the wale is not perpendicular to the course, forming an angle of spirality with vertical direction of the fabric. Spirality has calculated from the following formulae;

$$\text{Spirality} = \frac{\frac{\text{left side deformation + right side deformation}}{2}}{\text{Fabric length}} \times 100\%$$

(Factory source**:** Impress- Newtex Composite Textiles Ltd. Gorai , Mirzapur. **)**

Calculation of Shrinkage : The specimens are then allowed to cool, preconditioned and then conditioned for another 24 hour to bring them into the same state they were in when they were marked. They are then remeasured on a flat smooth surface and the percentage dimensional change calculated.

$$\text{Shrinkage} = \frac{\text{original measurement} - \text{final measurement}}{\text{original measurement}} \times 100\% \text{ (Savile, 1999)}$$

Sequence of operation for spirality and shrinkage determination:

(i) Sample size 50 cm × 50cm

(ii) Marking area 35cm × 35cm

(iii) Liquor ratio 1:50

(iv) Sample weight should be (1.8 ± 0.1) kg. If the sample is less than1.8kg put the dummy cloth and maintains the weight of 1.8 kg.

(v) Suitable detergent 0.5% on the weight of the sample.

(vi) At 40°C for 40min in the wash bath.

GSM: Fabric GSM is measured directly with the help of GSM Cutter and electronic balance.

Results and Discussion

Two thread fleece weft knitted fabrics were produced on circular knitting machine at same loop length (loop length 2.80 mm for base and 1.25 mm for loop at the back side of the fabric) and same yarn count but they were dyed four different shade% which are

represented by A,B,C,D respectively. After knitting, dyeing and finishing, the samples were tested and found the following parameters which was shown in Table no 5:

Table 5. Different parameters of two thread fleece fabric

Fabric. sample	Yam Count	Color	Shade%	Stitch length (mm)	Grey GSM	Finished GSM	Finished Dia (inch)	Dimensional Stability			Wash & Dry Condition	After washing GSM
								Length wise Dimension change%	Widthwise Dimension change%	Spirality%		
A	26s/+26s/1	Lt Beige	0.11	2.80+1.25	190	217	57//	-3	-4	3.7	WT	245
								+3.0	-4	5.0	WL	241
B	26s/1+26s/1	Fake Coral	1.2	2.80+1.25	190	221	57//	-3.2	-4.3	3.5	WT	252
								+2.8	-4.3	4.5	WL	245
C	26s/1+26s/1	Black	7	2.80+1.25	190	230	58//	-3.0	-5	3.2	WT	254
								+1.4	-5	2.5	WL	252
D	26s/1+26s/1	Crimson	7.6	2.80+1.25	190	236	58//	-3.04	-5	0.8	WT	259
								+1.2	-5	2.4	WL	256

(N.B.: WT: wash with tumble dry, WL: wash with line dry)

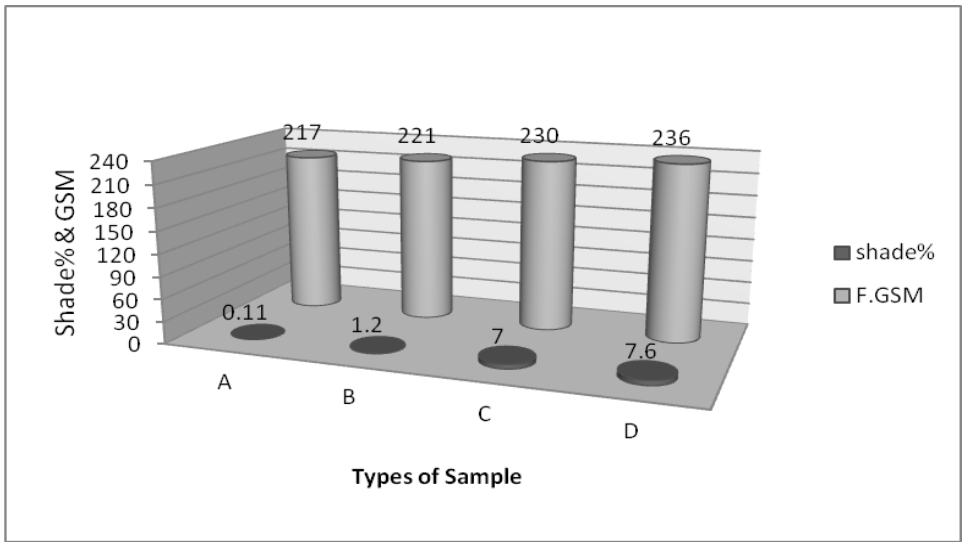

Fig. 1. Relation between Shade% and Finished GSM for tumble drying

This figure shows that finished GSM increases with the increases of shade%.

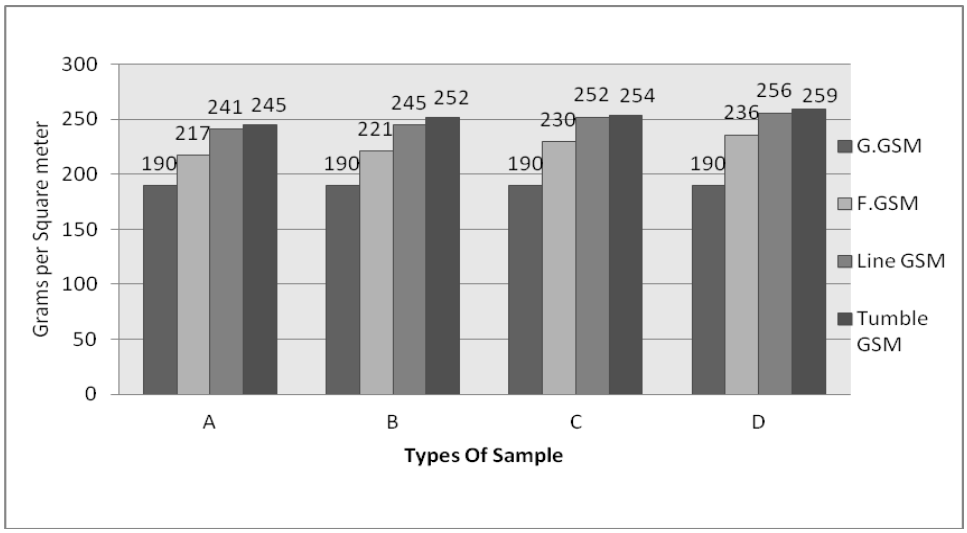

Fig. 2. Relation among Grey GSM, Finished GSM and After wash GSM.

GSM increased most in after wash of those sample fabric comparison with the grey GSM and finished GSM. Also found that GSM increased more in tumble drying than line drying with the increase of shade% due to tumble dryer revolving pressure and temperature.

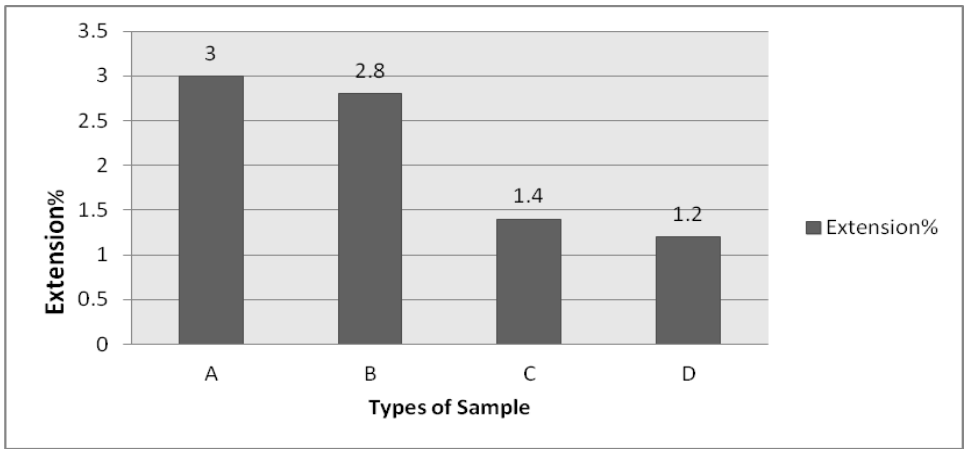

Fig. 3. Lengthwise extension% in case of wash with line dry

Line drying caused length extension of weft knitted two thread fleece fabric due to the mass of the fabric causing the fabric to be drawn downwards. Lengthwise extension% in sample 'A' is more to the other sample, with the increasing of shade% lengthwise extension decreased.

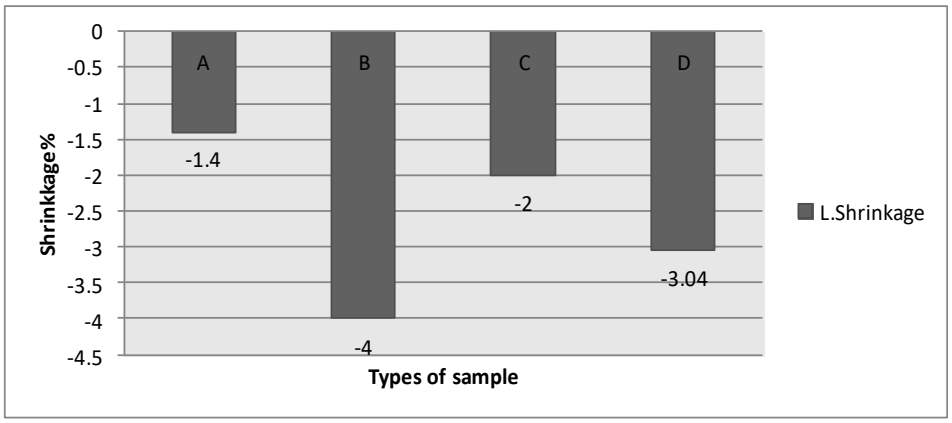

Fig. 4. Lengthwise shrinkage% in case of wash with tumble dry

In tumble drying lengthwise shrinkage was found but in line drying lengthwise extension was found. In case of sample 'B' lengthwise shrinkage% is higher than other samples.

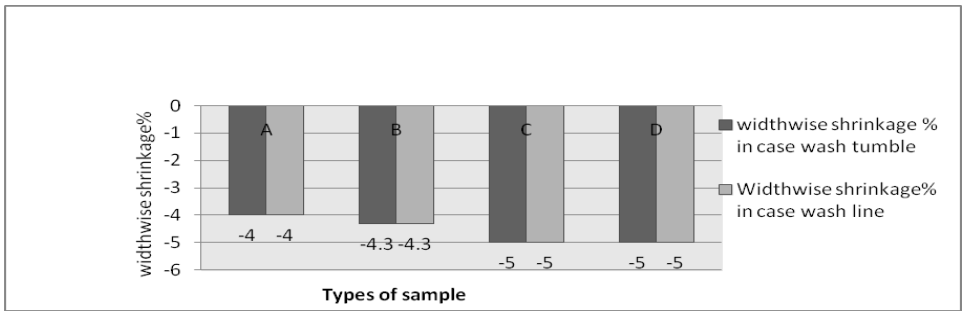

Fig. 5. Widthwise shrinkage% both in wash with line and tumble dry

With the increased of shade% widthwise shrinkage% increased both tumble and line drying.

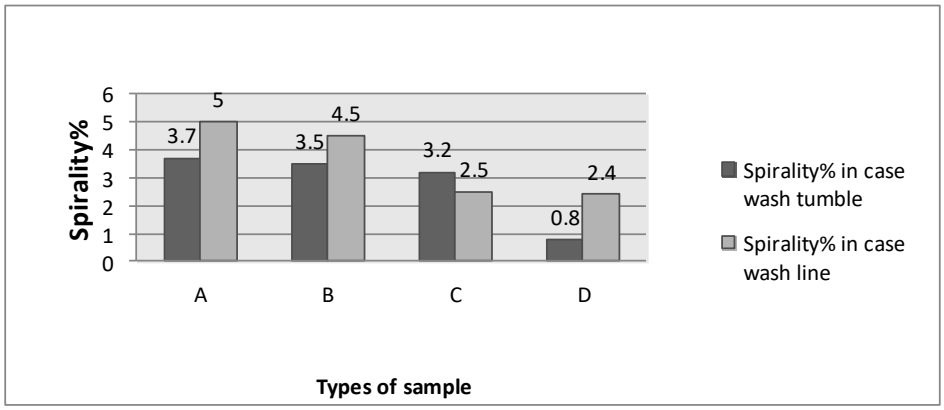

Fig. 6. Spirality % in case of wash with line and tumble dry

From this figure it was found that for line and tumble drying spirality decreasing with the increased of shade%. But in line drying spirality was more than tumble drying except Sample C

Table 6. Different Color Fastness (C/F) Properties Test Report

Name of Test	Test Method	Staining in Color		Color	Fabric sample
		Cotton	Wool		
C/F to Wash	ISO 105-C06	4 to 5	4 to 5	Lt Beige	A
C/F to Perspiration	ISO 105-E04	4 to 5	4 to 5		
C/F to Water	ISO 105-E01	4 to 5	4 to 5		
C/F to Rubbing	ISO 105-X12	4 to 5(Dry), 4(Wet)			
C/F to Light	ISO 105-B02	2 to 3			
C/F to Wash	ISO 105-C06	4 to 5	4 to 5	Fake Coral	B
C/F to Perspiration	ISO 105-E04	4 to 5	4 to 5		
C/F to Water	ISO 105-E01	4 to 5	4 to 5		
C/F to Rubbing	ISO 105-X12	4 (Dry), 3(Wet)			
C/F to Light	ISO 105-B02	2 to 3			
C/F to Wash	ISO 105-C06	3 to 4	3 to 4	Crimson	C
C/F to Perspiration	ISO 105-E04	4 to 5	4 to 5		
C/F to Water	ISO 105-E01	4 to 5	4 to 5		
C/F to Rubbing	ISO 105-X12	3-4 (Dry), 2(Wet)			
C/F to Light	ISO 105-B02	3 to 4			
C/F to Wash	ISO 105-C06	3 to 4	3 to 4	Black	D
C/F to Perspiration	ISO 105-E04	4 to 5	4 to 5		
C/F to Water	ISO 105-E01	4 to 5	4 to 5		
C/F to Rubbing	ISO 105-X12	3 (Dry), 2(Wet)			
C/F to Light	ISO 105-B02	3 to 4			

In color fastness(C/F) test report shows that C/F to perspiration and C/F to water range (4 to 5) are same for all tested sample. But light fastness increasing with the increased of the shade% due to the effect on the color of photochemical fading of a given number of dye molecules is more pronounced the fewer the initial number of molecules. On the other hand, washing fastness is usually inferior for deeper shades since the concentration gradients driving diffusion between the fibre and the washing solution are much higher when more dye is present in the fibres. Rubbing fastness also decreased with the increased of shade %.

Conclusion

The work illustrated that GSM increased due to shade% increased. Lengthwise extension and shrinkage occurred in line and tumble drying process respectively. Widthwise shrinkage happened in both line and tumble drying. Spirality% decreasing with the increased of shade%. Color fastness of different sample against different shade%, light fastness has increased, on the other hand wash and rubbing fastness decreased.

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