

Study on the Changes of GSM (Gm/m^2) of Grey Knitted Fabric from Pretreatment to Finishing

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Abstract This Project is on, Study on the changes of GSM (Gram per Square meter) of grey knitted fabrics from Pretreatment to finishing. This project helps to a greater extent to know about the whole procedures of knitted fabrics GSM Change from Pretreatment to finishing and compare with the theoretical and calculated values of GSM change & to take necessary initiatives against it. GSM change from Pretreatment to dyeing & finishing depends on the properties of fabric like structure of fabric, wales per inch, courses per inch, stitch length, yarn count, fabric spirality and shrinkage because the Fabric texture, extensibility of fabric depends on these property & also with the types of shade which is needed to be dyed like dark, medium or light shades. The final part of the project was to accumulate the data with sample and put them in table or chart as required as to identify & overcome the GSM related issues in a knit dyeing factory. It is seen that, average 15 to 30% GSM is changed from Grey stage to finishing stage in a knit dyeing factory.

Keywords Fabric GSM, Pretreatment, Dyeing, Finishing

1. Literature Review

1.1. Fabric GSM

GSM means Gm per square meter. It's an essential property for knitted fabric. Due to fabric GSM the knitted fabric may be heavier or lighter. GSM varies from fabric to fabric, especially with the count & stitch length of fabric [1]. GSM is changed in Pretreatment, Dyeing & finishing to a greater extent. During these processes GSM Change depends on the types of chemicals & dyes used & also with the processes used [2, 3].

1.2. Some Terminology of Knitted fabrics

There are different types of related parameters are mentioned below [2-7]:

1. Wales per inch
2. Courses per inch
3. Stitch length
4. Yarn count
5. Yarn twist
6. Twist liveliness
7. Yarn type
8. Gram per square meter (GSM)
9. Spirality

10. Shrinkage
11. Area density
12. Fabric thickness

1. Wales per inch:

Wales per inch means how many numbers of wales are present in one inch, it is very important for calculation of knitted fabric GSM and fabric properties.

2. Courses per inch:

Courses per inch mean how many numbers of courses are present in one inch. It is also very important for calculation of knitted fabric GSM.

3. Stitch length:

Stitch length is theoretically is a single length of yarn which include one needle loop and half the length of Yarn (half of a sinker loop) between that needle loop and the adjacent needle loops on either side of it. Loop exists in coarse in course length and it is that which influence fabric dimension and other properties including weight.

4. Yarn count:

Yarn count is a numerical expression of fineness or coarseness of yarn.

Yarn count is calculated in two systems:

- a. Direct system
- b. Indirect system

5. Direct system:

In this system the count of yarn express the weight per unit's length of yarn. In this system, "higher the count, coarser the yarn" & "lower the count, finer the yarn". This

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system is used for thrown Polyester & other Synthetic yarn.

$$\text{Count} = (W \times l) / (w \times L)$$

Here, W = the weight of sample

L = the length of sample

w = the unit weight in system

l = the unit length in system

System	Unit mass	Unit length	Uses
Tex	Gram	1000m	Polyester
Denier	Gram	9000m	Polyester

6. Indirect system:

In this system the count of yarn express the length per unit

wt. In this system, “higher the yarn count, finer the yarn” & “Lower the count coarser the yarn. This system is generally used for cotton, worsted, woolen, linen etc and the yarn count calculation formula is.

1.3. GSM at a Glance

GSM depends on the fabric stitch length, course per unit length, wales per unit length and yarn count. GSM indicates the properties of the fabric such as fabric weight; in define area (one square meter). Fabric GSM calculations depend on the yarn count system. In direct system GSM calculation formula is given below [8-12]:

Table 1. Relation between yarn count, fabric type, stitch length and finished GSM

Fabric type	Yarn count	Stitch length	color	D X G	Finished dia	Finished GSM
Plain s/j	18s/1	2.94	white	26X24	30 inch	220-230
	20s/1	2.98	white	30X24	33.5 inch	200-210
	24 s/1	2.68	white	30X24	32 inch	175-185
	26s/1	2.66	white	30X24	31 inch	160-170
	28s/1	2.70	avg	26X24	25 inch	150-160
	30s/1	2.68	avg	30X24	30 inch	130-140
	34s/1	2.40	avg	26X24	24 inch	125-135
	40s/1	2.44	avg	24X24	20 inch	100-110
Single lacost	18s/1	3.00	avg	30X24	46 inch	245-255
	24s/1	2.64	avg	30X24	40 inch	210-215
	26s/1	2.60	avg	30X24	36inch	200-210
	30s/1	2.50	avg	30X24	33inch	180-190
1x1 Rib	26s/1	2.50	avg	40X18	41 inch	240
	24s/1	2.75	avg	30X18	64 inch	235
	26s/1	2.45	avg	40X18	40inch	245
	26s/1	2.55	avg	40X18	47inch	235
	26s/1	2.65	avg	32X18	32inch	230
	36s/1	2.65	avg	32X18	33inch	170
	24s/1	2.95	avg	34X18	32inch	220
	24s/1	2.90	avg	40X18	38inch	225
	28s/1	2.40	avg	30X24	38.5inch	232
2X1 L Rib	34s/1	2.60	avg	40X18	23inch	190
	34s/1	2.70	avg	32X18	20inch	185
2X2 Rib	40s/1	2.76	avg	30X20	35”T	160
	28s/1	2.87	avg	34X18	32”T	260
	26s/1	3.25	avg	34X18	31”T	205
	24s/1	3.50	avg	34X18	31.5”T	285
	20s/1	3.25	avg	34X20	55”(op)	260
2X2 L/Rib	20/1+40D	3.10	avg	30X18	18”T	390
	24/1+40D	2.90	avg	30X18	18”T	320
	30/1+70D	2.90	avg			320
	30/1+40D	2.98	avg			240
	30/1+40D	2.80	avg	30X18		240

IN TEX SYSTEM:

$$\text{GSM} = \text{WPI} \times \text{CPI} \times \text{Stitch length (mm)} \times 39.37 \times 39.37 \times \text{TEX} / (1000 \times 1000)$$

$$\text{Or, GSM} = \text{WPCm} \times \text{CPCm} \times \text{Stitch length (mm)} \times 100 \times 100 \times \text{TEX} / (1000 \times 1000)$$
IN DENIER SYSTEM:

$$\text{GSM} = \text{WPI} \times \text{CPI} \times \text{Stitch length} \times 39.37 \times 39.37 \times \text{Count in denier} / (1000 \times 9000)$$

$$\text{Or GSM} = \text{WPCm} \times \text{CPCm} \times \text{Stitch length (mm)} \times 100 \times 100 \times \text{Denier} / (1000 \times 9000)$$

In direct system GSM calculation formula is given below:

IN ENGLISH (Ne) SYSTEM:

$$\text{GSM} = \text{WPI} \times \text{CPI} \times \text{Stitch length} \times 39.37 \times 39.37 \times 453.6 / (1000 \times 840 \times \text{count in Ne} \times 0.9144)$$

$$\text{Or GSM} = \text{WPCm} \times \text{CPCm} \times \text{Stitch length (mm)} \times 100 \times 100 \times 453.6 / (1000 \times \text{count in Ne} \times 0.9144)$$
IN METRIC SYSTEM:

$$\text{GSM} = \text{WPI} \times \text{CPI} \times \text{Stitch length (mm)} \times 39.37 \times 39.37 \times 1000 / (1000 \times 1000 \times \text{count in Nm})$$

$$\text{Or GSM} = \text{WPCm} \times \text{CPCm} \times \text{Stitch length (mm)} \times 100 \times 100 \times 1000 / (1000 \times 1000 \times \text{yarn count in Nm})$$
Other parameters are:

- Stitch length
- Fabric structure
- Finishing process
- Depth of shade
- Stitch density
- **Machine Gauge**

NB: If the fabric is to be Enzyme washed, the stitch length should be kept (10%) less than the normal range. Because, enzyme wash reduces the total weight of the fabric by removing the floating fiber and hairy fiber [12-15].

For light color, the finished GSM varies near about 15-20% from grey GSM.

For average color, the finished GSM varies 20-25%.

For dark color, grey GSM is kept less (i.e. the stitch-length is large) because take up% of dark color is more and the weight of dyed fabric will be increased.

If the GSM varies 25-30%, it is not only necessary to control the VDO pulley dia but also yarn tension & take up roller.

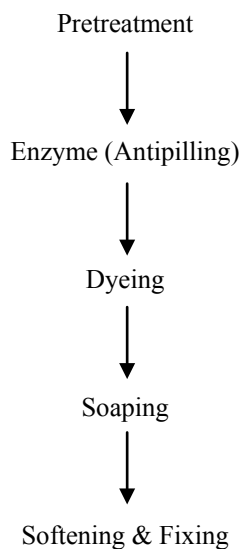
NB: We know that the stitch length increases with the increasing of VDO pulley dia. For the change of VDO pulley dia for one point stitch length will be changed approximately 0.04 mm (CAMBER, England, and Model: 95 QUATTRO II).

2. Experimental

2.1. Process Sequence

Normally a knit dyeing factory performs the dyeing of a fabric in following sequence. Here, pretreatment means scouring & bleaching of knit fabrics which is performed combinedly.

For Dyeing,



2.2. Chemicals & Dyes Used

Recipe-1 for 30-60°C to dye S/J fabric:

Process	Chemical /Dye	Concentration	Liquor Ratio
	Contipon S (10%)	2.50 g/l	7.20
	Jinsofter BSK	1.50 g/l	7.20
	Ablutex-AP-50(42%sol ⁿ)	0.75 g/l	7.20
PREBLEACHING CEL 110 & 95	Reduzin –AC-BL-100	1.50 g/l	7.20
	H ₂ O ₂ (50%)	2.80 g/l	7.20
	Caustic Soda (pearls)	2.50 g/l	7.20
	Raduzin-THN (50% sol ⁿ)	2.40 g/l	6.50
	Acetic Acid	1.50 g/l	7.30
	SQ-117	0.75 g/l	6.80
	Retrocell-PLX-TRA	1.20 g/l	6.80
Antipilling	SQ-117	1.00 g/l	6.80
	Soda Ash	0.55 g/l	6.80
	Acetic Acid	0.25 g/l	6.80
	Jinlev- CI-225	1.60 g/l	8.30
	Antisil Conz	0.30 g/l	8.30
	Jinsofter BSK	1.50 g/l	8.30
	Acetic Acid	.0 50 g/l	8.30
	Contipon S (10% sol ⁿ)	2.50 g/l	8.30
	Glauber salt	20.00g/l	8.30
Method 30-60°C	Levafix Brilliant RED CA	0.27900%	6.30
	Levafix Blue-CA CA	0.00200%	6.30
	Levafix Amber- CA	0.01200%	6.30
	Soda Ash	.700g/l	8.30
	Soda Ash	6.30g/l	8.30
Soaping Extra Light	Acetic Acid	.50/l	6.8
Fixing & Softening	Acetic Acid	0.25g/l	8.30
	Bevasoft-CF (10% sol ⁿ)	2.00%	8.30

2.3. Recipe-2 for Bio Scouring Dyeing Elite to dye Lacoste Fabric

Process	Chemical /Dye	Concentration	Liquor Ratio
	Contipon S (10%)	2.50 g/l	6.9
	Jinsofter BSK	0.750 g/l	6.9
	Ablutex-AP-50(42%sol ⁿ)	0.75 g/l	6.9
PREBLEACHING CEL 110 &95	Reduzin –AC-BL-100	1.50 g/l	6.9
	H ₂ O ₂ (50%)	2.80 g/l	6.9
	Caustic Soda (pearls)	2.50 g/l	6.9
	Raduzin-THN (50% sol ⁿ)	2.40 g/l	6.20
	Acetic Acid	1.50 g/l	7.00
	MA Scour AIN(Prep-IN)	1.50 g/l	8.00
	Glauber salt	20.00 g/l	8.00
	Remazol RED-3BS-A150	0.2090%	6.00
Bio scouring Dyeing Elite	Remazol Yellow-3BS	0.017033%	6.00
	Remazol B.ELUE RSPL	0.47453%	6.00
	Soda Ash	4.00 g/l	8.00
	Green Acid(Jintex-CPS)	0.50 g/l	7.00
Soaping bioscouring	MA Disp-ARE(SOAP REA)	1.00 g/l	7.00
	Acetic Acid	0.25 g/l	8.00
Softening	Bevasoft-CF (10% sol ⁿ)	2.00 %	8.00

2.4. Recipe-3 for Iso Thermal Process

Process	Chemical /Dye	Concentration	Liquor Ratio
	Contipon S (10%)	2.50 g/l	7.20
	Jinsofter BSK	1.50 g/l	7.20
	Ablutex-AP-50(42%sol ⁿ)	0.75 g/l	7.20
PREBLEACHING CEL 110 &95	Reduzin –AC-BL-100	1.50 g/l	7.20
	H ₂ O ₂ (50%)	2.80 g/l	7.20
	Caustic Soda (pearls)	2.50 g/l	7.20
	Raduzin-THN (50% sol ⁿ)	2.40 g/l	6.50
	Acetic Acid	1.50 g/l	7.30
	SQ-117	0.75 g/l	6.80
	Retrocell-PLX-TRA	1.20 g/l	6.80
Antipilling	SQ-117	1.00 g/l	6.80
	Soda Ash	0.55 g/l	6.80
	Acetic Acid	0.25 g/l	6.80
	Jinlev- CI-225	1.60 g/l	8.30
	Antisil Conz	0.30 g/l	8.30
	Jinsofter BSK	1.50 g/l	8.30
	Acetic Acid	.0 50 g/l	8.30
	Contipon S (10% sol ⁿ)	2.50 g/l	8.30
	Glauber salt	20.00g/l	8.30
Method iso thermal	Novacron orange FNR	0.10230%	6.30
	Novacron B Red FN 3GL	0.01080%	6.30
	Cibacron FN Yellow FN- CA	0.18000%	6.30
	Soda Ash	.700g/l	8.30
	Soda Ash	6.30g/l	8.30
Soaping Extra Light	Acetic Acid	.50/l	6.8
Fixing & Softening	Acetic Acid	0.25g/l	8.30
	Bevasoft-CF (10% sol ⁿ)	2.00%	8.30

Machines & Equipment's Used:

- Dyeing M/C (Athena)
- Dewatering & Slitting m/c
- Stenter M/c
- Compacting M/c
- GSM Cutter
- Electric Balance

2.5. GSM Measurement

GSM is measured by using GSM cutter & Electric Balance. GSM means Gram per square meter. The size of the GSM cutter is equal to the area of 1 cm X1 Cm. The radius of GSM cutter is 6cm X 6cm.

2.6. Procedure of GSM Measurement

- To dry the sample properly.
- At first, the sample is cut by GSM cutter accurately.
- Then its weight is taken by the Electric Balance Before it, the balance is made zero.
- Then the obtained value is multiplied by 100 to get the required GSM.

E.g. If any sample weight is 1.80gm then its GSM would be $1.80 \times 100 = 180$

2.7. Reasons of GSM Change**Pre Bleaching:**

During this process Caustic Soda is used as scouring Agent to remove natural impurities, oil & wax from the fibre of fabric. Per oxide is used as bleaching agent to remove natural colour of the fibre. So the GSM is reduced to a greater extent from Grey fabric as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b).

Antipilling:

During this process enzyme is used as antipilling agent that removes the protruding fibre from the fabric. So the GSM is changed. It varies from fabric to fabric & the amount of protruding fibre present in the fabric as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b).

Dyeing:

During dyeing significant amount of dyes are used depending on light, medium and dark shade. Here gluaber salt acts as electrolyte to penetrate the dye into fabric. Soda ash is used for fixation of dye into fabric by controlling the pH. So for fixing these dyes to a fabric considerable amount of GSM is increased depending on light, medium and dark shade. During this stage GSM is also increased for using lesser/larger amount of dye as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b).

Soaping:

After dyeing there's some unfixed dye and also some other chemicals which are removed by soaping that's why

the GSM is decreased as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b).

Softening and fixing:

Here fixing agent and softening chemicals are used but GSM is not considerably changed as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b).

Dewatering and slitting:

During dewatering for coloured fabric Inosoft CF & Jinsofter ME chemicals are used and for white fabric Jinsofter WCS & Microsol MA chemicals are used for why GSM is not considerably changed as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b).

Stentering:

During stentering 10-15% GSM is increased by increasing overfeed % (up) and controlling overfeed % (down). GSM is changed as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b) in this stage.

Compacting:

During compacting 10-15% GSM is increased by increasing overfeed % (up) as shown in table-2(b), 3(b), 4(b), 5(b), 6(b), 7(b), 8(b), 9(b), 10(b), 11(b), 12(b), 13(b), 14(b), 15(b).

By absorbing the humidity from the atmosphere 2-3% GSM is increased after compacting and buyer allow $\pm 5\%$.

2.8. Description of Selected Fabric**Single Jersey:**

This is produced by one set of needle only with all the loops intermeshed in the same direction. It's constructed with knit loop. Its face & back can be easily understood. It's used for T-shirt, fashionable knit garments, Underwear etc.

1×1 Rib:

Rib requires two sets of needle operating between each other. So wales of face & back stitches are knitted on each side of fabric. Rib fabric is used for waist bands, collar, Cuffs etc.

Double Lacost :

It's a Tuck-Knit single jersey structure. One set of needle is used for this structure.

GSM change For Single jersey fabric (First sample):
During overall wet processing & finishing process of Single jersey fabric GSM is changed to a greater extent. GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric which is shown in table-2(b). During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is

cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 2(a). GSM change For Single jersey fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Single Jersey	TEMA; Pink	Athena -1/1	03	40/1 Count	GTNIL-YRN	Grey stage	120
						Pre-treatment	108
						Enzyme	106
						Dyeing stage	119
						Soaping	118
						Fixing & Softening	120
						Stentering stage	109
						Compacting stage	138
						Final/finished stage	140

Table 2(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	120-108=12 ↓	Grey to Finishing	140-120=20
Pretreatment to Antipilling/Enzyme	108-106=2 ↓	Pretreatment to Finishing	140-108=32
Antipilling to Dyeing	119 - 106=13 ↑	Antipilling to Finishing	140-106=34
Dyeing to Soaping	119-118=1 ↓	Dyeing to Finishing	140-119=21
Soaping to Fixing & Softening	120-118=2↑	Soaping to Finishing	140-118=22
		Softening & Fixing to Finishing	140-120=20
Fixing & Softening to Stentering	120-108 =1 2↓	Stentering to Finishing	140-109=31
Stentering to Compacting	138-109 = 29↑	Compacting to Finishing	140-138=2
Compacting to Finished stage	138 -140 =2 ↑	Finishing(Required) to Finishing (Actual)	140-140 =0

GSM change For Single jersey fabric (second sample): During overall wet processing & finishing process of Single jersey fabric GSM is changed to a greater extent. GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric which is shown in table-3(a) &3(b). During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing a lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 3(a). GSM change For Single jersey fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Single Jersey	TEMA; Pink	Athena -1/1	03	40/1 Count	GTNIL-YRN	Grey stage	120
						Pre-treatment	106
						Enzyme	104
						Dyeing stage	120
						Soaping	118
						Fixing & Softening	120
						Stentering stage	113
						Compacting stage	138
						Final/finished stage	139

Table 3(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	120-106=18 ↓	Grey to Finishing	140-120=20
Pretreatment to Antipilling/Enzyme	106-104=2 ↓	Pretreatment to Finishing	140-106=34
Antipilling to Dyeing	120 - 104=16 ↑	Antipilling to Finishing	140-104=36
Dyeing to Soaping	120-118=2 ↓	Dyeing to Finishing	140-120=20
Soaping to Fixing & Softening	121-120=1↑	Soaping to Finishing	140-118=22
		Softening & Fixing to Finishing	140-120=20
Finishing to Stentering	121-113 = 8↓	Stentering to Finishing	140-113=28
Stentering to Compacting	138-113 = 25↑	Compacting to Finishing	140-138=2
Compacting to Finished stage	139 -138 =1 ↑	Finishing(Required) to Finishing (Actual)	140-139 =1

GSM change For Single jersey fabric (third sample): This is another sample test result from pretreatment to finishing stage as above table -4 (a) & 4(b) of same single jersey fabric. During overall wet processing & finishing process of Single jersey fabric GSM is changed to a greater extent. GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. GSM is increased after compacting by absorbing moisture (3-5%).

Table 4(a). GSM change For Single jersey fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Single Jersey	TEMA; Pink	Athena -1/1	03	40/1 Count	GTNIL-YRN	Grey stage	120
						Pre-treatment	109
						Enzyme	107
						Dyeing stage	122
						Soaping	120
						Fixing & Softening	122
						Stentering stage	114
						Compacting stage	138
						Final/finished stage	139

Table 4(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	120-109=11 ↓	Grey to Finishing	140-120=20
Pretreatment to Antipilling/Enzyme	109-107=2 ↓	Pretreatment to Finishing	140-107=33
Antipilling to Dyeing	120 - 107=13 ↑	Antipilling to Finishing	140-10=130
Dyeing to Soaping	122-120=2 ↓	Dyeing to Finishing	140-122=18
Soaping to Fixing & Softening	122-120=2↑	Soaping to Finishing	140-120=20
		Softening & Fixing to Finishing	140-122=18
Fixing & Softening to Stentering	122-114 = 8↓	Stentering to Finishing	140-114=26
Stentering to Compacting	138-114 = 24↑	Compacting to Finishing	140-138=2
Compacting to Finished stage	138 -139 =1 ↑	Finishing(Required) to Finishing (Actual)	140-139 =1

GSM change For Single jersey fabric (Fourth sample): During overall wet processing & finishing process of Single jersey fabric GSM is changed to a greater extent as shown in table-5(a) & 5 (b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During

Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 5(a). GSM change For Single jersey fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Single Jersey	TEMA; Pink	Athena -1/1	03	40/1 Count	GTNIL-YRN	Grey stage	120
						Pre-treatment	108
						Enzyme	106
						Dyeing stage	119
						Soaping	118
						Fixing & Softening	120
						Stentering stage	108
						Compacting stage	140
						Final/finished stage	141

Table 5(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	120-108=1 ↓	Grey to Finishing	140-120=20
Pretreatment to Antipilling/Enzyme	108-106=2 ↓	Pretreatment to Finishing	140-108=32
Antipilling to Dyeing	106 - 119=13 ↑	Antipilling to Finishing	140-106=34
Dyeing to Soaping	119-118=1 ↓	Dyeing to Finishing	140-119=21
Soaping to Fixing & Softening	120-118=2↑	Soaping to Finishing	140-118=22
		Softening & Fixing to Finishing	140-120=20
Finishing to Stentering	120-108 = 12↓	Stentering to Finishing	140-108=32
Stentering to Compacting	140-108= 22↑	Compacting to Finishing	140-140=0
Compacting to Finished stage	141 -140 =1 ↑	Finishing(Required) to Finishing (Actual)	140-141 =1

Comparison with all the samples for GSM change of Single jersey fabric: Comparing with all the four test sample it is found that the difference among all the separate samples GSM is very little, which could be negligible. So it is clear that my different test data results are near about similar as shown in bellow graph-1. So we can take these variation of data from different stages as experimentally approved data to assume any GSM related issues in different stages of knit dyeing factory.

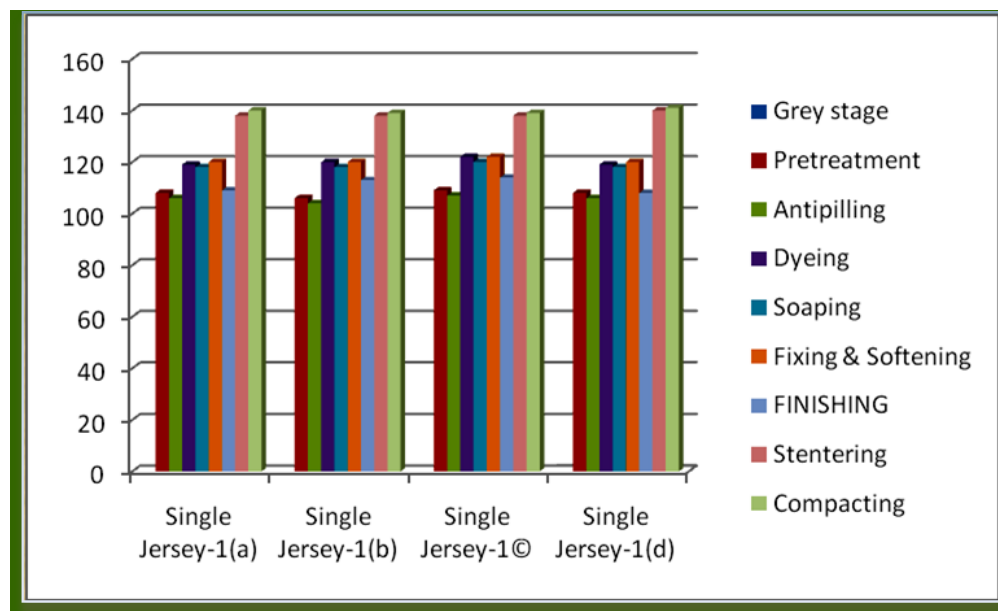


Figure 1. Graphical Representation of GSM Change

Table 6(a). GSM change For Stripe fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Stripe fabric	Grey Millange	HT-4/2	53	30/1	Paradise	Grey fabric	150
						Pre-treatment	145
						Enzyme	143
						Finishing	144
						Stentering	137
						Compacting	167
						Final/finished fabric	169

GSM change For Stripe fabric (First sample): During overall wet processing & finishing process of Stripe fabric GSM is changed to a greater extent as shown in table-6(a) & 6(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 6(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage of GSM	Required value of GSM for finishing from process
Grey to Pretreatment	150-145=05 ↓	Grey to Finishing	170-150=20
		Pretreatment to Finishing	170-145=25
Pretreatment to Antipilling/Enzyme	145-143=2 ↓	Enzyme to finishing	170-137=33
Enzyme to Finishing	144-143=1↑	Stentering to Finishing	170-137=33
Finishing to Stentering	144-137 = 7↓	Compacting to Finishing	170-167=3
Stentering to Compacting	167-137 = 30	to Finishing	170-169 =1
Compacting to Finished stage	169 -167 =2 ↑		

GSM change For Stripe fabric (Second sample): During overall wet processing & finishing process of Stripe fabric GSM is changed to a greater extent as shown in table-7(a) & 7 (b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing a lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After compacting GSM is increased by absorbing moisture (3-5%).

Table 7(a). GSM change For Stripe fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Stripe fabric	Grey Millange	HT-4/2	53	30/1	Paradise	Grey fabric	150
						Pre-treatment	144
						Enzyme	143
						Finishing	144
						Stentering	137
						Compacting	168
						Final/finished fabric	169

Table 7(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	150-144=06 ↓	Grey to Finishing	170-150=20
		Pretreatment to Finishing	170-145=25
Pretreatment to Antipilling/Enzyme	144-143=1 ↓	Enzyme to finishing	170-137=33
Enzyme to Finishing	144-143=1↑	Stentering to Finishing	170-137=33
Finishing to Stentering	144-137 = 7↓	Compacting to Finishing	170-167=3
Stentering to Compacting	168-137 = 29↓	to Finishing	170-169 =1
Compacting to Finished stage	169 -168 =1 ↑		

GSM change For Stripe fabric (Third sample): During overall wet processing & finishing process of Stripe fabric GSM is changed to a greater extent as shown in table-8(a) & 8(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 8(a). GSM change For Stripe fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Stripe fabric	Grey Millange	HT-4/2	53	30/1	Paradise	Grey fabric	150
						Pre-treatment	144
						Enzyme	143
						Finishing	144
						Stentering	138
						Compacting	168
						Final/finished fabric	169

Table 8(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	150-144=06 ↓	Grey to Finishing	170-150=20
		Pretreatment to Finishing	170-145=25
Pretreatment to Antipilling/Enzyme	144-143=1 ↓	Enzyme to finishing	170-137=33
Enzyme to Finishing	144-143=1↑	Stentering to Finishing	170-137=33
Finishing to Stentering	144-138 = 6↓	Compacting to Finishing	170-167=3
Stentering to Compacting	168-138 =30↓	to Finishing	170-169 =1
Compacting to Finished stage	169 -168 =1 ↑		

Comparison with all the samples for GSM change of stripe fabric: Comparing with all the four test sample it is found that the difference among all the separate samples GSM is very little, which could be negligible. So it is clear that my different test data results are near about similar as shown in bellow graph-2. So we can take these variation of data from different stages as experimentally approved data to assume any GSM related issues in different stages of knit dyeing factory.

GSM change For Double Lacoste fabric (First sample): During overall wet processing & finishing process of Double Lacoste fabric, GSM is changed to a greater extent as shown in table-9(a) & 9(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

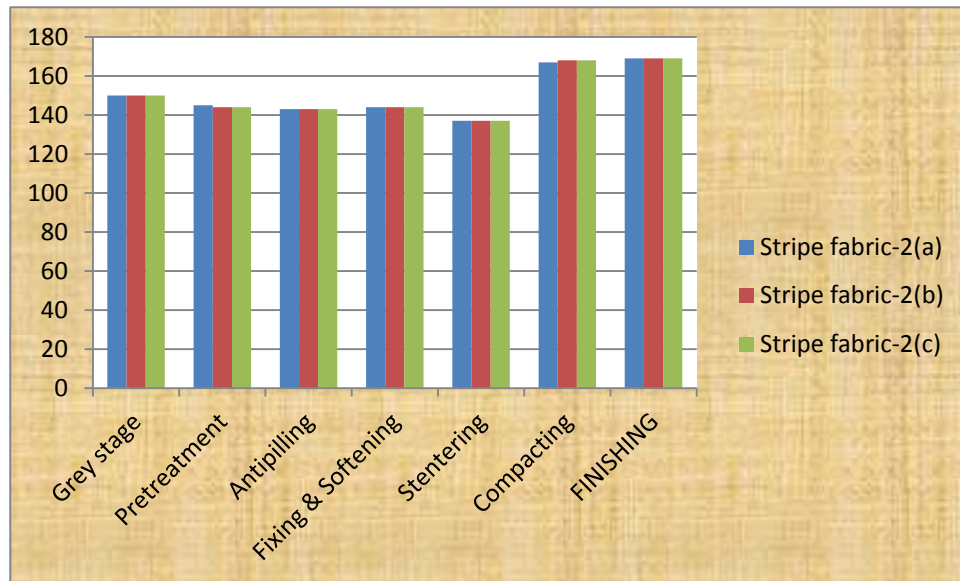


Figure 2. Graphical Representation of GSM Change

Table 9(a). GSM change For Double Lacoste Fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Double Lacost	ZARA; Lavenda	HT-6	28	26/1	KAMYA-YRN	Grey Fabric	230
						Pre-treatment	221
						Dyeing	236
						Soaping	234
						Fixing & Softening	236
						Stentering	225
						Compacting	258
						Final/finished	260

Table 9(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	230-221=9 ↓	Grey to Finishing	260-230=30
Pretreatment to Dyeing	236-221=15 ↓	Pretreatment to Finishing	260-221=39
Dyeing to Soaping	236-234=2 ↓	Dyeing to Finishing	260-236=24
Soaping to Fixing & Softening	236-234=2 ↑	Soaping to Finishing	260-234=26
		Fixing & Softening to Finishing	260-236=24
Finishing to Stentering	236-225= 11 ↓	Stentering to Finishing	140-108=32
Stentering to Compacting	258-225 = 33 ↑	Compacting to Finishing(Required)	140-140=0
Compacting to Finished stage	260-258 =2 ↑	Finishing(Required) to Finishing (Actual)	140-141 =1

GSM change For Double Lacoste fabric (Second sample): During overall wet processing & finishing process of Double Lacoste fabric, GSM is changed to a greater extent as shown in table-10(a) & 10(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing a lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During

Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 10(a). GSM change For Double Lacoste Fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Double Lacoste	ZARA; Lavenda	HT-6	28	26/1	KAMYA-YRN	Grey Fabric	230
						Pre-treatment	223
						Dyeing	236
						Soaping	234
						Fixing & Softening	236
						Stentering	223
						Compacting	259
						Final/finished	260

Table 10(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	230-223=7 ↓	Grey to Finishing	260-230=30
Pretreatment to Dyeing	236-223=13 ↓	Pretreatment to Finishing	260-221=39
Dyeing to Soaping	236-234=2 ↓	Dyeing to Finishing	260-236=24
Soaping to Fixing & Softening	236-234=2↑	Soaping to Finishing	260-234=26
		Fixing & Softening to Finishing	260-236=24
Finishing to Stentering	236-225= 11↓	Stentering to Finishing	140-108=32
Stentering to Compacting	258-225 = 33↑	Compacting to Finishing (Required)	140-140=0
Compacting to Finished stage	260-258 =2 ↑	Finishing(Required) to Finishing (Actual)	140-141 =1

GSM change For Double Lacoste fabric (Third sample): During overall wet processing & finishing process of Double Lacoste fabric, GSM is changed to a greater extent as shown in table-11(a) & 11(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed% .After Compacting GSM is increased by absorbing moisture (3-5%).

Table 11(a). GSM change for Double Lacoste Fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
Double Lacoste	ZARA; Lavenda	HT-6	28	26/1	KAMYA-YRN	Grey Fabric	230
						Pre-treatment	221
						Dyeing	236
						Soaping	234
						Fixing & Softening	237
						Stentering	229
						Compacting	258
						Final/finished	260

Table 11(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	230-221=9 ↓	Grey to Finishing	260-230=30
Pretreatment to Dyeing	236-221=15 ↓	Pretreatment to Finishing	260-221=39
Dyeing to Soaping	236-234=2 ↓	Dyeing to Finishing	260-236=24
Soaping to Fixing & Softening	237-234=3↑	Soaping to Finishing	260-234=26
		Fixing & Softening to Finishing	260-237=23
Fixing & Softening to Stentering	237-229= 8↓	Stentering to Finishing	260-229=31
Stentering to Compacting	258-225 = 33↑	Compacting to Finishing(Required)	260-258=2
Compacting to Finished stage	260-258 =2 ↑	Finishing(Required) to Finishing (Actual)	260-260 =2

GSM change For Double Lacoste fabric (Third sample): During overall wet processing & finishing process of Double Lacoste fabric, GSM is changed to a greater extent as shown in table-12(a) & 12(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed% .After Compacting GSM is increased by absorbing moisture (3-5%).

Table 12(a). GSM change For Double Lacoste Fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
						Grey Fabric	230
						Pre-treatment	221
Double Lacoste	ZARA; Lavenda	HT-6	28	26/1	KAMYA-YRN	Dyeing	236
						Soaping	234
						Fixing & Softening	235
						Stentering	225
						Compacting	258
						Final/finished	260

Table 12(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	230-221=9 ↓	Grey to Finishing	260-230=30
Pretreatment to Dyeing	236-221=15 ↓	Pretreatment to Finishing	260-221=39
Dyeing to Soaping	236-234=2 ↓	Dyeing to Finishing	260-236=24
Soaping to Fixing & Softening	235-234=1↑	Soaping to Finishing	260-234=26
		Fixing & Softening to Finishing	260-235=25
Fixing & Softening to Stentering	235-225=10↓	Stentering to Finishing	260-225=35
Stentering to Compacting	258-225 = 33↑	Compacting to Finishing(Required)	260-258=2
Compacting to Finished stage	260-258 =2 ↑	Finishing(Required) to Finishing (Actual)	260-260 =2

Comparison with all the samples for GSM change of double Lacoste fabric: Comparing with all the four test sample it is found that the difference among all the separate samples GSM is very little, which could be negligible. So it is clear that my different test data results are near about similar as shown in bellow graph-1. So we can take these variation of data from different stages as experimentally approved data to assume any GSM related issues in different stages of knit dyeing factory.

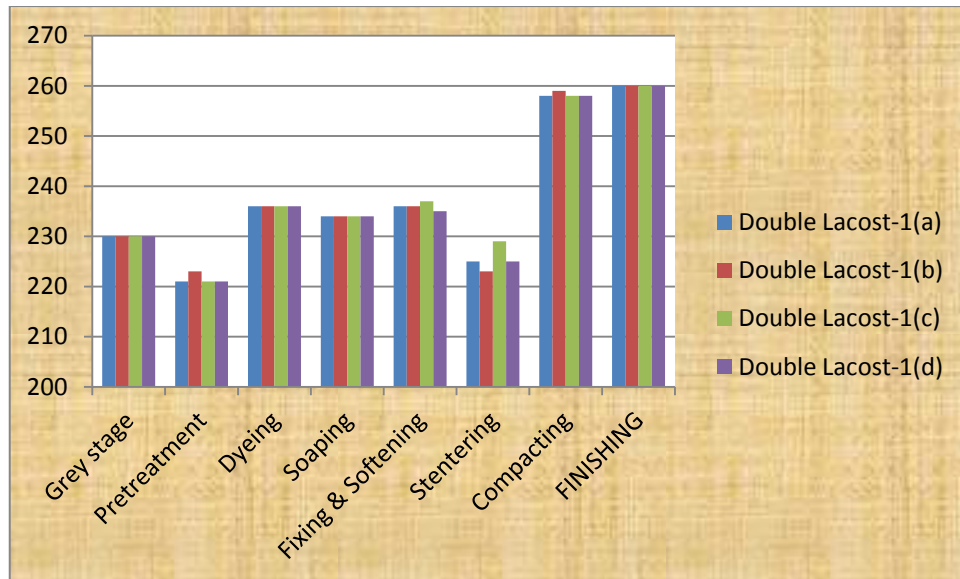


Figure 3. Graphical Representation of GSM Change:

GSM change For Double Lacoste fabric (1×1 Rib Fabric): During overall wet processing & finishing process of 1×1 Rib fabric, GSM is changed to a greater extent as shown in table-13(a) & 13(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 13(a). GSM change for 1×1 Rib Fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
1×1 Rib	C & A; Mock Orange	Athena -4/1	36	28/1	Paradise	Grey fabric	140
						Pre-treatment	133
						Enzyme	132
						Dyeing	146
						Soaping	145
						Fixing & Softening	147
						Stentering	139
						Compacting	166
						Final/finished fabric	169

Table 13(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	140-133=7 ↓	Grey to Finishing	170-140=30
Pretreatment to Antipilling/Enzyme	133-132=1 ↓	Pretreatment to Finishing	170-133=37
Antipilling to Dyeing	146 - 132=14 ↑	Antipilling to Finishing	170-132=38
Dyeing to Soaping	146 - 145=1 ↑↓	Dyeing to Finishing	170-146=24
Soaping to Fixing & Softening	145-147=2↑	Soaping to Finishing	170-145=25
		Fixing & Softening to Finishing	170-147=23
Fixing & Softening to Stentering	147-140 = 7↓	Stentering to Finishing	170-140=30
Stentering to Compacting	166-140 = 26↑	Compacting to Finishing(Required)	170-166=04
Compacting to Finished stage	166-169=3 ↑	Finishing(Required) to Finishing (Actual)	170-69 =1

GSM change For 1×1 Rib Fabric (Second sample): During overall wet processing & finishing process of 1×1 Rib fabric, GSM is changed to a greater extent as shown in table-14(a) & 14(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

Table 14(a). GSM change for 1×1 Rib Fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
1×1 Rib	C & A; Mock Orange	Athena -4/1	36	28/1	Paradise	Grey fabric	140
						Pre-treatment	133
						Enzyme	132
						Dyeing	147
						Soaping	145
						Fixing & Softening	147
						Stentering	138
						Compacting	166
						Final/finished fabric	169

Table 14(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	140-133=7 ↓	Grey to Finishing	170-140=30
Pretreatment to Antipilling/Enzyme	133-132=1 ↓	Pretreatment to Finishing	170-133=37
Antipilling to Dyeing	147 - 132=15 ↑	Antipilling to Finishing	170-132=38
Dyeing to Soaping	146 - 145=1 ↑↓	Dyeing to Finishing	170-146=24
Soaping to Fixing & Softening	145-147=2↑	Soaping to Finishing	170-145=25
		Fixing & Softening to Finishing	170-147=23
Fixing & Softening to Stentering	147-138 = 9↓	Stentering to Finishing	170-140=30
Stentering to Compacting	166-138 = 28↑	Compacting to Finishing(Required)	170-166=04
Compacting to Finished stage	166-169=3 ↑	Finishing(Required) to Finishing (Actual)	170-69 =1

GSM change For 1×1 Rib Fabric (Second sample): During overall wet processing & finishing process of 1×1 Rib fabric, GSM is changed to a greater extent as shown in table-11(a) & 11(b). GSM is mainly changed in Pretreatment, Dyeing, Stentering & in Compacting stages. During Pretreatment overall impurities are removed by using scouring & Bleaching Agent for why GSM is extremely reduced than grey fabric. During Antipilling Protruding fibres are removed by using Enzyme for why GSM is reduced. During Dyeing A lot of dyes are used for Combination shade for why GSM is increased. During soaping extra unfixed color is cut for why GSM is reduced. During Stentering GSM is reduced. During Compacting GSM is increased to a greater extent due to increase Overfeed%. After Compacting GSM is increased by absorbing moisture (3-5%).

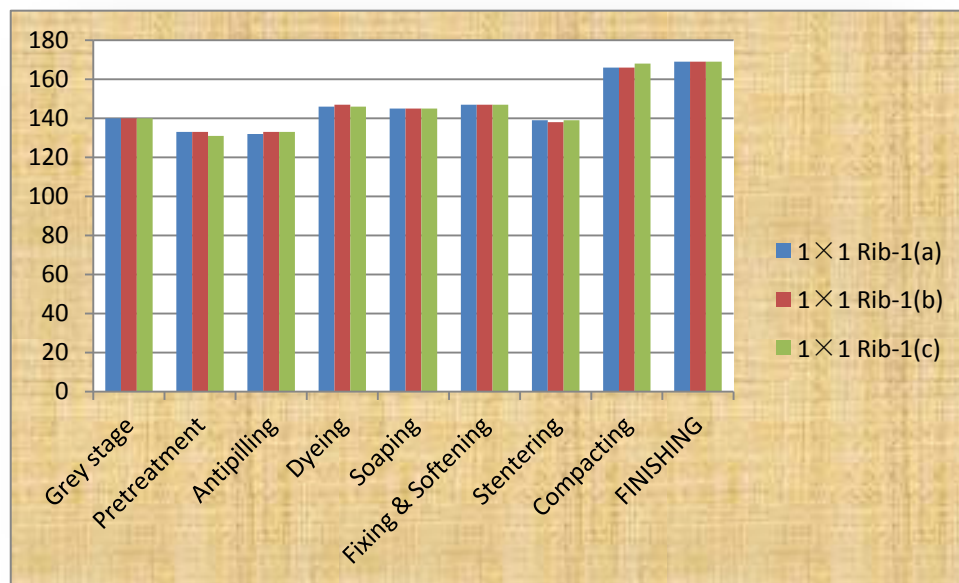
Comparison with all the samples for GSM change of 1×1 Rib Fabric: Comparing with all the four test sample it is found that the difference among all the separate samples GSM is very little, which could be negligible. So it is clear that my different test data results are near about similar as shown in bellow graph-1. So we can take these variation of data from different stages as experimentally approved data to assume any GSM related issues in different stages of knit dyeing factory.

Table 15(a). GSM change for 1×1 Rib Fabric

Fabric name	Buyer & Colour	M/c no.	Lot no.	Count	Brand of yarn	Treatment observation stage	Obtained GSM
1×1 Rib	C & A; Mock Orange	Athena -4/1	36	28/1	Paradise	Grey fabric	140
						Pre-treatment	131
						Enzyme	133
						Dyeing	146
						Soaping	145
						Fixing & Softening	147
						Stentering	139
						Compacting	168
						Final/finished fabric	169

Table 15(b). GSM change from stage to stage

GSM Change in processing stages	Changing Value	Difference between Process to final stage GSM	Required value of GSM for finishing from process
Grey to Pretreatment	140-131=9 ↓	Grey to Finishing	170-140=30
Pretreatment to Antipilling/Enzyme	131-133=2 ↓	Pretreatment to Finishing	170-131=39
Antipilling to Dyeing	146 - 133=13 ↑	Antipilling to Finishing	170-133=37
Dyeing to Soaping	146 - 145=1 ↑↓	Dyeing to Finishing	170-146=24
Soaping to Fixing & Softening	145-147=2↑	Soaping to Finishing	170-145=25
		Fixing & Softening to Finishing	170-147=23
Fixing & Softening to Stentering	147-140 = 7↓	Stentering to Finishing	170-140=30
Stentering to Compacting	147-139 = 8↑	Compacting to Finishing(Required)	170-168=02
Compacting to Finished stage	168-139=29 ↑	Finishing(Required) to Finishing (Actual)	170-169 =1

**Figure 4.** Graphical Representation of GSM Change

3. Effect of GSM on Finished Fabric

- ✓ 10-15% GSM of grey knit fabric is increased after overall Dyeing & finishing process.
- ✓ If GSM is increased than diameter is decreased.
- ✓ With the change of fabric GSM Shrinkage & Spirality of

fabric is changed.

- ✓ Fabric remains heavier or lighter with the change of GSM.
- ✓ If GSM is increased in uncontrolled way than the fabric may be damaged due to extra overfeed which is responsible for GSM.

3.1. Cares that should be Taken for GSM Measurement

- √ To collect two or more sample from different parts of the fabric of same lot & same order no. to get accurate result.
- √ To ensure the sample is accurately dried. To ensure that no pressure is applied to the sample before cutting by the GSM cutter.
- √ To measure the GSM before absorbing the moisture to get accurate result.
- √ To ensure that the sample is cut by GSM cutter accurately.
 - To ensure that the blade is sharp enough to cut the sample for GSM.
 - To make sure that the Rubber pad is plane but not rough.
 - To apply uniform Tension.
 - To ensure that there's not any yarn of sample to be cut later.
 - Numbering of sample for specific process is to be done.
- √ To measure the GSM accurately.
 - To clean the Balance properly
 - To make zero the Electric balance reading.
 - When the sample is put in the balance its covered with the head.
 - The reading is taken & multiplied by 100

3.2. Faults that may Arise during GSM Measurement

- GSM may vary due to existing dirt variation in different parts of the fabric Grey Stage).
- If Pretreatment is not proper in all parts of the fabric.
- If GSM of Uneven shade (fabric) is taken.
- To take improper Weight.
- To cut the sample improperly.
- To take the Stentering sample which is not properly gripped?
- To take the measurement after long time
- If the fiber is immature in some particular places.
- If the Electric balance exist any dirt or dust.
- If the sample is remained rough through any pressure applied directly or indirectly to it before cutting by GSM cutter.

4. Conclusions

I tried my best to find out the Change of GSM of different fabrics (mentioned in the experimental data) from Pretreatment to finishing both in dyeing & finishing section.

For this purpose, I had to collect the sample of each & every processes for GSM measurement. For some fabrics we took more than one or two sample for accuracy of the result.

Through this measurement of GSM, I got the GSM of different fabrics for different processes & I was able to compare these GSM values for different fabric for different processes.

All most all the GSM values found are near about to acceptable limit. When we observed more than one GSM values for same fabric & same processes we did not get larger difference.

More research and development is required to monitor the Change of GSM in different processes.

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