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Physical Change of Various Knitted Fabrics by Stentering & Compacting

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Abstract In my thesis I wanted to show different type of physical property changes due to different Type of machine applied in different type of fabric structure. Here I have worked with knitted fabric and also used knit finishing machine. In my thesis I have given some technical data and some valuable information how we can follow the buyer instruction and maintain proper use of machine to constant physical property of the fabric. Knitted fabric is not dimensionally constant, so we have to maintain shrinkage as well as maintaining the dia and GSM. Here I have shown comparison between machine to machine and the variation between fabric to fabric.

Keywords Knit Fabrics, GSM, Shrinkage, Stentering, Compacting

1. Introduction

The study that reported in this thesis basically a survey type work. For proper data collection and analyzing I have gone Different knit composite factory. For my thesis I have used stenter machine and compacting machine. But this machine cannot found in lab because they are so expensive. That why I have worked in the floor during production running. So some information may be incorrect or missing. But I have tried hard to give them accurate value.

In my thesis I want to explain about changes of Dia, GSM and Shrinkage in different structural fabrics. Here I also discuss to follow buyer requirement what type to decision we have to take for machine and also fixing shrinkage issue.

Here I have also discuss about how shrinkage may vary by changing Dia and overfeed of a stenter.

2. Equipment Needed for the Test

1. Knitting machine for different type of fabric such as Single Jersey, Interlock and Lacost fabric.
2. De-watering Machine with Squeezer
3. Stenter Machine
4. Compactor Machine
5. GSM Cutter
6. Spectrophotometer etc

3. Experimental Details

Technical Data of Stenter Machine:

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Roller Width	1500 mm to 3800 mm
Fabric Width	1200 mm to 3600 mm
Mangle	Two Bowl or Three Bowl
Fabric Feeding Draw Nip	1.1 kW / 1.5 kW
Mangle Motor	5.6 / 7.6 / 11 kW
Top Roller	305 mm Diameter
Driven Roller	295 mm Diameter
Bottom Roller	305 mm Diameter
Trough	Single Trough with 2 or 3 Guide Rollers or Double Trough
Guide Roll Diameter	114 mm / 141 mm / 152 mm / 177 mm (Wider Width)
Weft Correction	Fully Automatic Electronic OR Motorised Manual
Stenter	From 3 Chamber to 10 Chamber Pin-Clip Chain, Clip Chain, Pin Chain Vertical Return Pin Chain execution
Heating Media	Thermic Oil / Direct Gas / Steam
Selvedge Tension Motor	1.5 kW / 2.2 kW AC
Over-feed Motor	1.5 kW AC
Pinning Motor	0.75 kW AC
Blower Motor	5.6 kW / 7.6 kW / 11 kW
Thermic Fluid Heater	60,000 - 1,30,000 kCal - Multipass - 2 per Chamber)
Natural Gas / LPG Burner	60,000 Kcal to 1,50,000 Kcal (2 per Chamber) Approx. 65 - 150 kW
Drive	Variable Frequency AC Drive
Exhaust	With / without moisture controller

Technical Data of Open Width Compactor:

Fabric width	:	2400mm maximum
Roller length	:	2600mm
Operating speed	:	40m/min maximum
Power	:	35kw
Air pressure	:	6 bar
Steam pressure	:	6 bar saturated steam
Felt thickness	:	22mm
Material of construction	:	MS with powder coated
Dimensions	:	L - 6800 mm W - 4000 mm H - 2800 mm

4. Factor Consideration

Shrinkage control:

-Shrinkage is controlled by proper over feeding.

-To apply less or more over feed speed fabrics reduce along to length and increase along to width. Maximum 70 – 75% shrinkage is controlled by using it.

GSM Control:

- GSM is also controlled by applying proper over feeding speed.
- If over feed is more than GSM is also more.
- If Over feed speed is less then GSM is also is less.
- If Dia is more than GSM of the fabric will less.
- If Dia is less than the GSM of the fabric will more.

N.B: If GSM of the fabric is OK then shrinkage is also OK.

Dia Control:

- Dia is controlled by dia controlling meter scale.
- If any fault, GSM of the fabric is reduced then to increase the GSM of the fabric dia will have to be reduced (2 – 3) inch.
- If Over feed speed is more thanDia of the fabric will be more.
- If Over feed speed is less thenDia of the fabric will be less.
- If length is more than width of the fabric is reduced.
- If length is less then width of the fabric is more.

N.B: Fabric speed is controlled on the fabric dia. Here, Dia less or More fully depends on yarn count and buyer order. Dia is done less or more by using expander rod.

5. Effect of Different Machines on Different Structural Fabrics

Effect of different fabric structure by using Knitting Machine:

Specification of Knitting Machine:

Brand (Origin)	M/C Model	M/C Specification	M/C Dia.	M/C Gauge	No. of Feeder	No. of Needle
ORIZIO (Italy)	JOHN/C	S/J	15"	24	45	1140
ORIZIO (Italy)	DO	S/J	17"	24	51	1272
ORIZIO (Italy)	CMO/4A	Rib/Inter.	30"	18	60	1680
ORIZIO (Italy)	CMO/AN	Rib/Inter.	30"	18	60	1680
ORIZIO (Italy)	C1/C	Interlock	34"	24	108	2544
MAYER & CIE (Germany)	Rentil 1.6R	S/J Engg. Striper	34"	24	54 (10 Color)	2544

Table 1. Details of fabric samples making in circular knitting machine according to the buyer requirement

Fabric Type	Req. GSM	Req. Width	Knitting COUNT	S.L	Gray GSM	Gray Width
	130	70	34	2.80	110	68
S/J						
	140	60	30	2.84	115	58
	150	68	30	2.70	130	66
	160	70	26	2.86	125	68
	160	70	34	1.58	180	68
Interlock	220	74	30	1.58	200	72
	220	65	24	2.74	164	63
	240	72	26	2.66	170	70
	240	68	26	2.64	185	66
	240	62	26	2.74	170	60
	200	58	40	2.48	108	56
Lacost						
	215	68	30	2.68	165	66
	220	72	30	2.66	170	70
	220	32	28	2.70	170	30
	220	58	30	2.56	156	56
	160	58	40	2.46	130	67
1x1 Rib	190	68	30	2.68	165	61
	200	68	30	2.78	150	69.5
	200	68	30	2.66	170	70

6. Using Stenter Machine

Specification of a Stenter Machine:

Brand Name	Bruckner
Serial no	72276-0463
Origin	Germany
Year of manufacture	1995
Speed range	15-30 m/min
Temperature range	50-250C
Used utilities	Electricity, Gas, Compress air, Steam
Production capacities	8 ton /day
No. of chamber	3
Maximum fabris width	102”
Minimum fabric witdth	30”
Steam pressure	2 bar
Air pressure	10 bar
Applied for	Open tube fabric
No. of ratamatic burner	6
Extra Attachment	Mahlo weft straightener
M/C parts	Burner, Nozzle, Exhaust air fan, Over feed roller, Suction fan, Chain arrangement

Table 2. Effect of Stenter on the properties of different structure fabric

Fabric Type	Req. GSM	Req.Width	After Dyeing	Stenter Over feed	Width after Stenter	GSM after stenter	Shrinkage%
S/J	130	70	65	55	72.5	140	L=8% W=9%
	140	68	62	50	71.5	145	L=8% W=5%
	150	68	63	30	70	155	L=5% W=5%
	160	70	65	40	71.5	170	L=9% W=8%
	160	74	68	40	76	170	L=8% W=8%
I/L	220	70	67	25	73.5	225	L=8% W=7%
	220	70	67	34	72.5	230	L=7% W=6%
	240	65	62	30	67.5	245	L=6% W=7%
	240	65	61	20	67	245	L=8% W=8%
	240	74	70	30	77	250	L=8% W=7%
Lacost	200	65	62	40	67.5	205	L=8% W=7%
	215	72	69	45	74.5	220	L=8% W=6%

	220	68	64	50	71	225	L=6% W=6%
	220	72	69	45	74.5	228	L=7% W=6%
	220	62	68	40	64.5	225	L=6% W=7%
1x1 Rib	160	58	52	24	60.5	162	L=6% W=6%
	180	68	63	20	70	183	L=6% W=5%
	200	68	62	14	69.5	205	L=7% W=5%
	200	68	64	14	70	203	L=7% W=7%
	200	62	59	20	64	207	L=6% W=4%

7. Using Compactor Machine

Specification of Open Width Compactor Machine:

Brand name	Ferraro
Model no.	Comptex/Fv200
Manufacturing country	Italy
Speed range	13-22 m/min
Temperature	110-140C
Used utilities	Electricity, Compressair, Steam
Production capacity	4 ton/day
Maximum width	86”
Minimum width	36”
Applied for	Open width

Table 3. Effect of Compacting on the properties of different structure fabric

Fabric Type	Req. GSM	Req. Width	width After Stenter	GSM after Stenter	Compact Over Feed	Width after Com	GSM	SHR%
S/J	130	70	72.5	140	16	68	130	L=5% W=6%
	140	68	71.5	145	18	70	142	L=5% W=6%
	150	68	70	155	94	56	153	L=5% W=6%
	160	70	71.5	170	17	60	160	L=3% W=3%
	160	74	76	170	16	73	161	L=5% W=3%
I/L	220	70	73.5	225	25	70	220	L=6% W=5%
	220	70	72.5	230	94	70	220	L=3% W=2%
	240	65	67.5	245	40	62	242	L=5%

								W=5%
	240	65	67	245	45	70	240	L=3%
								W=4%
	240	74	77	250	50	74	240	L=3%
								W=3%
Lacost	200	65	67.5	205	40	65	205	L=5%
								W=4%
	215	72	74.5	220	40	83	220	L=4%
								W=5%
	220	68	71	225	40	72	225	L=5%
								W=5%
	220	72	74.5	228	40	84	220	L=6%
								W=5%
	220	62	64.5	225	40	68	220	L=6%
								W=5%
1x1 Rib	160	58	60.5	162	16	58	165	L=6%
								W=4%
	180	68	70	183	18	68	180	L=4%
								W=0%
	200	68	69.5	205	17	67	202	L=5%
								W=6%
	200	68	70	203	18	72	203	L=3%
								W=5%
	200	62	64	207	18	68	202	L=3%
								W=5%

8. Discussion of Result

Required GSM VS Finished GSM:

It can be seen in Table 2 that knitting GSM is always less than finished GSM for all types and structures of fabrics, because after knitting fabric need to be dyeing and finishing. If dyestuff added in the fabric, its GSM must be increase and after softener added as finishing process GSM also increases. To follow the buyer requirement for GSM we have to look after the gray GSM very well. If GSM is more than buyer require GSM, the will not pay for excess weight and factory will face problem.

Effect of steter:

Effect of stenter on width: It can be seen in Table 1 that if tension applied to the fabric widthwise its Dia will be increase but shrinkage will be increase. As we have to follow buyer require width, we have to look after the shrinkage as well. If width increase shrinkage will be high and higher shrinkage means lower quality for garments. So we have to give Over Feed in order to increase dia and for better shrinkage.

Effect of stenter on GSM: It can be seen in Table 1 that for following buyer requirement GSM; we have to look for dia of the fabric and also shrinkage of the fabric. If GSM is less quality of the fabric will also be decrease. To keep constant GSM Dia, Shrinkage and Overfeed must be perfectly follow-up.

Effect of stenter VS fabric structure: It can be seen in Table 1 that different types of fabric have different type of nature. For example Single Jersey fabric GSM maintain is difficult rather than 1x1 RIB and Interlock fabric. Dia controlling and shrinkage controlling may vary for different structure fabric. Sometime less overfeed needed for other fabrics rather than single jersey. This happens because of their structural behavior. Single jersey fabric is more flexible than other structural fabric, so speed of fabric processing also varies.

Effect of Compacting:

Effect of compactor on width: It can be seen in Table 3 that if tension applied to the fabric widthwise its Dia will be increase but shrinkage will be increase. As we have to follow buyer require width, we have to look after the shrinkage as well. If width increase shrinkage will be high and higher shrinkage means lower quality for garments. Compactor usually increases Dia by compaction using blanket, so here width must be shorter than stenter.

Effect of compactor on GSM: It can be seen in Table 3 that for following buyer requirement GSM, we have to look for dia of the fabric and also shrinkage of the fabric. If GSM is less quality of the fabric will also be decrease. Compactor usually increase the GSM by compaction with blanket, so GSM must be good after stentering.

Effect of compactor VS fabric structure: It can be seen in Table 3 that different types of fabric have different type

of nature. For example Single Jersey fabric GSM maintain is difficult rather than 1x1 RIB and Interlock fabric. Dia controlling and shrinkage controlling may vary for different structure fabric. For compacting machine parameter may varies for fabric to fabric. For single jersey high compaction pressure applies and other fabrics low pressure applies due to their structure.

9. Conclusions

The work reported here provide various important conclusion regarding processing in stenter and compacting machine. Some of the important findings are as follows;

Finished GSM of fabric must be higher than gray GSM, because due to some process such as Dyeing and Finishing GSM increases. After dyeing process it is very important to follow the operation of stenter machine in case Dia. GSM and shrinkage, without proper maintain Dia or GSM shrinkage cannot be control.

In compacting machine compaction must me proper follow up so that here GSM not over than buyer requirement and Dia and Shrinkage report must be good.

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