Title

"Plucks Treatment in some Weft Circular Knitted Fabrics and its effect on Finished Garment for International brand standards"

"Circular Knitting Snagging Study Under International Brand Quality Standard Criteria"

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Abstract;

As a result of a quality costs which both the apparel/textiles sectors face which occur mainly due to (Internal/External failure and re-work). Plucks/Snagging is a phenomenon which appears on the knitted fabric as a pulled up yarn. Float showing up in the form of a large loop. Some fabrics can be easily snagged than others especially in case of a continuous filament yarn; it can be a mechanical strain during knitting. It can be noticed in the greige status, in the work in progress stage or at final inspection for the finished fabric. As the picks are displaced out of alignment and sometimes also jammed, a lumpy fault occurs with locally displaced lines of weft i.e. the picks are not aligned. As a result of this defect (Snagging/Plucks) cannot be repaired, so it turns to a second quality. This can be evaluated by the test method used for the brand targeted i.e. ASTM snagging test method to determine the resistance of fabrics to the formation of snags and other surface changes.

By procedure two trials in two different stages to define whether the improvement existed or not and comparing the results to decide which trial will be more appropriate to apply without affecting the other fabric characteristics.

Key words;

International brands, Plucks, Quality, Weft circular knitting, Polyester (PES), Heat setting.

Introduction;

The business environment of fashion sector has been constantly changing and the development and the implementation of marketing strategy has a critical importance for the apparel firms to lead their growth or long term survival [1] Thus determination of consumers' tastes and choices with the understanding of their quality perception and analysing the reason lying beneath these behaviours and significant point of concern. Effective Brand Company creates a perception that there is no other product is good enough as theirs' whether the distinction is a result of function, form, ease of care, price and definitely all of this will not be ruined with a poor quality.

For a strong fashion brand apparel quality has two dimensions; physical aspects or what the garment is and performance aspects or what the garment does.

The functional performance of a fabric refers to its utility and durability as its components of the garment which including (Shape retention- Comfort- ease of care) whilst the durability refers to the serviceability of the fabric regarding these characteristics of the garment (strength- abrasion resistance- resistance to degradation by chemicals and other environment elements) from the other hand every fibre and fabric has a different performance/ characteristics. If we consider what happens when playing sports then its easily to take the decision of which fabric will turning to and to manufacture it with the suitable way for sportswear i.e. to bear (Dirt- sweat- moving easily- rubbing- pilling and snagging).

From here comes the importance of studying one of the factors which can eliminate the fabric/garment quality which is snagging/ plucking. Snagging can be defined as catching the thread easily by sharp objects. Some fabrics are likely to be more snaggable than others which lead us to make the study on the fabric structure, knitting, dyeing & finishing circumstances which the fabric goes through.

Materials and Methods;

Knitting machine specifications;

Double Jersey

Jacquard

72 Feeders

Terrot UMT 172-1 30" Nu 28 circular knitting machine
Model: UMT 172-1
Cylinder diameter: 30" inch
Gauge: 28

Fabric Specification;

Swiss Pique,

Double Jersey that means both of the Cylinder & Dial are working (with a repeat for 4 feeders).

Kg/1000 Revs (72 Feeders): 3.8 kg

Spec 30 (3% Aristan).

Linear weight 155 gms

Square weight 100gsm

Overall width 153-156 cm

Usable width 150 cm

Fabric yarn specification:

There are two different yarns in the studied fabric

1- 75/72 (microfiber/Denier numbering) Textured Polyester – with a percentage in the fabric 80.75%
2- 50/36 Textured Polyester with a percentage in the fabric 19.25%.

Yarn description: 50D/36F 2H SD soft intermingle.

Methods:

Applying changes in finishing stage;

Preheat setting

Heat setting (1) is a term used in the textile industry to describe a thermal process taking place mostly in either a steam atmosphere or a dry heat environment. The effect of the process gives fibers, yarns or fabric dimensional stability and, very often, other desirable attributes like higher volume, wrinkle resistance or temperature resistance. Very often, heat setting is also used to improve attributes for subsequent processes. Heat setting benefits staple yarns as well as bulked continuous filament (BCF) yarns. (2)

Material	*Deformation point*	*Distortion temperature*
Polyester	*80-85 °C*	*230-240 °C*

The change in this process while Stentering the fabric will be as follows;

At the greige status for the fabric and before dyeing below had been applied

Batch #	*No. of pcs*	*Batch size/kg*
454944	*8*	*200*

Procedures;

Vapour + Thermo on 195°c with the same machine speed 35 mt/min with zero under/over feed, as the main purpose of this stage is to set the fabric before dyeing in order to be more stable and to minimize the plucks/snagging phenomena. It's like making the structure more coherent to make it harder to get the loop caught easily and by turn minimize the snagging problem.

Then to proceed with normal dyeing & finishing processes mentioned in Chapter 2, section 2 and section 3.

Applying changes in knitting process;

Tightening the fabric with a 10 % for the odd feeders only (Face of the fabric). This action is not affecting on anything in the fabric structure, but the RPM of the knitting machine only.

By closing the wheel of the machine (minimizing the distance between the needles & by turn somehow the width of the greige fabric get narrower and the amorphous space between filaments minimized, so you may minimize the probability of catching the loops/filaments of the fabric.

The 10% tightness will give below fabric specification readings. The change between the original (slack) fabric and the changes applied (tighter) fabric was as below;

Comparison factors	Slack construction		10% tight construction	
Course length per 3 revs	Feeder 1	Feeder 2	Feeder 1	Feeder 2
	30.9	11.5	27.8	11.5
Square weight/ gms	89		90	
Linear weight/ gms	161		165	
Width/ cm	92		92	
Courses/3 cm	45		52	
Wales/ 3 cm	42		41	
Revs	6450		7000	

Results and Discussions:

1 Results

3-1-1 Results of changes applied in Dyeing and finishing process

After processing batch # 454944 and been inspected the result was; four pcs were a second grade quality out of the eight pieces (the trial range). That means around 50% of the experiement failed.

Trial : PHS-1			
PC. #	First Length	No. of DP/mts	Comments
PHS-1-1	0	125	SEC
PHS-1-2	0	135	SEC
PHS-1-3	0	136	SEC
PHS-1-4	138	13	First
PHS-1-5	138	18	Need to Salvage
PHS-1-6	139	17	Need to Salvage
PHS-1-7	130	16	Need to Salvage
PHS-1-8	0	135	Second (FC-FS-FP)
Total	545	595	
%	48%	52%	

2 Results of applying changes in Knitting process

Date: 30/12/2014						
Tight/Slack	Insp. Date	Lot. #	batch size	First grade	SEC for DP	Comments
Slack	16-Dec	PHS-2	8	3	5	
	23-Dec	PHS-3	8	3	5	2 parts sec FP
	24-Dec	PHS-4	8	6	2	
	24-Dec	PHS-5	4	2	2	
	26-Dec	PHS-6	8	6	2	
	26-Dec	PHS-7	8	4	0	4 SEC (KR-KS-KY)
	28-Dec	PHS-8	4	3	1	
	28-Dec	PHS-9	4	3	1	the two parts SEC are very small (10meter each one)
	Total		52	32	9	
	%			62%	17%	
Tight	22-Dec	T-2	8	6	0	2 PCs sec for FS
	23-Dec	T-3	8	7	1	
	24-Dec	T-4	4	1	2	
	29-Dec	T-5	8	7	1	
	28-Dec	T-6	8	8	0	
	30-Dec	T-7	8	8	0	
	30-Dec	T-8	8	8	0	one part SEC KR
	Total		52	45	4	
	%			87%	8%	

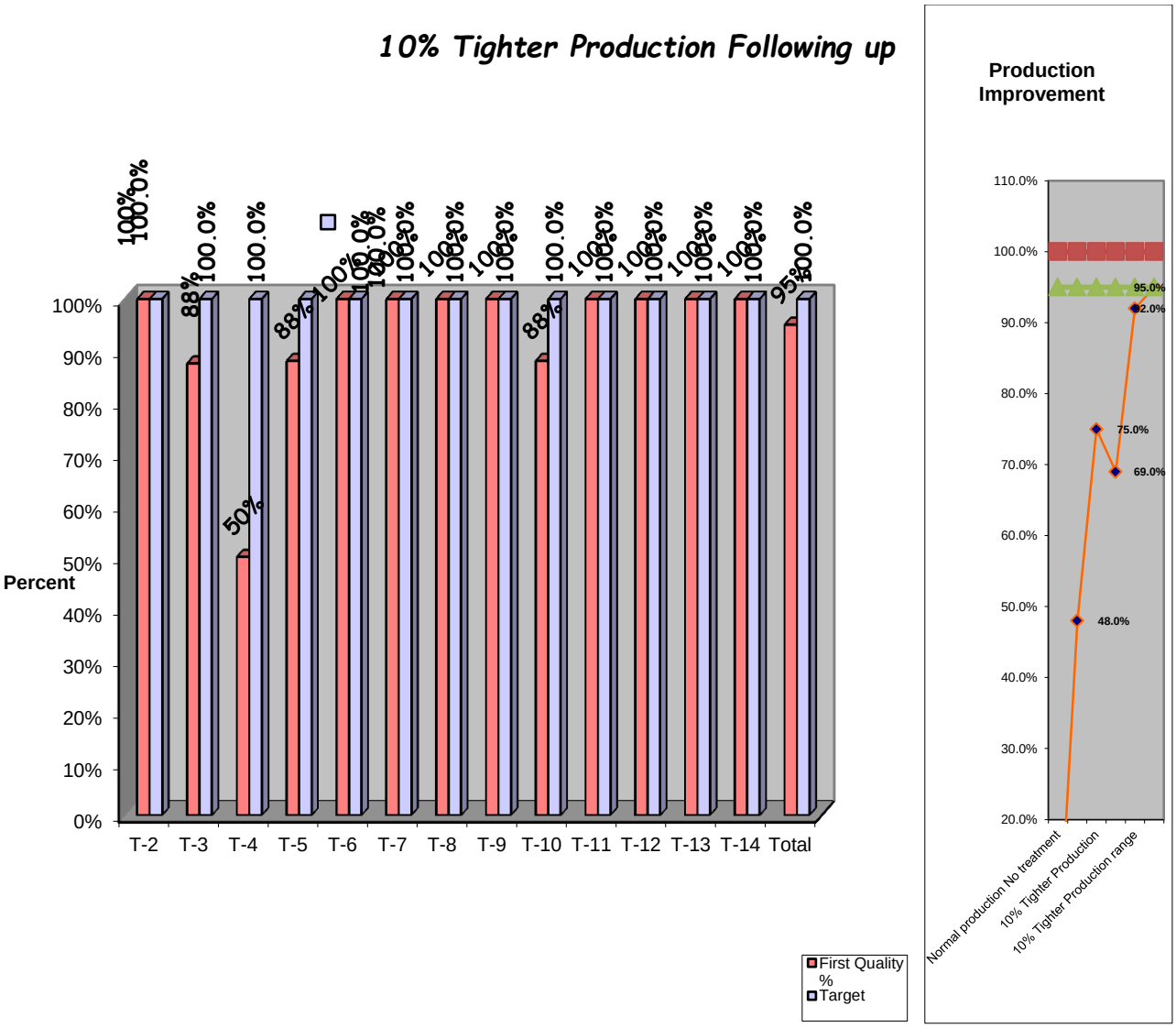
Statistics:

Production Improvement KPI

	Stages Of Improvement			
Sequence	**Stage**	**First Quality %**	**Target**	**Trigger point**
1	Normal production No treatment		100.0%	95.0%
2	Normal production with Pre-Heat setting	48.0%	100.0%	95.0%
3	10% Tighter Production	75.0%	100.0%	95.0%
4	Normal production with Pre-Heat setting range	69.0%	100.0%	95.0%
5	10% Tighter Production range	92.0%	100.0%	95.0%
6	10% Tighter Production Following up	95.0%	100.0%	95.0%

10% Tighter Production Following up

Trial no.	First Quality %	Target	Trigger point	Pieces/Batch
T-2	100%	100.0%	95%	8
T-3	88%	100.0%	95%	8
T-4	50%	100.0%	95%	4
T-5	88%	100.0%	95%	8
T-6	100%	100.0%	95%	8
T-7	100%	100.0%	95%	8
T-8	100%	100.0%	95%	8
T-9	100%	100.0%	95%	8
T-10	88%	100.0%	95%	8
T-11	100%	100.0%	95%	8
T-12	100%	100.0%	95%	8
T-13	100%	100.0%	95%	8
T-14	100%	100.0%	95%	8
Total	95%	100.0%	95%	100


10% Tighter Production Following up
Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
T-2
T-3
T-4
T-5
T-6
T-7
T-8
T-9
T-10
T-11
T-12
T-13
T-14
Total
88%
50%
95%
First Quality %
Target
Production Improvement
110.0%
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
95.0%
92.0%
75.0%
69.0%
48.0%
Normal production No treatment
10% Tighter Production
10% Tighter Production range

Summary, Conclusion and recommendations

Summary:

The overriding purpose of this study was to have scope on one of the sportswear brands product evaluation. Determining what a quality perception is and how it can effects on the consumer behavior and how that ideal is connected with the field of knitting technology assumed a high degree of importance during the literature review conducted for this dissertation. Related to that effort, it became necessary to reach an understanding about the nature of the technological part in the knitting, dyeing and finishing processes to study one of the most known phenomenon found as a major defect which was the Snagging (Plucks) problem. This chapter reports the conclusions and recommendations that resulted from this study. To prove the possibility of improvement in the study target it was important to study and track the product from scratch while it's still a yarn and to have some trials different stages then to compare the results the develop/apply new methods for improvements. Once these fundamental steps were achieved, this research was able to go forward. This chapter reports the conclusions and recommendations that resulted from this study.

A theoretical study made first to understand the root cause of the plucks defect, after that the applied part had its turn; to apply two methods individually; one on the finishing stage by getting the fabric into a pre-heat setting stage in the greige status in order to make the structure more coherent to make it harder to get the loop caught easily and by turn minimize the snagging problem and the second method can be summarized in the knitting process itself by tightening the fabric by closing the wheel of the machine (minimizing the distance between the needles & by turn somehow the width of the greige fabric get narrower and the amorphous space between filaments minimized, so you may minimize the probability of catching the loops/filaments of the fabric).

A range of batches were produced with implementation for method one and method two then the results and data were collected which addressed the research problems posed in the first chapter of this dissertation. Finally Statistics were made to show the improvements got in numbers and percentages.

Conclusions:

- Slight improvement was achieved when applying heat set on the fabric before the dyeing process.

- After heat-setting, slight changes were observed in the twist values of the yarn. Yarn twist was fixed via heat- setting, thus preventing yarn snarling. As a result of these, the yarn is likely to show better performance in the following production steps.

- A noticed improvement achieved when changing to the tight fabric by closing the wheel of the machine and minimizing the distance between the needles so the probability of catching the loops/filaments of the fabric has been minimized.

- Some fabrics are likely to snag more than others and this phenomenon can be minimized or cured by so many ways.

- When applying both stages number 1 and 2, more improvement are fulfilled, but the factory productivity will descend and go down so this is hard to apply especially in the business sector.

- Snagging test result became within the customer requirements tolerance and was successfully achieved 4 & 4-5 whilst the minimum is 4 and the company had a delegation of 3-5 due to the fabric ability to snag easily.

Recommendations for Research

The following recommendations are offered for related research

A research from Textile Auxiliaries from journals 2014 was made regarding the Anti -snagging agent and a product was mentioned which can solve the problem of snagging permanently without effecting on the other characteristics, but no more information mentioned regarding any actual experiments applied or how it works; this could be a good muck to work on. Below is the anti-snagging product information found:

Name	Purpose	ION	Characteristics	Applications
Welnol	Anti-snagging (Agent Nano coating)	Cationic	Good snagging resistant effect Doesn't affect the feel and water absorbtion No Formaldhyde	Applicable to antin-snagging finishing, for woven and knitted fabrics

Recommendations for Improving this Study

The following recommendations are offered as possible ways to improve this study.

- A larger range of fabrics can be used to apply the studied methodology of both heat setting & fabric tightness.
- A scope study for the yarn used can be helpful for more accurate results and detailed study as the yarn spinning, way of twisting or intermingle point… etc. can effect on the ability of snagging.

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