American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

http://asrjetsjournal.org/

Plucks Treatment in Some Weft Circular Knitted Fabrics and its Effect on Finished Garment for International Brand Standards

Ahmed Elsalmawy[1], Shahera Hefny[1], Wissam Metwally[2]

[1]Apparel Department, Faculty of Applied Arts, Helwan University, Cairo, Egypt
[2]Cloverbrook Textiles Egypt SAE, Free Zone, Nasr City, Cairo, Egypt
Email[2]: wissam.metwally@yahoo.com

Abstract

As a result of a quality costs both the apparel/textiles sectors face which occur mainly due to (Internal/External failure and re-work). Plucks/Snagging is a phenomenon which appears in 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.

Keywords: International brands; plucks; quality; weft circular knitting; polyester (PES); heat setting.

1. Introduction

The business environment of fashion sector has been constantly changing, the development and the implementation of marketing strategy have 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 analyzing the reason lying beneath these behaviors are significant point of concern.

---

* Corresponding author.

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.

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 fiber 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.

2. Materials and Methods

2.1 Materials

2.1.1 Knitting machine specification

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

2.1.2 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

2.1.3 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.

2.2 Methods

2.2.1 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)

Table 1: Polyester under temperature

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

Table 2: Trial Pre-heat setting 1 (PHS-1)

Batch #	No. of pieces	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.

2.2.2 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:

Table 3: Slack and tighter fabric comparison

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/3cm	45		52	
Wales/3cm	42		41	
Revs	6450		7000	

3. Results and Discussions

3.1. 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 experiment failed.

Table 4: Trial Pre-heat setting 1 (PHS-1)

PC #	First grade qty/mt	No. of DP/mt	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 grade
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%	

3.2. Results of applying changes in Knitting process

3.3. Statisitcs

3.3.1 Production improvement KPI (Key Performance Indicator)

3.4. 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 effect 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 in 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).

Table 5: Slack with pre-heat setting VS Tight fabric

PC #	Insp. Date	Lot. #	batch size	First grade	SEC for DP	Comments
	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	
Slack	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%		
	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	
Tight	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%	

Table 6: Stages of Improvements

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%

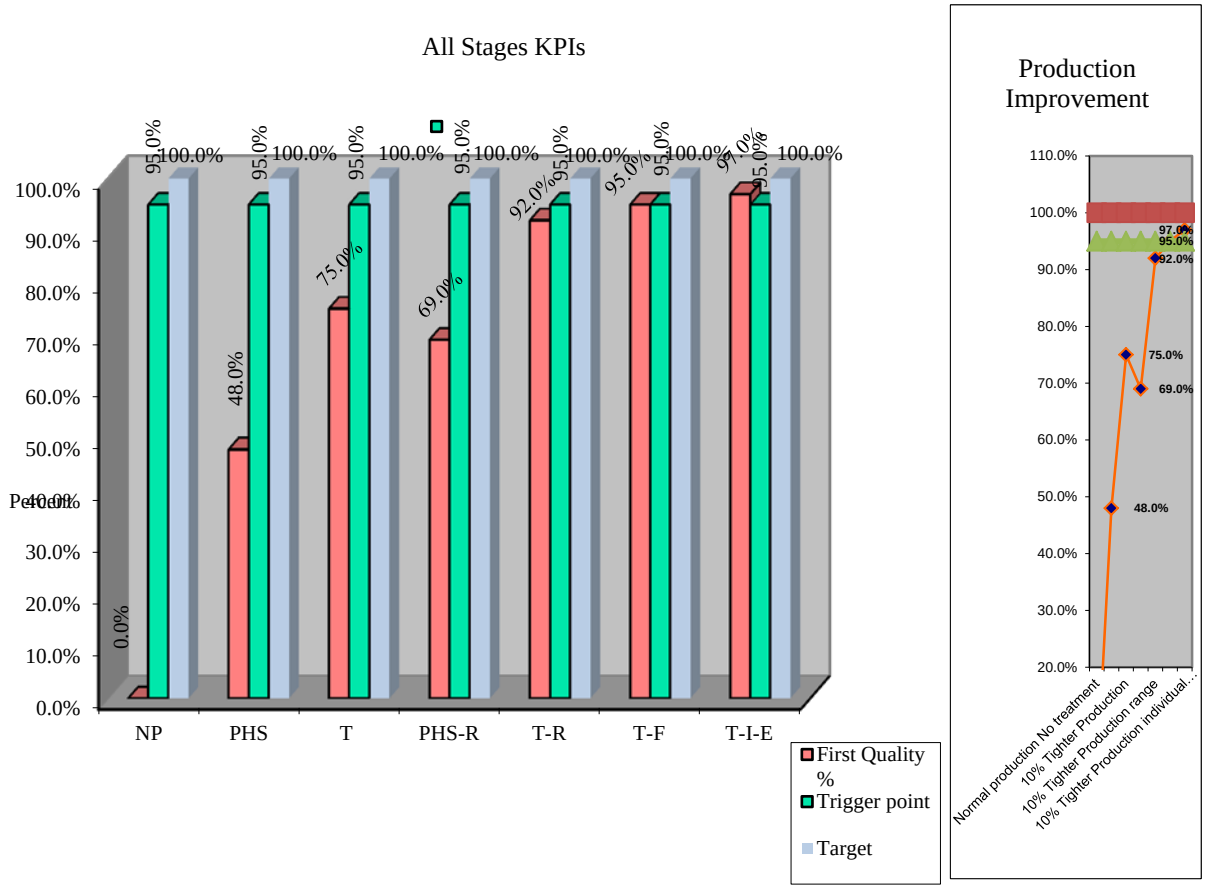

Figure 1: Stages of production improvements

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.

Table 7: Tighter 10% 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

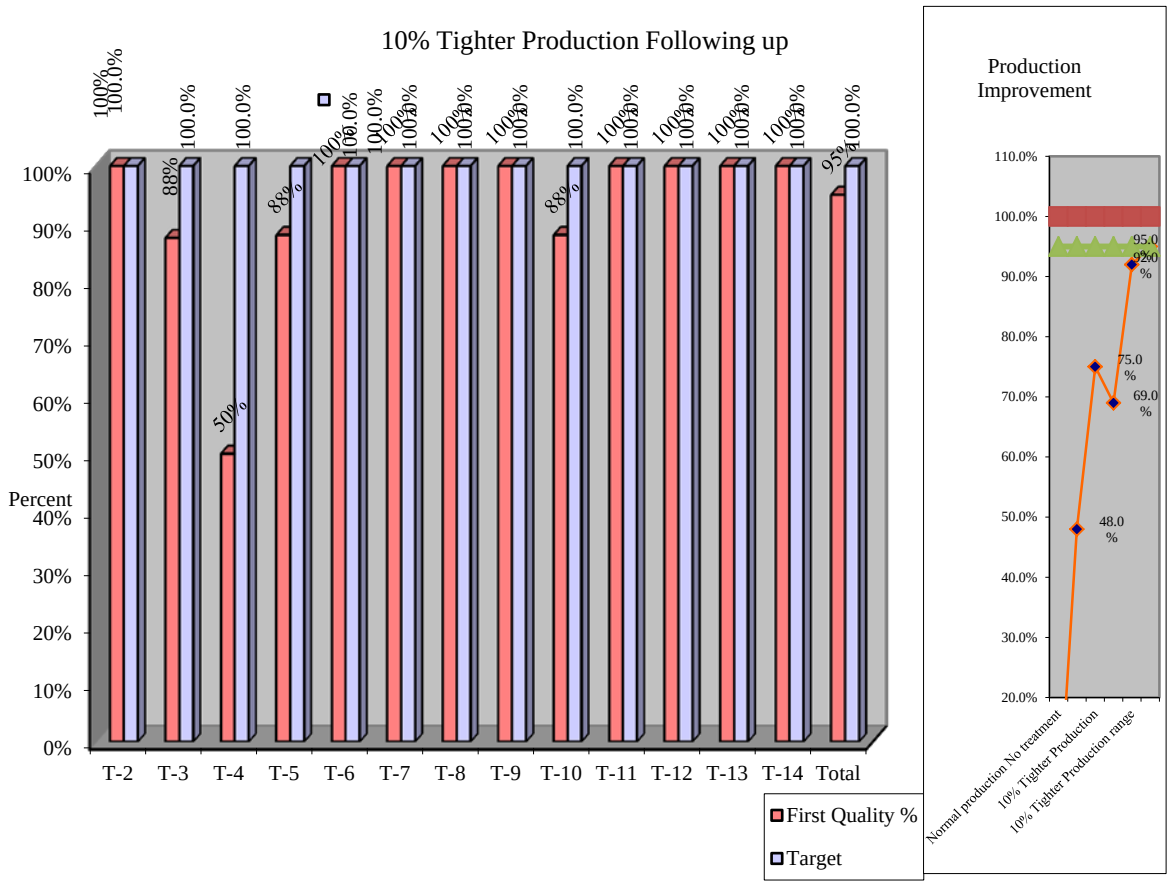

Figure 2: Tighter 10% production following up

3.5. 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 noticeable 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 (grey scale standard for the studied brand) and the company had a delegation of 3-5 due to the fabric ability to snag easily.

3.6. Recommendations

3.6.1. 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. Table no. 8 shows the anti-snagging product information found.

Table 8: Anti snagging agent

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

- Non slip finishes

Which give the filament a rougher surface. Synthetic warp and weft threads in loosely-woven fabrics are particularly prone to slip because of their surface smoothness when the structure of fabric is distributed and appearance is no longer attractive. Silica gel dispersions or silicic acid colloidal solutions are used in

combination with latex polymer oracrylates dispersions to get more permanent effect, along with simultaneous improvement in resistance to pilling or snagging. These polymer finishes are also capable of imparting a soft and smooth handle to synthetic fabric without making it water repellent.

- To make some trials with anti-pilling finishes

3.6.2. Recommendation for improving 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

Acknowledgements

Actually I owe Professor A. Elsalmawy all the gratitude for the ultimate support before and during doing this research; he was like the light guide and the backbone for me. I learned a lot from him not only on the academic side, but the personal life as well and I want to express and show all the respect for the wonderful professor Shahera Hefny who was always there for me and gave me from her time, science, a lot of trust and encouragement all the way to get such a worthy research out to the light. Thanks my dearest professors.

I would like to thank Cloverbrook ltd Textiles members as with this company and all the team in there this research was possible. I would thank the business manager Jonathan Young and the Commercial Executive Marwa Tareef my direct manager who gave me the time and space to get my thesis done.

I want also to thank Mohamed Nabhan the knitting factory director & Mohamed El Azazy the technical department manager for their support, head of Finishing dep. Mohamed Hassan, Karim Matar Quality control manager, Amr Abdullah & Waleed Gamal (Dye lab team) for what I learned from them regarding the dyeing and finishing processes and finally the process improver Mohamed Salah who taught me how to get my data analysis done.

And I can't finish without acknowledging both my Mother and father for their trust, support and their encouragement all the way -long live for them- .

Thank you all

References

[1]. Akira Nakamura. Fiber Science and Technology (Translated from Japanese), Enfield, N.H: Science Publishers, 2000, pp. ISPN 1578081343 ; 9781578081349.

[2]. Moore,M. and Fairhurst, A. "Marketing capabilities and firm performance in fashion retailing." Journal of Fashion Marketing and Management, vol. 7, no.4, pp. 386-397, 2003.

[3]. Canan Saricam, Fatma Kalaoglu, Yasin Sercan Ozduyga and Hulya Orun. "Apparel Product Evaluation and Quality Perception of Turkish Consumers," in *Proc. RMUTP International Conference: Textiles & Fashion*, Bangkok, Thailand, 2012 July 3-4.

[4]. Ismaıl Kara Department of Textile Engineering. (2007, Dec.). "The Effects of Heat-Setting on the Properties of Polyester/Viscose Blended Yarns." *FIBRES & TEXTILES in Eastern Europe*. [On-line]. Vol. 15 No. 4(63). Available:http://www.fibtex.lodz.pl/search.html?fraza=The+Effects+of+Heat-Setting+on+the+Properties+of+Polyester%2FViscose+Blended+Yarns [Oct. / Dec. 2007].

[5]. F. Mousazadegan, S. Saharkhiz and M. Maroufi. (2010, Aug.). "Weight reduction of microfiber polyester and the effect on its physical and mechanical properties." *The Journal of the Textile Institute*. [On- line]. 101. (8), pp. 716-728. Available: http://www.tandfonline.com/toc/tjti20/current [Aug.2010].

[6]. Das, S. (2008). "Apparels for exports: Importance of quality characterization." *Indian Textile Journal*. [On- line]. 45. Available: http://www.indiantextilejournal.com/articles/FAdetails.asp?id=1306 [July 2008].

[7]. Greg Stine, "The Nine principles of Branding, Supplemental information for the Branding Essential Workshop," http://infografik.com.my/images/articles/9_principles_of_branding.pdf, 2013 [Oct., 2014].

[8]. Welsum Technology Co., LTD. Taiwan. Textiles Auxiliaries:

www.welsum.com.tw/WELSUM/EN/EN_Products_024d_Anti_Snagging_agent.html, 2010.

[9]. Nour Afifi Hassan. "The Influence of Different Setting for Circular Knitting Machines on the Physical and Mechanical Properties for Weft Knitting Fabrics." Master degree in Spinning, Weaving & Knitting Dep. Applied Arts University, Helwan , 2006.

[10]. Maha Ahmed Farag. "Effect of Natural and Mechanical Properties of the Knitted Fabrics on some sewing Problems and Quality." PHD Thesis Department of Clothes and fabrics, Faculty of Domestic Economy, Helwan, 2012.

[11]. Polyester Textured Yarn, http://www.libolon.com/polyester-textured-yarn-2.html, date when it was updated [date accessed].

[12]. Heat setting. "Heatsetting," WIKIPEDIA: https://en.wikipedia.org/wiki/Heatsetting, 2 January 2016, [January. , 2016].