The study about the improvement of the quality for the fabrics made of chenille yarn

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Abstract: The work is a study about the decrease of the serious defects from the fabrics such as: the deviations from quality or the high costs, discovered and seized by customers. The analyzed fabrics have in their structures three types of different chenille yarns, such as: the Article A1 (viscose fiber with cotton, Nm 3500 dyed coil), the Article A2 (textured polyester, Nm 8000 dyed coil), the Article A3 (Trevira CS polyester, Nm 3000 the pre-dyed raw materials). The technology of chenille yarn, regardless of composition and properties is the same and is performed on the twisting machines. This study has found that the most of the flaws in the fabric, noticed by customers, are caused by the production technology of the chenille yarns. In any organization which makes goods, there are concerns about the improvement of the quality through the elimination of the nonquality. It is extremely difficult to get to “zero defects” but the first step is a systematic action plan to reduce drastically the nonconformities and the defects. The continuous improvement of the effectiveness of the integrated quality and environmental management is achieved by applying the PDCA methodology: planning, development, control, action.

1. Introduction

The fault frequency analysis of the industrial products provides statistical and analytical indicators and graphics, suitable technological correct interpretation of the results, in quality control level. Through these indicators, the beneficiary is warned about the level of poor quality, and the supplier is warned about the dynamics of defects and directed to take effective measures for prevention, remediation and removal of the causes of non-compliances, with the largest share, thus reducing the risk of losses due to an inadequate quality [1-4]. Analyze the frequency of industrial products defects while providing statistical, analytical indicators and diagrams appropriate correct technology interpretation of the results for quality control [2-6]. By these indicators, the beneficiary is warned about non-quality level and the provider is made aware of the defects dynamics and directed to take efficient measures of prevent, remedial and removal of generating causes of non-conformity with the highest share, thus, decreasing the risk of loses due to inadequate quality [6-10].

Analyze Pareto, although not the most accurate method of control is however the fastest and easiest to use, allowing conclusions to be drawn and immediate action to remove defects and pursuit of
quality production. The defects gravity can be assessed by the size of the losses caused it causes lack of quality, both in manufacturing process and during use of product [7-10].

The classification of defects according to their effects, depends largely on the beneficiaries imposed requirements. Anlizete Pareto allows continuous monitoring of production quality. It starts with ordering defects in frequency of occurrence. The Pareto diagram differentiates the defects in order of importance for control actions and improvement of quality as support for a preventive control development.

The defects found in production control the manufacturer source of information is very useful for setting targets to improve the production [11-13].

The Pareto diagram shows the imbalance of the studied categories and offers a starting point for finding directions to improve or main factors determining nonquality.

In case of continuous series of product, the quality made for a certain time period (daily, weekly, monthly or annually) can be estimated using a global indicator, in terms of „nonconformity” or defects found at final inspection [14-17].

The evaluation of this serious problem should take into account the possible evolution of defect during the manufacturing process or during the use of product. Some defects are considered critical in a certain technological stage, can be attenuated or removed in the subsequent stages [18-20].

There are cases where some defects with reduced impact may be increased during the technological process or wearing [21-23].

The manufacturing process is not an easy one and great care is taken in production to ensure that the fabric is of good quality. Chenille fabric can be made of different fibers but cotton is the most commonly used fiber [23-25]. Other fibers that are used to make chenille include acrylic, olefin and rayon. The cost of the fabric depends on the fiber composition with fabric comprised of natural fibers costing more than the ones made of manmade fibers [25-27].

A proper development of the relations provider-beneficiary requires also the defects differentiation depending on the size of the effect severity, especially establishing the penalties every time they are found [27-30].

2. Methods and materials
The fabrics analyzed have in their structure three different kinds of chenille yarn, whose characteristics are shown in Table 1.

| Cod article | Nm   | The effect yarn | The connecting yarn | T  |
|-------------|------|----------------|---------------------|----|
|             | Fibrous composition | Fiber finess  | % | Fibrous composition | Fiber finess | % | (ras/m)  |
| A1          | 3500 | viscose Ne 20/1 | 72 | bumbac Ne 16/1 | 28 | 750s |
| A2          | 8000 | textured polyester Tdtex 167/144 | 66 | polyester Ne 30/1 | 34 | 950s |
| A3          | 3000 | Trevira CS polyester Tdtex 167x2/64 | 87 | polyester Tdtex 167x2/64 | 13 | 820z |

The process for producing the chenille yarn is based on the main winding and cutting operations carried out on the winding machine, the details of which are shown in Figure 1.

The principle of making yarns chenille, presented in detail in Figure 1 is that the connecting yarns (A) and the effect yarn (B) are drawn on the pulling cylinders (E) and against pulling cylinders (F) past the caliper (D) where connecting yarns are twisted with a twist number set by adjusting the machine, and the effect yarn is cut with a razor (G), resulting chenille yarn (C) which is deposited on cops.
Figure 1. Details of the twisted machine:
   a) process for obtaining chenille yarn; b) caliper; c) blade

3. Experimental part

When a product does not fulfill partially or completely one or more functions it induces to the beneficiary a state of dissatisfaction. In this case doing an analysis on the product can highlight a number of defects and/or non-conformities that are considered features of poor quality.

This research is based on reducing defects, starting from analysis of complaints received from customers; we checked the company archive from 2010-2014. The database obtained reading the complaints received from customers is summarized in Table 2, where are exemplified by defects recorded and coded like categories A to H, so: A-striped coils after painting; B-color differences in the fabric; C-breakage during weaving; D-neps; E-striped fabric; F-yarn floatations; G-dirty yarns; H-mixed weft/Foreign fibers.

| Code Year | E  | B  | D  | C  | A  | G  | H  | F  |
|-----------|----|----|----|----|----|----|----|----|
| 2010      | 17 | 14 | 5  | 0  | 2  | 0  | 1  | 0  |
| 2011      | 15 | 12 | 2  | 3  | 1  | 1  | 0  | 1  |
| 2012      | 12 | 11 | 3  | 2  | 0  | 1  | 2  | 0  |
| 2013      | 16 | 8  | 0  | 1  | 2  | 1  | 0  | 1  |
| 2014      | 9  | 3  | 2  | 3  | 1  | 1  | 1  | 0  |
| Total     | 69 | 48 | 12 | 9  | 6  | 4  | 4  | 2  |

The hierarchy of the defects following the complaints received from customers is achieved by Pareto diagram, figure 2, which highlights the main factors that determine non-quality and upon which it can determine the directions for improvement or remediation of the defects.

Pareto analysis begins with sorting the defects by frequency, determining the relative frequency and cumulative frequency for the recorded defects categories.
In Pareto chart is noted that from all the complaints received from clients, 75.97% are categories of defects: E - striped fabric and B - differences in color in fabric. It also notes that it is sufficient to solve the first two types of defects that reduce their share to over 75%.

Ordering of defects frequency leads to the establishment of technical measures succession, knowing that the removing of the first 2 types of defects can minimize the number of rejects.

![Figure 2. Analysis of factors which generate complaints using Pareto chart.](image)

One of the causes of fault stripes in woven is caused by the structure of chenille yarn unevenness. The defect is visible and at the microscopic analysis of it, it is noted that some portions have not the specific effect of chenille yarns, shown in figure 3.

No effect in chenille thread, which causes stripes in the fabric, can be caused by: breakage of connection in the twisting and untying them immediately, eliminating the portion of thread with no effect; replacing the effect yarn coils so that production goes on; the failure of the sensor which senses no effect on winders.

![Figure 3. Microscopic appearance of the Article A1 with no defect and with the banding.](image)

After the microscopic analyzing of the fabrics, there is a difference in width between yarns, for example in the case of Article A2 (figure 4) it was found a difference in width 0.03 mm between them.
Going on analyzing the yarns, it appears that the chenille thread that led to the stripes in the weft of the fabric has a number of three bond yarns instead of two, as the specification of production (figure 5) asks.

The cause of this defect is the carelessness or negligence of the operator did not notice that the third yarn of connection is actually a yarn accidentally hooked up on a reel located on the same rack with coils in it. Another category of defects highlighted by Pareto chart is the difference of color fabric that can have various causes, such as dyeing uneven of the yarns from the same batch and a gap width effect, which makes the incidence of light on the fabric to give a different complexion of the color.

The continuous improvement of the effectiveness of the quality and environmental integrated management system is achieved by applying the PDCA methodology: planning, development, control, action.

The methodology consists in planning processes, establish performance criteria, implementation and verification of the results of work processes in relation to performance criteria.

To improve continuously the effectiveness of the quality and environmental integrated management system, it may use the environmental quality policy, quality and environmental objectives, the management programs, the results of internal and external audits, and corrective and preventive action analysis.

A corrective action involves: fix non-conforming products; resolution of written/unwritten complaints; training / retraining / qualification of staff assigned to resolve nonconformities. The preventive actions can be solved by monitoring and controlling the production for each stage of the technological process.

The first action that can be taken is to monitor more closely the twisting machines. Given that a single operator can take care of up to 3 machines, it is quite likely that some of the posts problems such as the breaking of the connection or termination of the yarn in the coils and no replacing it immediately, not to be noticed in time by the operator.

It would be advisable for an operator to monitor up to two machines, thus reducing the response times to address any faults. Also, the operator must do a visually check each time for the spindle and eliminate non-compliant spindles, though not always lack of effect is visible on the outside of the spindle.

The corrective actions are not necessarily required for each instance of an irregularity, but they will be taken into account in regular analyzes in order to identify opportunities for the process improvement. It also it will conduct investigations in order to establish whether non-compliance is an isolated problem or a chronic one. The actions to prevent the width difference of the effect are mainly related to technical adjustments to the twisting machine, the verification and proper maintenance of its,
the causes of having this problem are: consumption gauge and no replacing it in a timely manner; improperly sharpened blade, taking shorter or uneven edges or the blade was not centered correctly.

4. Conclusions
In any organization which produces goods there are concerns about quality improvement through the elimination of poor quality. It is extremely difficult to get to "zero defects", but the first step is a systematic action plan to reduce drastically the nonconformities and defects.

To improve the quality of products, always it has to invest in technology and staff training.

Pareto chart ranks the defects in order of importance for the control and improve quality actions being a support for the development of a preventive control.

The internal audits are very important, being designed to test a number of organizational issues, to provide a clear and real business activity image, finding not only the weaknesses or non-conformities that need to be corrected, but also the strengths which must be maintained and improved.

The defects are the most serious quality deviations and have high costs, given that they are found and seized by customers.

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