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Yield and Quality Improvement of Asian Spinning Mill

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Abstract - Yield% shows the performance of any industry, it shows efficiency of the industry to convert the raw material into the finished goods. The industry management focuses so much on the maximization of yield so that maximum profit can be earned. Yield% directly relates with profit of the industry, textile cotton spinning industry usually give the yield% up to 84, this can be increased up to 1 to 2% , adding million in the profit of cotton spinning industry. This article presents the methodology to enhance the yield % of cotton spinning industry. Food, shelter and clothing are very basic needs of human beings. Cloths are used by the human beings to protect themselves from light, wind and rain and other environment factors. Cloths are manufactured from the cotton. In spinning mill industry raw cotton is processed to produce yarn. At present condition quality and productivity of yarn is very important factor and lot of mills failing to achieve the quality as per standards due to this the spinning mills are in financial crisis. In India many spinning mills have stopped their production. So it has direct impact on economical condition of farmers, mill workers and the people who are connected directly or indirectly to spinning mill industry.

Index Terms - Spinning mill, Yarn Quality, Yarn Productivity, Yield and Quality

1 INTRODUCTION

The textile industry is one of the largest industrial sectors in the world and the challenges facing the textile industry with regards to providing sustainable growth with acceptable quality and profitable production are huge. As increasing population and greater use of such products in technical and industrial applications has led to a remarkable growth in

demand for textiles; the development of innovative design, processes and raw materials are of paramount importance. After the quality revolution, the textiles industry has started implementing the modern manufacturing paradigms like Lean, Six Sigma, Total Quality Management, etc. However, textile manufacturers should adapt more implementation for such tools. Our project is to improve quality and productivity of Asian spinning mill. This process of improving quality and productivity of Asian spinning mill is applied in “Priyadarshani Sahakari soot Girni Limited” Situated in shirpur town of Dhule District of Maharashtra state, India. Reducing variability is a magic solution to solve our quality problem in our project; we guarantee reducing the variation in significant range and achieve the required quality level.

2 LITERATURE REVIEW

2.1 Comparative Study of Mechanical Properties TPI Hairiness and Evenness of Conventional Ring and Modern Rotor Spun Yarn

This work presents a comparative study of the properties of yarns manufactured from identical raw material (100% cotton fiber), of 16 Ne &20 Ne in conventional ring and modern rotor spinning frame. Mechanical properties e.g. tenacity, elongation%, TPI, hairiness and evenness e.g. unevenness, Thin/km, Thick/km, Naps/km, hairiness, CV of mass of both types of yarns were tested and compared. The results show that the tenacity of the ring yarns expresses greater value than rotor spun yarn and the elongation% of the ring yarns has a significantly lower Value than that of rotor yarn. The hairiness tests revealed an essential difference between the ring and the rotor yarn. Rotor yarn is less hairy compared to the conventional ring yarn. [1]

2.2 Design and Optimization of Process in Spinning to Improve Quality and Productivity of Yarn

Food, shelter and clothing are very basic needs of human beings. Cloths are used by the human beings to protect themselves from light, wind and rain and other environmental factors. Cloths are manufactured from the cotton. In spinning mill industry raw cotton is processed to produce yarn. At present condition quality and productivity of yarn is very important factor and lot of mills failing to achieve the quality as per standards due to this the spinning mills are in financial crisis. In India many spinning mills have stopped their production.

In this work by applying the integrated approach of Six Sigma and TOC the sigma level of spinning mill industry was raised from 3.788 to 4.03. Due to this, variations of parameters which are critical to quality is reduced so results in the production of cotton

yarn with fine quality which can be acceptable all over world. After improvements done it was seen yield percentage of spinning mill raised from 93.55 % to 96.71 %. [2]

2.3 An Application of DMAIC Methodology for Increasing the Yarn Quality in Textile Industry

This article presents a quality improvement study applied at a yarn manufacturing company based on six sigma methodologies. More specifically, the DMAIC (Define, Measure, Analyze, Improve, and Control) project management-methodology & various tools are utilized to streamline processes & enhance productivity.

In this paper, we have achieved a lot of results regarding to process problems during manufacturing of yarn in different departments. The main thing in our paper is to reduce the defects rate and also reduce fault opportunities in the final yarn; we have worked in every department to reduce these opportunities and gave a solution in the form of preventive action. As in Six Sigma methodology, if we decrease the opportunities in the final product then we can increase the Sigma value which shows that the process improvement. We have also applied a basic tool of Six Sigma like DMAIC in our thesis in which highlighted the different phases of tool With respect to process behavior and importance in the manufacturing of yarn. [3]

2.4 Implementation of Lean Six Sigma in the Yarn Manufacturing: a case study

The purpose of this study is to explore the implementation of Lean Six Sigma (LSS) project in the textile industry as a case study. Meanwhile, the literatures in the field of Lean Six Sigma and its implementation in the manufacturing industry and especially in the Textile industry have been explored. The lean techniques have been utilized to maximize winding speed, reduce variation between individuals production positions (The process speed) and provide tools for analyzing process flow and delay times, the setup delay has been minimize from 30 minutes to 5 minutes.

By implementing the Lean Six Sigma different techniques, a significant change and effect have been done and notice either in the quality level of the produced cones and satisfaction of the weaving mill or in the production of the whole spinning mill and the flow of the work process. In addition, a notice saving in the quality and production costs has been achieved by implementing the Lean Six sigma by reducing the waste and no value added times and the low quality refused cones from the weaving process. [4]

2.5 To study how to improve the productivity of yarn and fabric production in a production mill

Productivity in every sector is essential, Production areas like textile require more production, more profit with less cost. Everyone should play their own role in achieving better production rate in these working sectors. There are many factors which can improve the productivity, but here we will focus on some specific areas. By working on these issues or factors, we can achieve our productivity goal. There are challenges for production managers and they need to take healthy measures for the enhancement in their production rates E.g. to find the best raw material Available, to train its team and keep them updated to the latest technologies etc.

The research project showed that there are many factors by which we can improve productivity, but our emphasis was on one of the most important factor which yielded very important results. We focused on raw material staple length and machine efficiency. By using the same raw material with good staple length, we achieved better results in the form of high production and high profit. The other benefit is that due to increase in staple length, Short fibers percentage also decreases and results in the form of less TPI and less yarn breakage. Breakage is one of the big factors due to which efficiency of department is disturbed. Productivity increases with a variation in a raw material staple length and machine efficiency is directly dependent on the staple length of a raw material. [5]

2.6 Effect of Spinning Parameters on Thick, Thin Places and Neps of Rotor Spun Yarn

Defect free yarn is a great demand for spinner, knitter, and weaver and also other textile personnel because numerous end products from knit apparels to woven fabrics, from towels to sheets and from carpets to industrial fabrics characteristics significantly depend on the physical properties of yarn. The qualities of rotor yarn are really directed by spinning parameters. The aim of this study is to observe the effect of spinning parameters such as rotor diameter and speed on thick, thin places and neps of yarn in rotor spinning process. 0.11 sliver hank of 100% cotton was used to produce 12 Ne yarn. 65% virgin cotton and 35% wastage cotton were mixed together. The positive impact of spinning parameters on yarn properties were accessed by thick places, thin places and neps. Results indicate that the yarn qualities were improved with increasing of rotor speed and rotor diameter. The rotor diameter was settled to 43 mm while rotor speed fluctuated from 35,000 to 45,000 rpm and rotor speed was fixed to 35,000 rpm while rotor diameter across contrasts from 43 mm to 66 mm. Rotor-spun yarns have established firmly in fields of application for woven and knitted fabrics. Rotor-spun yarns could be utilized effectively where the particular properties of the rotor-spun yarns corresponded particularly closely to the requirements of the end products. Terry products and upholstery fabrics are the main applications for rotor-spun yarns in the home textiles sector. Also worth mentioning as end products using rotor spun yarns are socks and sweaters in the clothing sector, sheets and upholstery fabrics in the home textile sector, as well as technical textiles. Noteworthy effect of rotor speed and rotor diameter on the yarn thick, thin places and neps in rotor spinning was studied. At constant rotor diameter of 43 38.3 25 28.7 0 10 20 30 40 35000 40000 45000 Neps Rotor Speed (rpm) 38.3 50 32.5 0 10 20 30 40 50 43 54 66 Neps Rotor diameter (mm) Md. R. Repon et al. 54 mm, the yarn qualities were improved i.e. thick, thin places and neps were decreased with increase of rotor speed from 35,000 to 45,000 rpm. Conversely, analogous scenario observed due to augmentation of rotor diameter from 43 to 66 mm at constant rotor speed of 35,000 rpm. The yarn quality tends to deteriorate i.e. thick, thin places and neps were increased when the rotor diameter increases from 43 to 54 mm. Further work could be done on producing quality yarn of various counts from other natural, synthetic and blends fibres to justify this analysis. It also could be checked by changing others spinning parameters. [6]

2.7 Process control and yarn quality in spinning

This chapter discusses about the various definitions and dimensions of quality and their significance on process and quality control. The seven tools of quality control and their application have been discussed. The problems faced, need for quality management systems and organizational structure of spinning industries are also discussed in this chapter. [7]

2.8 Influence of Friction Spinning Process Parameters on Spin ability of Pergularia/Cotton-Blended Yarns

In this study, spin ability of Pergularia daemia seed fiber (70%) and cotton fiber (30%) core/100% cotton fiber sheath DREF-3 core yarns of 74 tax were studied using different spinning parameters in order to understand their effect on yarn properties. Box-Behnken Design was used for the optimization of core ratio, drum speed, and suction pressure and to evaluate the effects and interactions of the process variables on the yarn properties at a constant opening roller speed of 12,000 rpm and delivery rate of 100 m/min. The effect of the core/sheath ratio on yarn quality index is significant. With an increase in the core/sheath ratio, yarn tenacity, and elongation decreases due to insufficient wrapper fibers in the yarn and yarn unevenness increases due to higher feed rate and draft at higher core ratio. An increase in the spinning drum speed increases the yarn quality index up to certain range and then decreases at higher speed due to damaging of fibers in the sheath and more number of hooks at the end of fibers. At a higher air suction pressure, yarn tenacity and the elongation at break increases which ultimately increases the yarn quality index. From the regression analysis, it is observed that the drum speed and suction pressure has no significant effect on yarn unevenness.

The core/sheath ratio has a significant effect on the YQI. An increase in the core/sheath ratio decreases the tenacity and elongation ratio due to a decrease in the wrapper fiber ratio in the core yarn and increases the yarn unevenness thereby reduces the YQI significantly at higher core ratios. The spinning drum speed and suction pressure has a significant effect on yarn tenacity and elongation but has no significant effect on yarn unevenness. The YQI increases with increase in drum speed up to certain point and then decreases but it increases with increase in suction pressure which aids to improve yarn tenacity and elongation. The surface frictional force is perhaps. One of the most important parameters. If the friction force between the core and sheath materials high, the Production of core yarns with a high core ratio at a high air suction pressure is possible. Since the pergularia daemia fibers in the core are smooth and brittle, the frictional force between core fibers and sheath fibers are less especially at higher core ratio which leads to drastic strength loss and higher yarn unevenness and ultimately reduces the YQI. [8]

2.9 Analysis on the Defects in Yarn Manufacturing Process & its Prevention in Textile Industry

This paper is related to textile industry especially to Yarn manufacturing process. Textile is one of the biggest manufacturing industries in India. Defects rate of product plays a very important role for the improvement of yield and financial conditions of any company. Actually defects rate causes a direct effect on the profit margin of the product and decrease the quality cost during the manufacturing of product. Companies strive to decrease the defects rate of the product during the manufacturing process as much as possible. By checking and inspection of defects of product at different point in a production cycle and management implement some changes specifically at those points in production where more defects are likely to happen. The main thing of this paper is to give the understanding of different problems in different departments in quality point of view and how to reduce the problems by taking preventive action against any defects produce during process. Now days, defects rate reduction is so important especially in recession days, when every company wants to improve the financial goals and reduce quality cost of product.

In our paper, we have achieved a lot of defects regarding to process problems during manufacturing of yarn in different departments. First we have discussed all problems that can occur in the process, then at the same time we have also gave a preventive action for those problems. We have also highlighted the critical success factors of every department that can cause more dangerous in quality point of view and improvement of process. In our opinion, the paper which we have written is very useful for yarn manufacturing plant. In textile industry, especially in yarn manufacturing plant (Spinning Plant) there are seven big departments and it's difficult to achieve the objectives in every department without implement of suitable system in the process. As our practical experience in yarn manufacturing plant, it is very necessary to reduce or eliminate the defects in ever department to achieve the required specification of customers in the final yarn end product. For capture market in these days and from customer's requirements, product should have a good product of quality and service [9].

2.10 Impact of Carding Parameters and Draw Frame Doubling on the Properties of Ring Spun Yarn

The impact of card cylinder speed, card production rate and draw frame doubling on cotton yarn quality parameters was investigated by using the Box Behnken experimental design. It was found that yarn tenacity, elongation and hairiness increase by increasing the number of draw frame doubling up to a certain level and then decrease by further increase in doubling. Yarn unevenness increased by increasing card production rate and total yarn imperfections increased by decreasing card cylinder speed and increasing card production rate.

Increase in card cylinder speed significantly decreases the yarn IPI, without significantly affecting any other yarn parameter. An increase in card production rate results in a significant increase in yarn IPI as well as yarn unevenness. The number of draw frame doublings not only significantly affects the yarn tenacity and elongation, but also yarn hairiness. However, the effect of draw frame doubling is not linear. By increasing the number of doubling up to a certain level, the yarn tenacity, elongation and hairiness increase, but on a further increase in number of doubling, the trend is reversed. [10]

3 PROCESS OF SPINNING MILL

3.1 Blow Room:

Blow room is the starting of the spinning operation. It is the section where supplied compressed bale is turn into a Uniform lap of particular length. The basic functions of blow room are opening, cleaning, and dust removal, blending and evenly feeding the material on the card.

FIGURE 3.1

BLOW ROOM

3.2 Carding:

The carding machine mainly removes the naps, short fibers and remaining impurities in the cotton fiber and forms carded sliver. Mainly impurities are removed at the intake and the naps and short fibers are removed by action between the cylinder and flat. It is called the heart of cotton spinning because the quality of a yarn is greatly dependent upon the carding machine. In carding machine, cotton converted into sliver, which is deposited in sliver can.

FIGURE 3.2

CARDING

3.3 Draw Frame:

Parallelization of the fiber. Equalization of the sliver. Removal of the dust & short fiber. Mix the different types of fiber so as to give a homogeneous blending.

FIGURE: - 3.3

DRAW FRAME

3.4 Unilap:

Feed from 28 cans of drawing slivers. 14 cans/side. Slivers are guided by stationary creel. The slivers are assembled and fed to drafting zone. The drafted sliver emerge from the drafting zone as two fleeces

FIGURE 3.4

UNILAP

3.5 Comber:

The process of straightening and parallelizing of fibers and the removal of short fibers by using combs and this combs assisted by brushes. This processes carried out in order to improve the quality of the sliver coming out of the card. It also removes naps and residue impurities. It takes 8 laps from lap former and make a single sliver can.

FIGURE 3.5

COMBER

3.6 Finisher Draw Frame:

Parallelization of fibers. Equalization of fibers. Removal of dust neps and short fibers. Homogenous blending.

FIGURE 3.6

FINISHER DRAW FRAME

3.7 Speed Frame:

Speed frame should draft the sliver into roving with require hank with the help of effective drafting system. Speed frame should twist the drafted str & using flyer. Speed frame should wind the twisted roving on bobbin for easy handling of material.

FIGURE 3.7 SPEED FRAME

3.8 Ring Frame:

Attenuate the roving until the required fineness is achieved. To impact strength to the fiber strand by twisting it. To wind up the resulting yarn in a form suitable for storage, transportation and further processing. Components of ring frame are thread guide, spindle, ring, traveler, apron, rubber cots.

FIGURE 3.8

RING FRAME

3.9 Auto Conner: To convert smaller packages of yarn into larger packages. To remove objectionable yarn faults. To form continuous length of package.

3.10 Packing:

After yarn conditioning the yarn package (i.e. cones & cheeses) are packed in carton/bags/pallets. It helps to transport the yarn in huge amount to the customers with safe without any damage to the yarn. During packaging all precautions are taken to avoid damage to the yarn.

FIGURE 3.10

PACKING

4 CONCLUSIONS

The results show that the tenacity of the ring yarns expresses greater value than rotor spun yarn and the elongation% of the ring yarns has a significantly lower value than that of rotor yarn. The hairiness tests revealed an essential difference between the ring and the rotor yarn. Rotor yarn is less hairy compared to the conventional ring yarn. Unevenness of mass (1%, 3%) & their corresponding co-efficient of variation are higher for ring yarn with count than that of rotor yarn.

Rotor-spun yarns have established firmly in fields of application for woven and knitted fabrics. Rotor-spun yarns could be utilized effectively where the particular properties of the rotor-spun yarns corresponded particularly closely to the requirements of the end products. Terry products and upholstery fabrics are the main applications for rotor-spun yarns in the home textiles sector. Also worth mentioning as end products using rotor spun yarns are socks and sweaters in the clothing sector, sheets and upholstery fabrics in the home textile sector, as well as technical textiles.

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