SLUB YARN CHARACTERISTICS THROUGH IMAGE PROCESSING- A CRITICAL REVIEW

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ABSTRACT

In textile spinning mill apart from producing carded and combed yarn using ring frame, the mills are now producing slub yarn. Basically slub in the considered as fault in the yarn. But if the slub in the yarn introduced in the yarn at regular intervals with specified size, it becomes a value added yarn, which will fetch higher price per kg than that of normal yarn. For producing the slub in the yarn a retrofit arrangement the ring frame has to be done which provides intermittent drive to the front bottom roller of the drafting unit. Using this attachment various size of slub with different length intervals can be produced. Usually in ring yarn 3mm to 6mm slub size are produced with 25 to 40 slum/Meter of yarn. The specialty of slub yarn is that at the slub portion, the yarn twist level is almost zero and is of a twist less portion. Also the slub portion in the yarn is the weakest place in the yarn. So during dyeing process since the slub portion has zero twist, it absorbs more dye and produce more shade than the normal portion in the yarn. This brings a novelty appearance in the fabric. Now a days for making of denim fabric, upholstery fabric, furnishing fabric, home textiles the slub yarn is used. The main parameters of slub yarn such as slub length, slub distance, slub multiplier, base yarn count, twist level etc.., have an effect on the strength, elongation performance of the yarn as well as fabric. So far the slub yarn size and length characteristics has been analyzed using image analysis technique and simulation method. In this paper a collective abstract of research work done on yarn slub yarn quality and it character analysis has been dealt elaborately, which will be useful to understand the concepts for further work.

Keyword : *slub yarn , yarn count density, slub multiplier, slub length, slub size, drafting,*

1. INTRODUCTION

In textile spinning mill apart from producing carded and combed yarn using ring frame, the mills are now producing slub yarn. Basically slub in the considered as fault in the yarn. But if the slub in the yarn introduced in the yarn at regular intervals with specified size, it becomes a value added yarn, which will fetch higher price per kg than that of normal yarn. For producing the slub in the yarn a retrofit arrangement the ring frame has to be done which provides intermittent drive to the front bottom roller of the drafting unit. Using this attachment various size of slub with different length intervals can be produced. Usually in ring yarn 3mm to 6mm slub size are produced with 25 to 40 slum/Meter of yarn. The specialty of slub yarn is that at the slub portion, the yarn twist level is almost zero and is of a twist less portion. Also the slub portion in the yarn is the weakest place in the yarn. So during dyeing process since the slub portion has zero twist, it absorbs more dye and produce more shade than the normal portion in the yarn. This brings a novelty appearance in the fabric. Now a days for making of denim fabric, upholstery fabric, furnishing fabric, home textiles the slub yarn is used. The main parameters of slub yarn such as slub length, slub distance, slub multiplier, base yarn count, twist level etc.., have an effect on the strength, elongation performance of the yarn as well as fabric. So far the slub yarn size and length characteristics has been analyzed using image analysis technique and simulation method.

2. LITERATURE WORK

2.1: slub yarn quality

To achieve the minimum fabric abrasion with an optimization process on selected control factors of slub yarn descriptive parameters such as slub length, slub distance and slub thickness and yarn linear density (2).

Twill 1/3 woven fabrics were produced with these slub yarns and air permeability results were statistically analyzed. Optimum yarn parameters were determined for air permeability which was considered as nominal-the-better property according to the end-use purposes of the fabric. The analysis results showed that slub thickness had the most significant effect on air permeability (3).

In a research work it was theoretically discuss what happens to roller drafting when a roller speed is changed from time to time and found that the formation of the slub portion occurs somewhat later than the change in the roller speed. The correlation among such factors as the size and length of slub portion, the staple fiber length of fed sliver, and the duration of speed-change in the roller has been experimentally computed. Various characteristics of the slub portion, such as the distribution of its twist, its quantitative distribution, its strength and elongation have been experimentally computed (4).

Slub yarn which is manufactured on a spinning frame having a mechanism to speed up or slow down its roller speed from time to time. Theoretical study of the diameter distribution and the twist distribution along the slub length were established. The effects of the dynamical characteristics of the slub forming mechanism on both of slub diameter and twist distribution were investigated (5).

The effect of some important parameters like base yarn twist level, number of base yarn, twist direction and injected fibre components on injected slub yarn performance in terms of tensile strength and breaking elongation. In case of single base slub yarn, final yarn tenacity and elongation increases with the reduction of base yarn twist level keeping final yarn twist multiplier constant. However, the effect of base yarn twist level is marginal in case of injected slub yarn made with double base yarn. Yarn tenacity and elongation significantly higher in case of double base injected yarns as compared to single base injected yarn(7).

Based on the analysis on the impact of slub fancy yarn parameters on the mechanical and physical properties of flat knitted fabrics, it was found that the slub/meter had the most influence on all studied properties. The friction and bursting performance of the fabrics are improved through increasing the yarn slub/meter while, it decreases fabric pilling performance (10).

2.2: Slub yarn character analysis using Image processing

Slub yarn parameters were measured by using a capacitance-type sensor, and data was expressed as voltage signals through a data acquisition card (DAQ) installed in a PC (1), consequently, a repetition pattern of the slub yarn was determined by analyzing the 2D image using cluster analysis with an amended similarity-based clustering method.

To analyze the influence of slub yarn structure on air permeability of woven fabrics. Slub length, slub distance, amplitude of slub and yarn linear density were used as control factors to produce slub yarns with varying properties according to Taguchi L9 orthogonal design. Statistically significant descriptive parameters that have an effect on the breaking force and elongation of slub yarn has been studied using the full factorial design method. Slub yarn samples were produced by using a ring spinning frame on which an original slub attachment was designed and mounted. After the samples were produced, dimensional measurements and image analysis were made (6).

The overall yarn quality can be predicted Using artificial neural networks. The artificial neural network is trained to foresee only one response which is the Slub yarn quality index that includes all yarn responses. The definition of the yarn quality can be modified according to customer demands (8).

A novel method for manufacturing a ring-spun slub yarn through multi-channel drafting using a computer numerically controlled (CNC) ring spinning frame. The study reveals that increasing the slub multiplier increases the breaking force and the breaking elongation of the yarn due to the twist transfer from the slub to the base yarn. The increase of the slub length stabilizes the twist distribution and thus increases the breaking force and breaking elongation of the yarn (9).

The yarn diameter was measured by using digital image processing method (11) Methods such as smoothness processing, threshold value division and image repairing were used to obtain a clear digital image without yawp points and exactly measure the yarn diameter. Comparing with the actual yarn diameter, the computed yarn diameter accords with the actual diameter, which proves that the yarn diameter measured by image processing method is accurate, exactly reflects the appearance features of the yarn such as slub and neps.

Statistical models were developed using central composite experimental design of the response surface methodology to measure the slub yarn properties. Yarn's linear density, slub thickness, slub length and pause length were used as the key input variables while yarn strength, elongation, coefficient of mass variation, imperfections and hairiness were used as response/output variables. It was concluded that yarn strength and elongation increased with increase in linear density and pause length, and decreased with increase in slub thickness and slub length. Yarn mass variation and total imperfections increased with increase in slub thickness and pause length, whereas yarn imperfections and hairiness decreased with increase in slub length (12)

Factors of slub yarn descriptive parameters such as slub length, slub distance and slub thickness and yarn linear density has been considered for evaluating fabric abrasion resistance. The Taguchi experimental design technique, analysis of variance, and signal-to-noise ratio were used for the analysis. From the experiments, the optimum slub yarn descriptive parameters and yarn linear density values were determined which made a considerable improvement on the fabric abrasion resistance (13).

A computer-based system used for measuring slub yarn characteristics and evaluating the results using statistical methods. The measuring system was based on the electrical condenser of the Uster evenness tester as a measuring sensor. A digital storage oscilloscope was used to convert the analogue output signals into digital data to be recorded on a computer. By using a computer-designed program for signal analysis, the system is capable of measuring slub length, slub distance, slub thickness, number of slub per meter, percentage of slub length, percentage of base yarn length, and CV% of tested slub yarn and base yarn (14).

A new method is used for grading of yarn appearance based on yarn images of ASTM standard (section D 2255), by using an image processing technique and an artificial intelligence technique. Grading of yarn appearance is based on computer vision and analyzing the images of standard pictorial boards of yarn (15).

Size parameters of slub yarn were measured by using a capacitance-type sensor, and data was expressed as voltage signals through a data acquisition card (DAQ) installed in a PC. The voltage signals of the slub yarn were transferred to a two-dimensional (2D) image. The repetition pattern of the slub yarn was determined by analyzing the 2D image using cluster analyses with an amended similarity-based clustering method (16).

Yarn evenness in fabric (YEF) was measured using image processing technique. MAT lab software used to analyze the results (17).

A high-speed camera (HSC) with a proper magnification was used to capture the images of the yarn and a new robust algorithm was developed to analyze the massive amount of yarn pictures in a reasonable time. The collected data for the yarn diameter were analyzed and compared to the results of the commercial Uster Evenness Tester IV. The results of the HSC were very comparable to the results of Uster and they were able to detect the short term, the long-term, and the periodic variation of the yarn diameter (18).

To analyze the parameters of slub yarn from sequential images accurately, an automatic image mosaic method is used. a series of overlapping yarn images, which are captured from a moving slub yarn, are stitched into a panorama automatically. Background subtraction, image segmentation and judgment template traversal methods are applied to preprocess the sequential images for obtaining a test image. The experimental results show that the proposed method can find the match position accurately and is highly consistent with the manual method (19).

A new method for recognizing the parameters of slub-yarn based on image analysis has been proposed. The slub yarn was wrapped on the surface of the black board by YG381 Yarn Evenness Tester. A high resolution scanner was used to acquire the yarn image. Gray stretching and thresholding were carried out to preprocess the image of slub yarn. The experiment indicated that the method can identify the parameters of slub yarn with satisfactory results (20).

An analytical method used for determining slub yarn geometrical parameters based on a 2D visualisation image of a slub yarn. The method can be used to adjust the slub yarn mechanism by comparing experimental results with the setting used. Geometrical size data of slub yarn are acquired by DAQ (Data Acquisition Card), and expressed as voltage signals. According to the experimental results, the slub length is longer and the slub distance shorter than the values set for the mechanism of the spinning frame (21).

Study on the properties of yarn and fabric (Mechanical and low stress mechanical properties) and to analyze the effect of yarn linear density, effect of slub length on fabric properties by conducting series of tests in both the stages (in both yarn and fabric stages) and to find the suitable application (Sheeting fabric) (22).

Theoretical study of the diameter distribution and the twist distribution along the slub length were established. The effects of the dynamical characteristics of the slub forming mechanism on both of slub diameter and twist distribution were investigated (23).

The effect of some important parameters like base yarn twist level, number of base yarn, twist direction and injected fibre components on injected slub yarn performance in terms of tensile strength and breaking elongation were studied. Results also showed that the twist direction in the base and final yarn influence the strength and elongation of injected slub yarns (24).

CONCLUSION:

An elaborate study on the properties and characteristics of slub yarn was made by going through the past research work conducted by various authors. Various research work on the effective way of image processing method to analyze the slub parameters like slub length, slub diameter and slub interval has been studied.

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