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Effect of Cotton Yarn Imperfection Index on CSP

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Abstract:-The process by which fiber is transformed into yarn is affected by a number of factors. These include the nature of the raw material, the technical sophistication of the machinery, and the expertise of the operators. More than half of the retail price of ring spun yarn comes from the cost of the raw materials, making this an important consideration in cotton fiber spinning. However, defects in the yarn (neps, thick and thin patches) are a critical yarn parameter that affects both the processing of the yarn and the fabric, as well as quality factors. The relationship between yarn defects and fiber properties has been investigated. The imperfection index of yarns is abbreviated as "IPI". Yarn defects are the sum of the percentage of thin spots (-50%), thick spots (+50%), and neps (+200%) found in one thousand meters of ring-spun yarn. In this case, a thin place of -50% indicates that the cross-section of the yarn at the thick place is no more than 50% of its mean cross-section. A +50% thick spot indicates that the yarn's cross section at the thick spot is at least 150% of its mean cross section. The neps cross-section is at least twice as large as the yarn's average cross-section if the value is +200% Neps. Both in the upstream manufacturing stage and the final product, flaws can be a source of frustration and annoyance. The Count Strength Product is the result of multiplying the lea strength in Ibs by the count (English System) (CSP). A wrap reel with a circle of 1.5 yards covers a 120-yard area. Traversing mechanism included into the reel reduces yarn bunching. These leas are conditioned in a standard environment (27 degrees Celsius, 65% relative humidity) while being hung from a skein holder to relax. The breaking load is measured in pounds by using a lea strength tester, which is a pendulum type with a constant rate of traverse and a moving clam that travels at a consistent pace of 12 inches per minute. Once the yarn's strength has been evaluated, the CSP may be computed by multiplying the yarn's mean lea strength by its mean count.

Keywords:- *Yarn Imperfection; Neps; CSP; Breaking Load; Ring Spun Yarn.*

I. INTRODUCTION

Yarn is a long, continuous length of interwoven fibers that can be put to many uses. Yarn is made by drawing out and twisting together fibers from plants, animals, or synthetic materials, a process called spinning. The production of yarn harkens back to the early nineteenth century, when Ring Spinning provided the technological basis for its practical realization. As compared to undyed cotton, a greater proportion of damaged fibers result from flock dyeing and the subsequent mechanical procedures. As opposed to rotor spinning, which has issues with the deposition of detached particles on the rotor groove, the spin ability of melange yarns is higher in the ring spinning method [1]. Adding more coloured viscose to melange yarn has reduced the yarn's irregularity, imperfection, strength, and elongation. In contrast, the high percentage of viscose fiber in the melange yarn significantly raised the fabric's GSM. The more even the yarn is spun, the higher the spindle speed should be, ideally around 15500. Yarn elongation has decreased as spindle speed has increased. A faster spindle speed results in a stronger melange yarn with a lower viscose content. The imperfection index of yarns is abbreviated as "IPI." Imperfections can be defined as thin, thick spots, or neps per one thousand meters of yarn [2]. For the purpose of determining the IPI of yarns based on the results of several yarn evenness criteria, an Evenness Tester is required. What we call a flaw is the sum of all the neps, thick spots, and thin spots in a given length of yarn. Defects that fall within the measurement sensitivity range of the USTER evenness tester (50 percent with respect to the mean value of yarn cross-section size) are indicated by thin and thick patches, whereas neps are classified as flaws in the yarn that may exceed the 200% limit. The quality of both the yarn and the fabric produced from ring spun yarn suffers when flaws are present [3,4]. Cloth made from yarn with more faults will be weaker, of lower appearance grade, and have poor weaving performance. There was found to be minimal correlation between the mass of thick regions and neps and their size [5]. Reports indicated a positive correlation between their size and the presence of the thin areas. Thicker than previously thought, as discovered by researchers. The importance of neps size has been the subject of a great deal of research [6,7]. They developed a nep size prediction model in an effort to pinpoint the problematic nep size in cotton ring spun yarns. A model of the effect of yarn thickness on the processing and quality attributes of fabric was established by Seyam and El-Shiekh [8] using weft with random and period thickness fluctuations. They mentioned how the characteristics of the fabric changed when there were thick spots in the ring spun yarn. Maximum cover factor of a weavable fabric is predicted to be lower when using irregularly thick filling yarn compared to when using filling yarn of normal thickness with the same average count, as predicted by the model. According to reports, the model was successful in predicting how the existence of fiber clusters and fiber clusters containing foreign matter would affect the influence of yarn thickness on fabric quality. There have been several published research on the effect of fiber type, spinning method, and machine settings on yarn flaws [9]. W klein et al [10] built an empirical model that can be used to analyze the transformation of fiber into yarn. The

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model showed some good prediction efficiency, thus it might be employed provided the challenges related with the high degree of knowledge necessary in the model's design can be surmounted. Other models used to investigate the impact of fiber quality on yarn faults include the Artificial Neural Network (ANN) and the Adaptive Neuro-Fuzzy Inference System (ANFIS), both of which have been reported to have greater prediction efficacy when compared to statistical approaches. Although ANN and ANFIS have been used extensively to investigate the connection between yarn and fiber quality [11], they do not yet provide a comprehensive and easily digestible explanation for this connection. This means that either the current statistical methodologies need to have their operation improved so that they produce more accurate forecasts, or new yarn prediction models need to be developed. Furthermore, a combined strategy could be considered. Statistical methods were employed here to model the effect of fiber qualities on imperfections in the yarn. Materials and methodsThe statistical models were then used to predict the yarn flaws using Monte Carlo simulation [12,13].

A. Fibre Used in the Study

In the study two types of fibre was used such as Cotton Fibre, Shankar 6 super. Cotton fibres have a multilayered structure that has been studied for nearly a century. The structure of the primary cell wall of the cotton fibre and particularly the outer surface layer (the cuticle), has a major influence on fibre properties, processing and use. Shankar 6 fibre is the best quality cotton available only in Saurashtra Region of India. We purchase and process this category of cotton.

B. Processing of Spinning (Carded-Blended):

Carding is a mechanical process that disentangles, cleans and inter-mixes fibres to produce a continuous web or sliver suitable for subsequent processing. This is achieved by passing the fibers between differentially moving surfaces covered with card clothing. The major steps involved in Spinning (Carded-Blended) following out. These 8 slivers (82 grain/yd.) were passed through the breaker draw frame. Then delivered slivers (Each of 75 grain/yd.) fed to Finisher draw frame. From them 10 slivers (each of 70 grain/yd.) were taken. These 10 slivers were fed to simplex. From it 10 roving's (0.78 Ne)) were manufactured and creeled to the ring frame which is of 10 particular spindles. From the ring frame 10 ring cops of 26Ne LGM 05%, LGM 10%, GM 15%, and 100% cotton yarn was spun. Finally, for testing all spun yarns were taken to QC dept. Yarn twist: The digital twist tester's opposing twist method was used to measure the yarn twist. This reduced the random error of the mean value to under 2%.

According to the measurements for each yarn's irregularity (U%), coefficient of variation in mass (CVm%), thin places/km (50%), thick places/km (+50%), neps/km (+280%), and hairiness have various values depending on the degree of imperfection. As it can be seen that the strength of the yarn was tested using a 50 cm dimension on a universal yarn strength tester. The speed of the clump was 120 mm/min, and the diameter of each yarn was estimated using equation (3) as shown before. The linear densities of each yarn, which were gathered from several open-end mills, were provided, and the level twists were noted during the machine's real manufacture. -e properties of the fabric are measured, and in this regard, the thickness of the fabric varies because the degree of each yarn's imperfection varies; in fact, there are many possible explanations; however, in this paper, the warp and weft density are the same for all fabrics regardless of other restrictions. From table 1 shown that the 40 count different types of yarn result on CSP. Similarly Figure 2 and 3 shows the 60, 80 count yarn effect on CSP.

Table 1: 40 count yarn imperfection effect on CSP

Count	IPI	CSP
40/1 CWC GIZA	31	3915
40/1 CWC Fashion	584	2605
40/1 CWC Home	49	2826
40/1 Card	67	2732

Table 2: 60 count yarn imperfection effect on CSP

Count	IPI	CSP
60/1 CWC GIZA	83	3518
60/1 CWC Fashion	145	2828
60/1 CWC Home	257	3142
60/1 Card	234	2645

Table 3: 60 count yarn imperfection effect on CSP

Count	**IPI**	**CSP**
80/1 CWC GIZA	266	3236
80/1 CWC Fashion	254	3456
80/1 CWC Home	614	2719
80/1 Card	489	2459

II. RESULTS AND DISCUSSIONS

Imperfection of Index and count strength product (CSP) Values are more important for yarn manufacturing. These values are related with each other. If Imperfection of Index are increase then count strength product (CSP) are decrease. For producing good quality of yarn we should control Imperfection of Index of yarn accurately. From figure 1, it can be observed that the yarn imperfection of cotton, 40 count yarn in different types has an significant effect in count strength product. Giza, Home, fashion and carded yarn for 40 count shows that CWC giza exhibits highest CSP and others are on average. It would be due to the IPI value 31 which is very low comparing to others processed yarn. So the lower the yarn imperfection value upper the CSP.

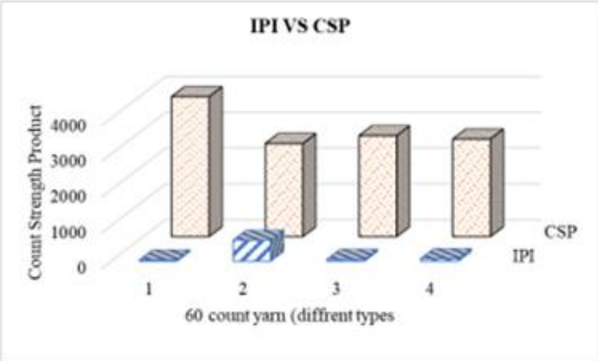

Fig 1. 40 count yarn imperfection effect on CSP

From the figure 2. Illustrates that 60 count yarn IPI value also has great effect on CSP. The lower the IPI the CSP value becomes higher due to the good quality of yarn. From figure 2, it also can be observed that the yarn imperfection of cotton, 60 count yarn in different types has an significant effect in count strength product. Giza, Home, fashion and carded yarn for 60 count shows that CWC giza exhibits highest CSP and others are on average. It would be due to the IPI value 83 which is very low comparing to others processed yarn. So the lower the yarn imperfection value upper the CSP.

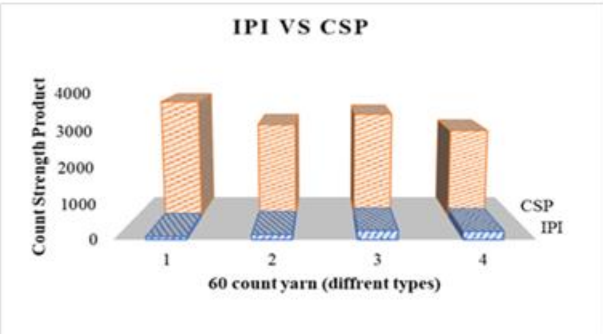

Fig 2. 60 count yarn imperfection effect on CSP

From the figure 3, shows that 80 count yarn IPI value also has great effect on CSP. The lower the IPI the CSP value becomes higher due to the good quality of yarn. From figure 3, it also can be observed that the yarn imperfection of cotton, 80 count yarn in different types has an significant effect in count strength product. Giza, Home, fashion and carded yarn for 80 count shows that CWC giza exhibits highest CSP and others are on average. It would be due to the IPI value 83 which is very low comparing to others processed yarn. So the lower the yarn imperfection value upper the CSP. But in this case the exceptional case is that CWC Home yarn CSP is higher even though the IPI is also high. It could be happen due to the yarn processing system has been changed abruptly to find out the IPI value of the processed yarn. Overall results can be concluded that the yarn imperfection data has an effect on count strength system to compare the study also proves that same count yarn but different processing system can be simply changed the overall performance of the yarn and this is research addition for the next step justify the yarn quality.

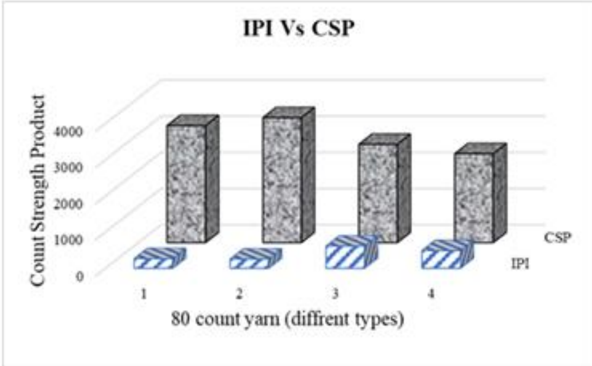

Fig 3. 80 count yarn imperfection effect on CSP

III. CONCLUSION

Finally, it was found that 40 count shows that CWC giza exhibits highest CSP and others are on average. It would be due to the IPI value 31 which is very low comparing to others processed yarn. So the lower the yarn imperfection value upper the CSP. Similarly, 60 and 80 count yarn consisting the same trends of IPI value 83 and 266 which is very low comparing to others processed yarn CSP value. So the lower the yarn imperfection value upper the CSP.

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