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Influence of Gas Yarn Singeing On Viscose Spun Yarn Characteristics

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Abstract: *Viscose spun yarnhas more hairiness and poses problem in the subsequent processes like yarn dyeing, fabric production and fabric processing due to protruding of hairs. In this research work, an attempt has been made to singe the viscose spun yarns of most commonly used yarn counts. Its influence on yarn quality characteristics were compared and studied with its parent un-singed yarns. It has been found that the primary objective of hairiness reduction was well achieved with singeing processes; however there isan impact on other quality characteristics such as yarn imperfections, tenacity and yarn elongation. There is overall improvement in yarn imperfection results by singeing process. Yarn tenacity is also improved after singeing, but there is drop in yarn elongation due to singeing.*

Keywords*: Viscose, hairiness, singeing, spun yarn, quality characteristics, tenacity, elongation*

I. Introduction

Yarn singeing is one of the surfaces finishing for value addition of textile goods.Viscose despite being man made cellulose fibre and comes with precise 'cut length' with zero short fibre content, yet displays more hairiness when viscose yarn is produced through ring spinning route. Hence it assumes importance to remove hairiness for better fabric quality and enhanced dyeing and printing clarity. In this study, viscose spun yarn of 3 different counts were singed on Gas yarn singeing machine so as to get the final viscose spun yarn of counts Ne 20/1, Ne 30/1 & Ne 40/1, which are most commonly used. The gas yarn singeing machine parameters like mixture of Air- Gas ratio, working pressure of air, gas andmachine speeds were considered accordingly to achieve the desired yarn countfor better comparison and evaluation with normal unsinged viscose spun yarn.

II. Materials and Methods

100% single viscose ring spun yarns of 3 different counts were selected and singed on gas yarn singeing machine to get the final singed yarn count of Ne 20/1, Ne 30/1 and Ne 40/1.The singeing process parameters were optimized for different yarn counts based on trials. 3 different machine speeds of 650, 750 & 800 M/Min were considered for trials and found that at higher speeds of 800 M/Min, the yarn breakage rate was high at 0.6 breaks/lakh meters on all the yarn counts, hence not considered for further tests. The Gas and Air pressure is kept at 1 kg/cm^2 and 0.28 kg/cm^{2}respectively and Gas & Air mixture is kept in the ratio of 1:30 (v/v) based on flame quality of "blue & star shaped', which is the best for effective singeing. The various process parameters at speeds of 650 M/Min and 750 M/min were tried and are shown in figure below:

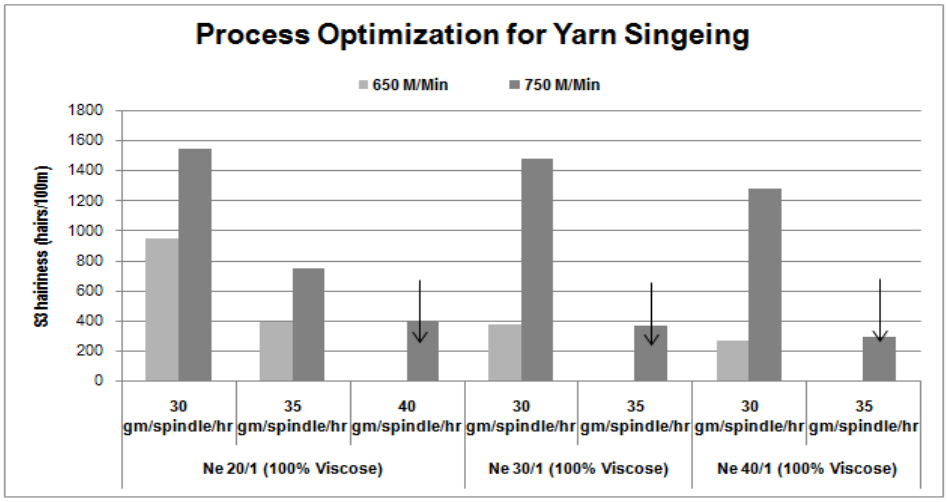

Fig 1: Process optimization for Gas Yarn singeing on 100% Viscose yarn

The 'down arrow' shows the optimized parameters for Ne 20/1, Ne 30/1 and Ne 40/1, 100% viscose ring spun yarn.

The optimized process parameters are summarized and tabulated as below:

Sl No	Parameters	Details		
1	Counts	Ne 20/1	Ne 30/1	Ne 40/1
2	Speed, M/Min	750	750	750
3	Gas Consumption, gm/spindle/hr	40	35	35
4	Gas Pressure (Kg/cm²)	1 (14.2 PSI)		
5	Air pressure (Kg/cm²)	0.28 (4 PSI)		
6	Gas : Air Volume ratio	1 : 30		

Table 1: Optimized process parameters

Thequality characteristics of singed yarns were compared with its parent unsinged viscose spun yarn. The yarn quality characteristics were tested on Zweigle Hairiness Tester (G 567), Uster Tester (UT5) and UsterTenso Rapid Tester.

III. Results and Discussions

The yarn quality characteristics such as hairiness, yarn irregularities, imperfection values, and tenacity and elongation values were tested and analyzed and discussed as below:

Yarn hairiness:

The yarn quality characteristics of singed and unsinged viscose spun yarns were analyzed and givenas below:

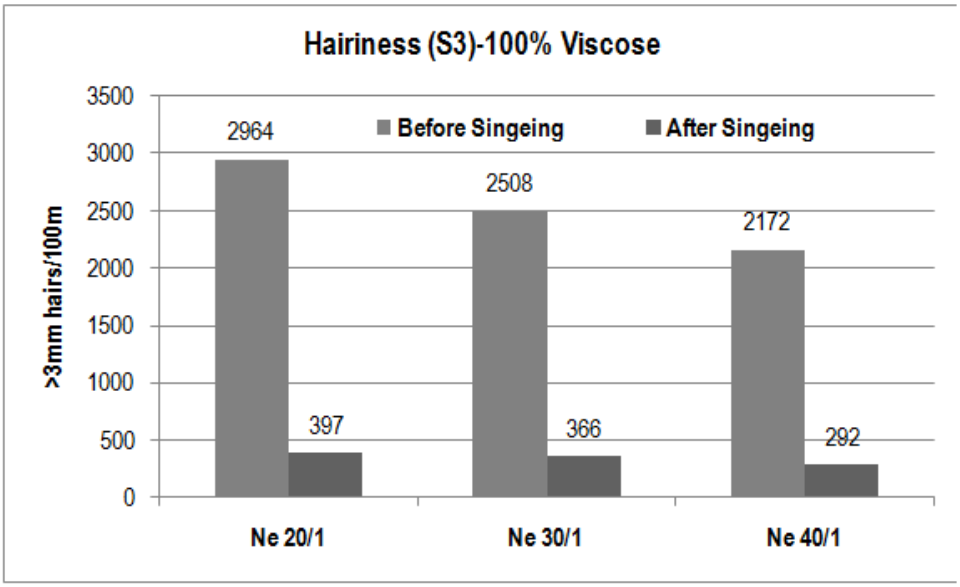

Fig 2: Hairiness values for 100% Viscose yarn before & after singeing

As expected, it is quite obvious that after singeing the protruding hairs were removed from the yarn surfaces and showed much reduction in hairiness value on all the yarn counts. The hairiness reduction on all counts was in the range of 85.4% to 86.6%.However, the weight loss % reduced with finer counts and the details of weight loss% for different yarn counts are shown in the table below:

Sl No	Parameters	Details		
1	Count	Ne 20/1	Ne 30/1	Ne 40/1
2	Weight Loss %	7.6%	7.0%	6.3%

Table 2: Weight loss % for different yarn counts

Finer the count, lesser the weight loss %. The reduction in weight loss may be due to lesser amount of fibres in cross section with finer counts.

Yarn Unevenness:

The yarn unevenness is shown in figure 3 below. It is observed that the yarn unevenness level was higher after singeing on all the experimented yarn counts, which supports the study conducted by Zhigang Xia et al[2]on cotton.

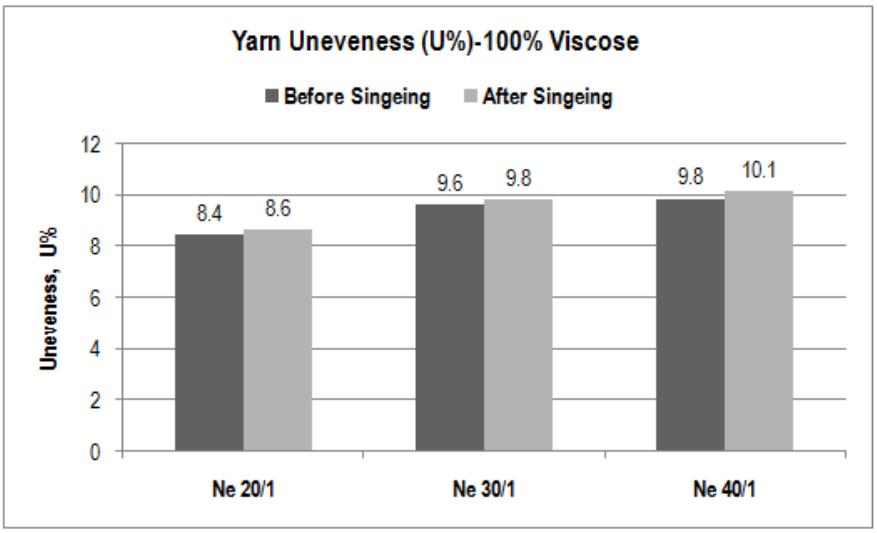

Figure 3: Yarn evenness values for 100% viscose yarn.

Yarn unevenness is mainly made up of 2 parts i.e basic body unevenness and hairiness unevenness. Therefore, removal of hairiness from the yarn surface worsens the evenness of yarn. It also clarifies that singeing will not improve yarn unevenness.

Yarn Imperfections

The figure 4 shows the imperfection values of all the 3 different yarn counts before and after singeing and this show that there is no change in the value of thin places on all the yarn counts. However, there is drop in value of thick places and nepson singed yarn of all the counts.

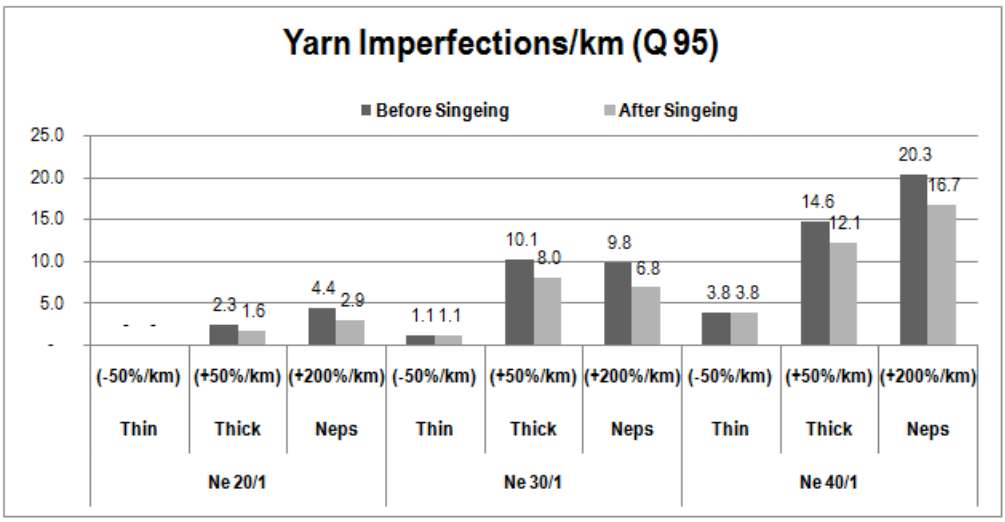

Figure 4: Yarn Imperfection values for 100% viscose yarn.

The drop in thick places varies from 17% to 30% and higher drops in value with coarser yarns. There is reduction in neps to the tune of 17.7% to 34% and lesser neps reduction with finer counts. Hairiness is responsible for neps due to snarling of hairs and removal of hairiness helps in reduction of neps [2]. There is overall reduction on imperfection level, which varies from 15.8% to 32.8% and lesser values with finer yarns. The reduction on value is due to lesser number of fibres in cross section of finer counts.

Yarn Tenacity

Figure 5 shows the yarn tenacity values of 3 different counts before and after singeing. It shows that there is gain in yarn tenacity to the level of 7.6% on Ne 20/1, 8.8% on Ne 30/1 and 3.9% on Ne 40/1. This increase in tenacity may be attributed to improvement in compactness of fibre structure, which has more loads bearing capacity. Ne 40/1 showed lesser increase, may be due to lesser fibres in cross section.

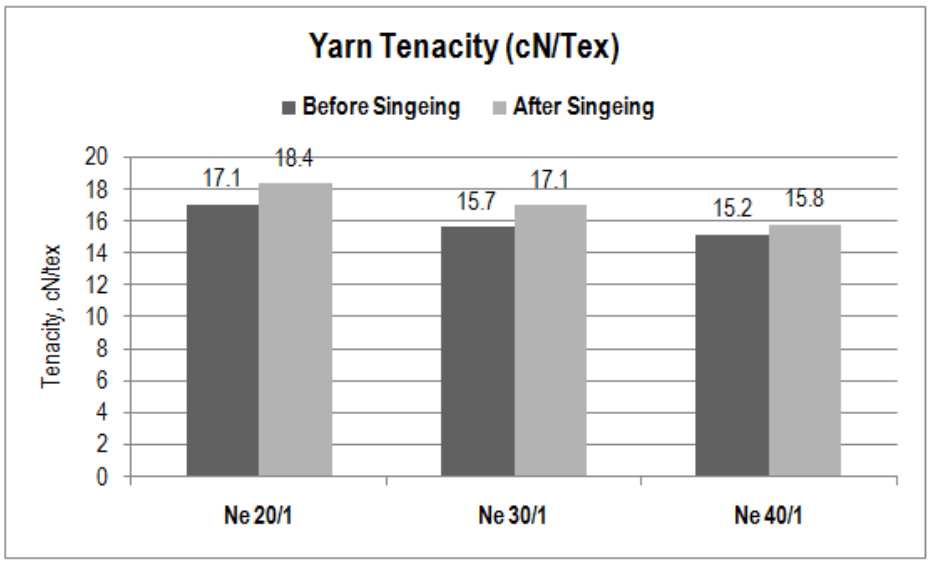

Figure 5: Yarn tenacity values for 100% Viscose yarn.

Yarn Elongation

Figure 6 shows elongation values of different yarn counts before and after singeing. There is elongation drop of 13.1% on Ne 20/1, 12.4% on Ne 30/1 & 11.9% on Ne 40/1.

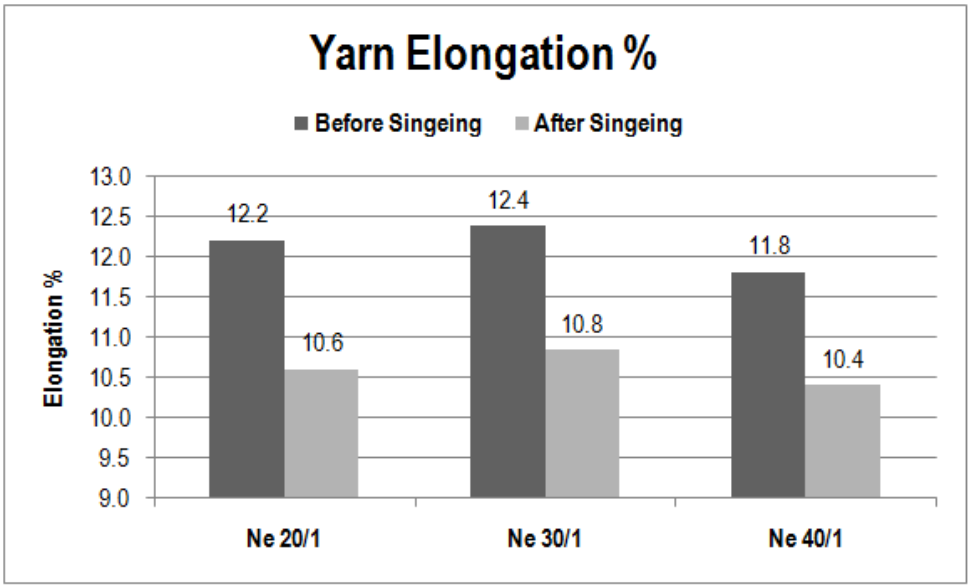

Figure 6: Yarn elongation values for 100% Viscose yarn

There is general drop in yarn elongation after singeing due to missing of hairs and no interlocking of hairs. The hairs present in the unsinged yarn also needs some extra load and hence the unsinged yarn showed more elongation values than singed yarns. When the load is applied, the singed yarn breaks in short time without much elongation than the unsinged yarn.

IV. Conclusions

It is evident that yarn singeing process helps in reduction of yarn hairiness to huge extend and by S3 value the hairiness reduction is up to 86%. The weight loss % is less with finer counts for the approximately similar hairiness reduction values due to lesser number of fibres in cross section.There is trend showing higher Unevenness values after singeing on all the counts; however, There is reduction on over all imperfection values, which is mainly due to reduction on thick and neps values. There is no change in thin values due to singeing. There is drop in yarn elongation after singeing due to missing of hairs and singed yarn breaks faster than unsinged yarn, however, the tenacity values show improvement after singeing on all the counts.

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