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An Analysis of Quality Characteristics of Bamboo/Cotton Blended Yarns of Rotor and Ring Spun

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Key Words
Denim
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Abstract

Denim fabrics are in general manufactured by using 100% cotton fibers. A novel attempt has been made by using bamboo/cotton yarns in warp and weft directions to produce denim fabrics using ring yarns in warp and rotor yarns in weft directions. In this research work, bamboo/cotton yarns are manufactured in different blend compositions like 100% bamboo, 100% cotton,70:30, 50:50 and 30:70 ratios. Ne 10 and Ne 16 carded yarns aremanufactured from both the ring and rotor spinning systems. The yarns manufactured out of these two spinning systems have been critically analyzed for their quality characteristics like Unevenness, Imperfections, Hairiness, friction, abrasion, strength and elongation. The influence of blend ratios on yarn quality characteristics in ring and rotor yarns has been analyzed and the optimum blend proportion which gives the best quality has been investigated.

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1.Introduction

Denim is of the most prominent category in India's garment sector. The denim market in India is skewed towards men's segments with 80 percent contribution coming from it. Women's denim sector contributes 12 percent to the market and the children's wear contribute the rest 8 percent. Furthermore, only 100% cotton of coarser counts are used for the manufacture of denim fabrics. Bamboo fabric has a natural sheen and softness that feels and drapes like silk but is less expensive and more durable.

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Bamboo clothing is easy to launder in a clothes washer and dryer. Because of the smooth and round structure of its fibers, bamboo clothing is soft and non-irritating, even to sensitive skin because of the smooth and round structure of its fibers. In this research work, bamboo fibers and its blends with cotton has been tried to produce the denim fabrics. In this researchwork denim fabric made out of 100% bamboo yarns,100% cotton in both the ring spun and rotor spun and its blends with cotton of different blend ratios like 70:30, 50:50 and 30:70. The objectives of the work is to study the antimicrobial properties, wear ability studies and offer suitable recommendations with special reference to the blend composition and finishing treatments.

2.Materials and Methods

Ne 10 and Ne 16 carded yarns of 100% cotton and blends of bamboo/cotton spunin rotor spinning system in the modern machineries for the production of denim fabrics. The rotor yarns are manufactured with a rotor diameter of 40 mm , rotor speed of 70,000 rpm and the opening roller speed of 8000 rpm. . The yarns produced were tested for their physical properties in the testing laboratory. The yarn samples were conditioned in the testing atmosphere of 65%RH and 25°C to get reliability in the results. The fibre properties of the cotton and bamboo fibers are shown in the Table 1. **(**ASTM D 3822/D 3822 M – 14).

Table1. Fibre properties of Cotton and Bamboo fibers

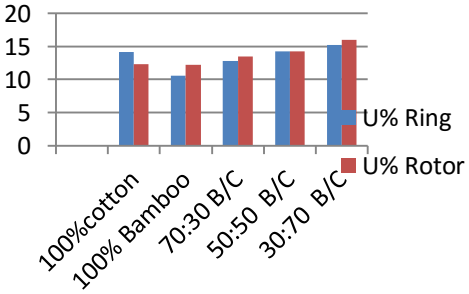
Fibre properties	Cotton	Bamboo
Fiber length (mm)	26 to 31	40
Fibre strength (g/tex)	22	27
Fibre denier	1.5	1.27
Fiber elongation (%)	6	18.35

Table 2.Fibre blend ratios of Bamboo and Cotton yarns

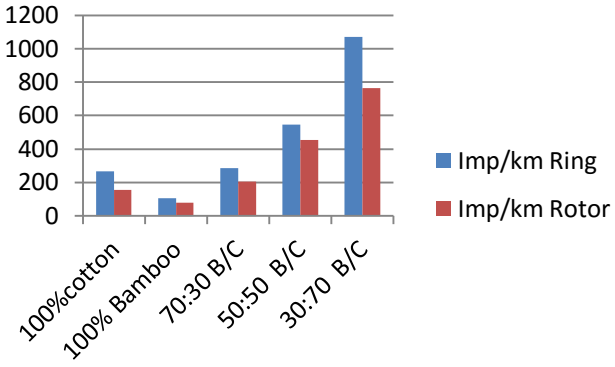
Fibres	Blend Ratio	Count spun	Spinning system
Bamboo	100%	Ne 10 & Ne 16	Ring and Rotor
Cotton	100%	Ne 10 & Ne 16	Ring and Rotor
Bamboo/ Cotton	70%:30%	Ne 10 & Ne 16	Ring and Rotor
Bamboo/ Cotton	50%:50%	Ne 10 & Ne 16	Ring and Rotor
Bamboo/ Cotton	30%:70 %	Ne 10 & Ne 16	Ring and Rotor

3. Results and Discussions

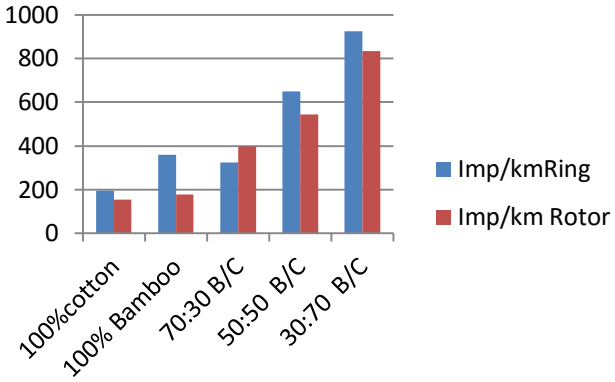
The mechanical processing of the 100% cotton, bamboo/cotton blends manufactured to produce carded yarns in rotor spinning systems have been studied The physical properties of the yarns in terms of Unevenness percentage (U%), imperfections like thin places, thick places, neps and other quality attributes like hairiness values, friction and abrasion characteristics of the yarns have been dealt in the following sections.



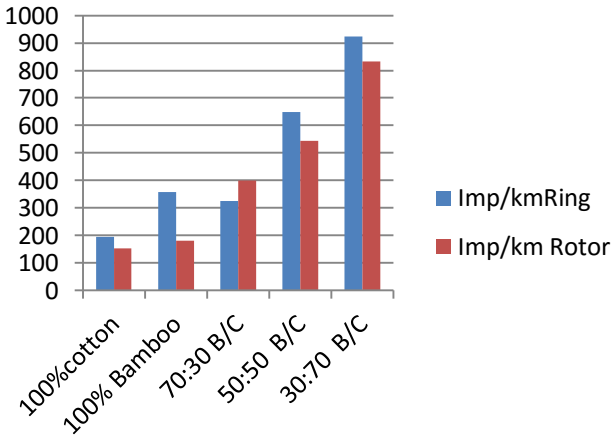
Graph 1. Yarn unevenness(U%) and for Ne 10 ring and rotor spun yarns.



Graph 2.Imperfections/km of Ne 10 for Ring and Rotor spun yarns.



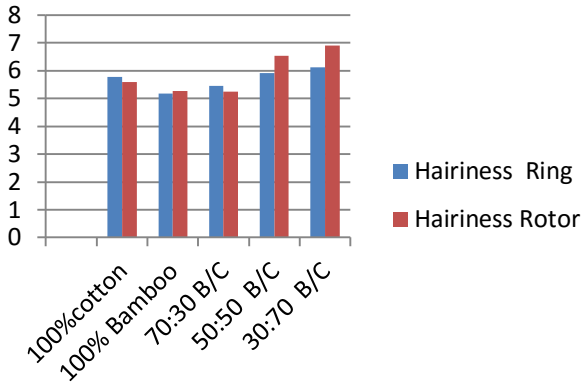
Graph 3. Unevenness (U%) of Ne 16 for Ring and Rotor spun yarns



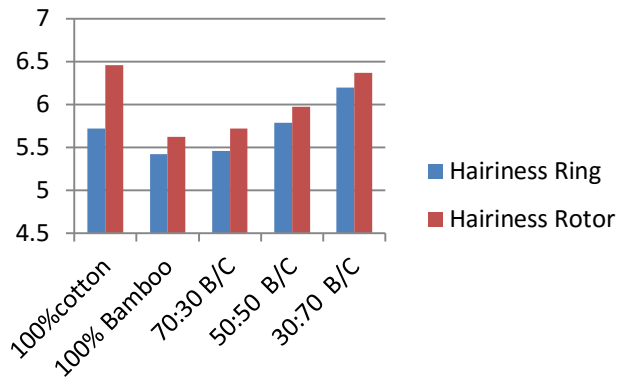
Graph 4. Imperfections/km of counts Ne 16 ring and rotor spun yarns

From the Graph 1,2,3&4. For the counts Ne 10 and Ne 16 rotor spun yarns, the unevenness (U%) level and the imperfection values that is mass variation per unit length is lower in 100% bamboo yarns and in the blend of 70:30 bamboo/cotton blended yarns. for rotor spun yarns. This is attributed to the better uniformity in

fiber length and no short fibers in bamboo fibers. In the other blends except 70:30 B/C, other blends show higher unevenness values. It means the increase in proportion of the natural fiber cotton which is influenced by higher proportion of short fibers and variation in fiber length uniformity. This is also reflected in the imperfection values in the yarns.



Graph 5.Hairiness values of the Ne 10 100% for ring and rotor

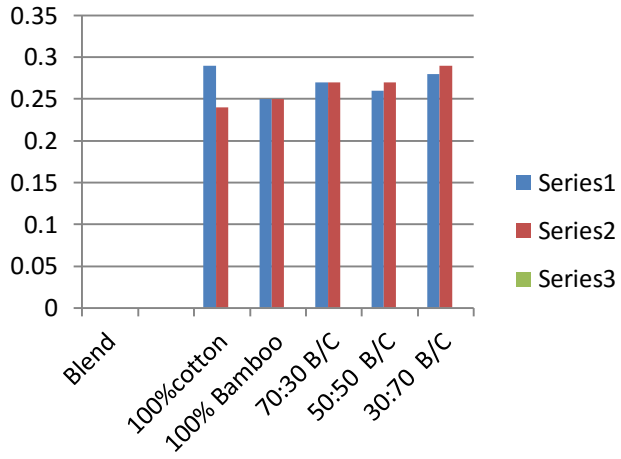


Graph 6.Hairiness Index for Ne 16 ring and rotor spun yarns.

From the Graph 5& Graph 6, Hairiness is defined as the number of protruding fibers from the body of the yarn after the yarn structure is formed. It affects many properties like fabric appearance, running performance in weaving and knitting. Lower the hairiness value better will be the yarn quality and fewer problems will be encountered in the downstream processes. It is observed that the hairiness values of 100% bamboo yarns of Ne 10 and Ne 16 exhibit lower hairiness values than 100% cotton and also with the various blend ratios. It is attributed to the absence of short fibers better yarn irregularity and uniformity in the bamboo fibers and also better binding of fibers in to the yarn structure which is responsible for the lower hairiness values.

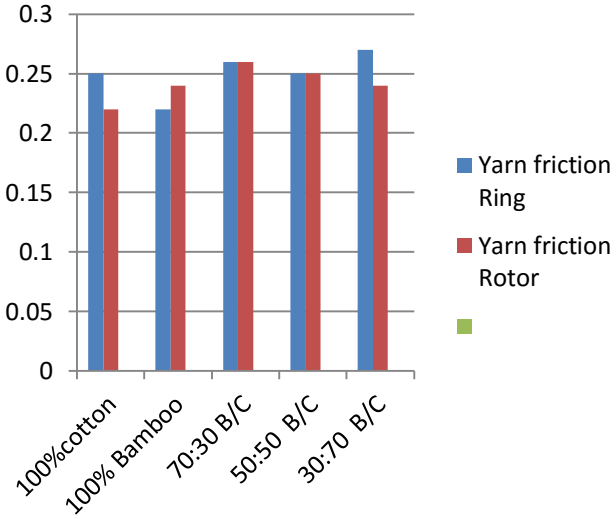
Yarn friction test results of the rotor spun yarns are tested in Lawson-Hemphill tester and the results are shown in the Graph 7.

Yarn abrasion is defined as the ability of the yarn to withstand the abrasive action in the subsequent processes like weaving, knitting. It is evaluated by subjecting the yarn to abrasive cycles and the number of strokes required to break the yarn samples. Higher the abrasive values, higher will be the abrasion resistance of the yarns.



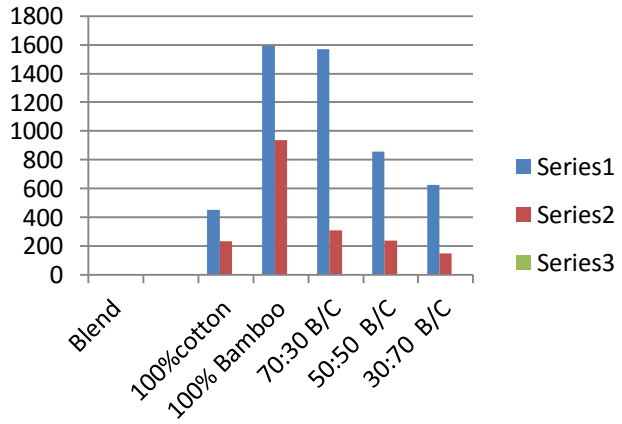
Graph 7. Yarn friction values for Ne 10 ring and rotor spun yarns.

The yarn friction values for the count Ne 10 for ring and rotor yarns show that there is only marginal difference in the friction values for bamboo and its blends. It is due to the presence of surface irregularities on the cotton fibers and unwaxed.

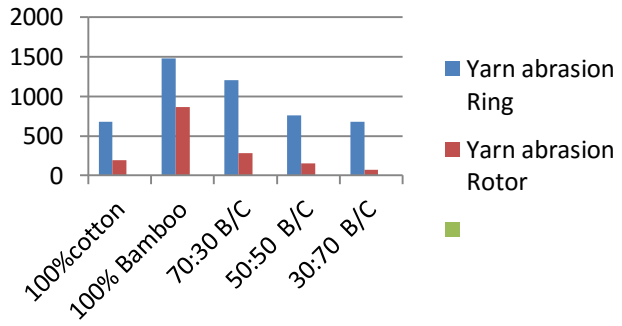


Graph 8. Yarn friction results for Ne 16 ring and rotor spun yarns.

Yarn abrasion test results of cotton and bamboo/cotton blends are shown in the Graph 9.



Graph 9. Yarn abrasion test results for Ne 10 ring and rotor spun yarns.



Graph 10.Yarn abrasion values for Ne 16 ring and rotor spun yarns.

From the Graph 9 &10, the abrasion resistance of 100% bamboo fibers shows higher abrasion resistance than its counterparts. It is due to the regenerated fibres which has higher strength and elongation and capable of resisting the abrasive cycles even at higher speeds than the 100% cotton fibers.

4. Conclusions

The influence of the bamboo fibers in the blends have a greater impact on yarn characteristics for the two counts of Ne10 and Ne 16 spun on rotor spinning systems. Yarns spun out of 100% bamboo fibers and 70:30 blends in rotor spinning systemshow better unevenness and imperfection values by 38% and 34% than the ring spinning system. In rotor spinning, due to the back doublings in the rotor and less process stages, the imperfections are lower as compared to ring spinning system which has more process stages and influence of drafting irregularities in every stage. This trend is observed in Ne 16 count also. Hairiness values are better in ring spun yarns of 100% bamboo fiber and in blend ratio of 70:30 which is due to the better binding of fibers in the spinning process and with higher fiber length uniformity. The difference in hairiness values spun on ring and rotor system is in the range of 2 to 4%.There is no significant difference in the yarn friction values of all the materials like cotton and bamboo blends which shows the surface irregularities in both the fibers. Good abrasion resistance values of 100% bamboo fibers and in the blend of 70:30 bamboo/cotton blends of 43% and 34% in ring spun yarns than the rotor spun yarns in both the counts.This is due to the better binding of fibers in to the yarn core and higher yarn strength due to the helical twisting of all the fibers in to the yarn core .

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