EMERGING FIBER OF THE CENTURY- BAMBOO

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ABSTRACT

In the last few years in the world market, more and more products from so-called bamboo fibers have been produced. In the media, a campaign promoting their advantages is underway, which encourages companies to elevate the prices of the “new” product. As a grass, bamboo can grow in very hard conditions without any need of pesticides and herbicides. Bamboo is the fastest growing plant in the world - some species grow even one meter per day. It is one of the fastest growing plants and available in abundance in many counties. Because of being naturally abundant, cheap and also ecological Bamboo fiber has gained in popularity in the production of a wide range of knitted fabrics in recent years. It is very common to blend existing fiber types to acquire fabrics with enhanced performance and improved aesthetic qualities as well as low cost. Bamboo fiber is frequently being used in blends with Cotton in textile industry. Since Bamboo fiber resembles like Cotton in its cellulosic structure, Bamboo together with cotton fiber will be compatible blends. This paper discusses about the emergence of bamboo as a fiber.

Keywords: Bamboo, Fiber, Cotton, Blend and Textile Industry.

INTRODUCTION

Bamboo fiber is a kind of regenerated cellulose fiber, whose production is from Bamboo pulp. It is one of the fastest growing plants and available in abundance in many counties. Because of being naturally abundant, cheap and also ecological Bamboo fiber has gained in popularity in the production of a wide range of knitted fabrics in recent years. It is very common to blend existing fiber types to acquire fabrics with enhanced performance and improved aesthetic qualities as well as low cost. Bamboo fiber is frequently being used in blends with Cotton in textile industry. Since Bamboo fiber resembles like Cotton in its cellulosic structure, Bamboo together with cotton fiber will be compatible blends.
The amount of positive aspects of bamboo fibers is quite exceptional:

- Natural antibacterial and antifungal properties, making clothes made from bamboo fibers hygienic and odour resistant. However, this effect starts after fifty washings;
- Smoothness, proving bamboo fibers to be non irritating for sensitive skin;
- Bamboo fabric is soft and silky with a natural sheen, making it close to natural silk but less expensive and more durable;
- Hypoallergenic and deodorant properties;
- High water absorption and fast drying caused by a high amount of microcracks and grooves on the fiber’s surface;
- Higher breathability and thermo regulating properties than cotton and even hemp. They are also said to be 2 - 3 °C cooler than the surrounding temperature;
- High durability in comparison to other fibers.
- UV protection abilities (SPF 15);
- High sorption of dyes and better colour clarity;
- Bamboo fabrics have low shrinkage;
- Bamboo fiber does not need to be mercerized to receive natural lustre;
- Clothes made from bamboo fiber are more wrinkle resistant than cotton and can be ironed at lower temperatures;
- Bamboo products are biodegradable and some companies have a utilization program that allows consumers to return a worn-out product and buy another at a lower price, which is a very

LITERATURE SURVEY

Now, through a modern manufacturing process, bamboo pulp is capable of producing bamboo fibers for use in yarn and fabric. Bamboo fibers is a kind of regenerated cellulosic fibers which is produced from raw material of bamboo pulp. Starchy pulp is produced through a process of alkaline hydrolysis and multi-phase bleaching; further chemical processes produce bamboo fiber. Bamboo can be spun purely or blended with other materials such as cotton, hemp, silk, lyocell and modal. Cotton has been one of the most human friendly plant with its soft, luxury and hygienic touch to the skin. The purpose of blending is to produce yarn with such qualities that cannot be obtained by using one type of fiber alone. Blending is also practiced for reasons of economic production, shortage of natural fibers, better performance in spinning, to improve the yarn strength, yarn evenness, imperfection level etc.

![Bamboo fiber production process](image-url)
Erdumlu and Özipek analyzed the general properties of bamboo fiber and its applications in the textile industry. They produced 100% bamboo yarns of 6 different counts, using ring yarn spinning technology. The test results were evaluated using the parameters of 100% viscose rayon calculated by way of Uster statistics.

Gun et al has analyzed the dimensional and physical properties of plain knitted fabric manufactured from 50/50 bamboo/cotton yarn and compared them with those of 50/50 viscose/cotton and 50/50 modal/cotton blended fabrics. They reported that fabrics made from these three yarns had a similar appearance. The study analyzed the weight per unit area, thickness, bursting strength, air permeability and pilling of the fabrics, and it was found that the weight, thickness and air permeability was independent.

Blending in the cotton spinning process has the objective to produce yarn with acceptable quality and reasonable cost. A good quality blend requires the use of adequate machines, objective techniques to select bales and knowledge of its characteristics.

Blending different types of fibers is a widely practiced means of enhancing the performance and the aesthetic qualities of a fabric. Blended yarns from natural and man-made fibers have the particular advantage of successfully combining the good properties of both fiber components, such as comfort of wear with easy care properties. These advantages also permit an increased variety of products to be made, and yield a stronger marketing advantage.

**MATERIALS AND METHODOLOGY**

This deals with material selected and methods followed for experimental work.

**3.1 Materials**

Tables 3.1 shows the details of yarn samples for production, coding and samples used for testing.

<table>
<thead>
<tr>
<th>Group</th>
<th>Code</th>
<th>Details of Yarn Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>A</td>
<td>24s Ne 100% Bamboo yarn produced in ring spinning system.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>24s Ne 50/50 Bamboo Cotton blended yarn produced in ring spinning system.</td>
</tr>
<tr>
<td>Group II</td>
<td>A</td>
<td>30s Ne 100% Bamboo yarn produced in ring spinning system.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>30s Ne 50/50 Bamboo Cotton blended yarn produced in ring spinning system.</td>
</tr>
<tr>
<td>Group III</td>
<td>A</td>
<td>40s Ne 100% Bamboo yarn produced in ring spinning system.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>40s Ne 50/50 Bamboo Cotton blended yarn produced in ring spinning system.</td>
</tr>
</tbody>
</table>

**3.1.1: Details of yarn production for experimental work**

For this research study six yarn samples produced keeping blend ratio constant but 3 different counts as well as same count yarn produced in 100% bamboo yarn also. For the experimental work these samples are grouped in 3 groups as shown in table 3.1.
To produce 100% bamboo yarn of 24\textsuperscript{S} Ne, 30\textsuperscript{S} Ne and 40\textsuperscript{S} Ne count following process parameters are followed.

3.1.2: Flow chart for sequence of machines to produce 100% Bamboo yarns of 24\textsuperscript{S} Ne, 30\textsuperscript{S} Ne and 40\textsuperscript{S} Ne count.

**Pre opening of Bamboo bales for relaxation by hand**

1. Hand or Machine mixing
2. Blow Room
3. Carding
4. Leveling Draw Frame
5. Speed Frame
6. Ring Frame
7. To Winding

3.1.3: Flow chart of machines and particulars used to produced 50/50 Bamboo/Cotton blended yarn.

In this yarn samples produced in ring spinning using 50/50 Bamboo Cotton blended yarn keeping blend ratio constant and draw frame blending is use with different counts.

3.1.4: Flow Chart of sequence of machines used to produce 50/50 Bamboo Cotton blended yarn

1. Mixing
2. Blow Room
3. Carding
4. SBD Draw Frame
5. Omega Lap LR
6. Draw Frame Blending
7. Speed Frame
8. Ring Frame
9. To Winding
RESULTS AND DISCUSSION

This chapter deals with results and discussion of yarn test report on various properties of yarns of 100% Bamboo and 50/50 Bamboo Cotton blended yarns.

4.1: Effect of Bamboo fibers and blend ratio on Unevenness and Imperfection of yarns

Table 4.1: shows results of yarn unevenness and imperfection

<table>
<thead>
<tr>
<th>Yarn Count (Ne)</th>
<th>100%/Blend</th>
<th>Unevenness Percentage</th>
<th>Thin Places</th>
<th>Thick Places</th>
<th>Neps</th>
</tr>
</thead>
<tbody>
<tr>
<td>24S 100% Bamboo</td>
<td>9.03</td>
<td>0</td>
<td>16</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>30S 100% Bamboo</td>
<td>9.19</td>
<td>0</td>
<td>12</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>40S 100% Bamboo</td>
<td>10.72</td>
<td>3</td>
<td>20</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>24S 50/50 B/C</td>
<td>9.26</td>
<td>0</td>
<td>17</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>30S 50/50 B/C</td>
<td>10.32</td>
<td>1</td>
<td>44</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>40S 50/50 B/C</td>
<td>10.17</td>
<td>2</td>
<td>31</td>
<td>82</td>
<td></td>
</tr>
</tbody>
</table>

When Bamboo fiber blended with Cotton the difference in their lengths causes floating fibers and thereby increases the unevenness. The unevenness percentage of Bamboo is less when compared to blends statistically it is significant, but in case of 40S count blended yarn and 100% Bamboo yarn has same U percentage. Imperfection is more and Cotton is blended with Bamboo in the all counts. It is statistically significant.

Comparing imperfection of 100% Bamboo and blended yarn 100% Bamboo yarn gives better result than Bamboo/Cotton. Because trash content will be very less in Bamboo.

4.2: Effect of Bamboo fibers and blend ratio on hairiness values

<table>
<thead>
<tr>
<th>Yarn Count (Ne)</th>
<th>100%/Blend</th>
<th>Hairiness index</th>
</tr>
</thead>
<tbody>
<tr>
<td>24S 100% Bamboo</td>
<td>5.52</td>
<td></td>
</tr>
<tr>
<td>30S 100% Bamboo</td>
<td>5.04</td>
<td></td>
</tr>
<tr>
<td>40S 100% Bamboo</td>
<td>4.03</td>
<td></td>
</tr>
<tr>
<td>24S 50/50 B/C</td>
<td>6.32</td>
<td></td>
</tr>
<tr>
<td>30S 50/50 B/C</td>
<td>4.42</td>
<td></td>
</tr>
<tr>
<td>40S 50/50 B/C</td>
<td>3.37</td>
<td></td>
</tr>
</tbody>
</table>

Yarn hairiness per 100 meter at 5 mm length as the proportion of Bamboo fiber increases the hairiness decreases. Similarly increase in count will also reduce hairiness index. This is mainly because Bamboo fibers are having longer length than Cotton. Hence short fibers are totally absent in Bamboo fiber. For 40S count both yarn gives very good H.I. value when export oriented knitted fabrics to be produced in that time H.I. value plays vital row. Hairiness will be reduce in Bamboo and Bamboo blended Cotton yarns because Bamboo fibers are wrapped very easily in the main yarn body when they emerge from front roller in ring frame thus the hairiness reduces. In case of hairiness 24S count 100% Bamboo yarn shows superiority over blended yarn. But in case of 30S and 40S Blended yarn trend is showing superiority over 100% Bamboo yarn. This may be due to the short fibers present in blended yarn is wrapped by long Bamboo fibers in these medium and finer counts.
4.3: Effect of Bamboo fibers and blend ratio on Shape, D value, Deviation Rate

Here shape factor of yarn which indicates average yarn roundness over the entire test length of yarn. These value corresponds to the ratio of short to long main axis of an ellipse. It is another factor which influences appearance yarn.

D value stands main density of yarn over the entire length of the yarn calculated. D value depends on degree of twist given to yarn there is a relation between density and hand value.

Deviation Rate described by water rate in percentage a certain marks deviation in percentage has been exceeded. Standard D. R. used for yarns is of 1.5 meter cut length with plus or minus 5% limit. Table 4.1 shows shape, D value and D.R. for different counts as well as 100% Bamboo and 50/50 Bamboo cotton blend yarn.

<table>
<thead>
<tr>
<th>Yarn Count (Ne)</th>
<th>Blend/100%</th>
<th>Shape</th>
<th>D.Value</th>
<th>D.R</th>
</tr>
</thead>
<tbody>
<tr>
<td>24S</td>
<td>100% Bamboo</td>
<td>0.83</td>
<td>0.54</td>
<td>27.6</td>
</tr>
<tr>
<td>30S</td>
<td>100% Bamboo</td>
<td>0.84</td>
<td>0.55</td>
<td>14.4</td>
</tr>
<tr>
<td>40S</td>
<td>100% Bamboo</td>
<td>0.84</td>
<td>0.79</td>
<td>31.1</td>
</tr>
<tr>
<td>24S</td>
<td>50/50 B/C</td>
<td>0.82</td>
<td>0.43</td>
<td>15.1</td>
</tr>
<tr>
<td>30S</td>
<td>50/50 B/C</td>
<td>0.85</td>
<td>0.52</td>
<td>33.6</td>
</tr>
<tr>
<td>40S</td>
<td>50/50 B/C</td>
<td>0.86</td>
<td>0.60</td>
<td>15.5</td>
</tr>
</tbody>
</table>

4.4: Effect of Bamboo fibers and blend ratio on C.S.P, Elongation and R.K.M Value

<table>
<thead>
<tr>
<th>Yarn Count (Ne)</th>
<th>Blend/100%</th>
<th>C.S.P</th>
<th>R.K.M Value</th>
<th>Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>24S</td>
<td>100% Bamboo</td>
<td>2110</td>
<td>16.33</td>
<td>13.08</td>
</tr>
<tr>
<td>30S</td>
<td>100% Bamboo</td>
<td>2076</td>
<td>14.74</td>
<td>14.7</td>
</tr>
<tr>
<td>40S</td>
<td>100% Bamboo</td>
<td>1904</td>
<td>14.64</td>
<td>13.01</td>
</tr>
<tr>
<td>24S</td>
<td>50/50 B/C</td>
<td>1956</td>
<td>12.51</td>
<td>6.0</td>
</tr>
<tr>
<td>30S</td>
<td>50/50 B/C</td>
<td>2115</td>
<td>12.63</td>
<td>4.71</td>
</tr>
<tr>
<td>40S</td>
<td>50/50 B/C</td>
<td>1894</td>
<td>12.20</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Form the above table it clears that Bamboo fibers are having highest elongation percentage when used as 100%. But when it is blended elongation percentage will reduces. With respect to R.K.M value 100% Bamboo fibers shows good results in all the counts compare to blended. C.S.P also falls on same line of R.K.M. and elongation. Because Bamboo fibers are having highest Elongation percentage. 100% Bamboo fiber yarns shows superiority in strength in elongation in all the counts. Which is statistically significant.

CONCLUSION

This chapter deals with conclusions from the result of obtained and discussions from previous chapter. The following conclusions are found.

1. Yarns produced from 100% Bamboo and Bamboo/Cotton 50/50 blend are showing ideal trend to proceed further and satisfy the need for knitting
2. Bamboo fiber blended yarns are having lower diameter than equivalent Bamboo/Cotton blended yarns. The tenacity yarns spun from 50/50 Bamboo/Cotton blend is lower than 100% Bamboo yarns. This happen due to large difference in breaking extension between Cotton and Bamboo fibers.
3. The yarn Unevenness of 50/50 Bamboo/Cotton yarn is higher than 100% Bamboo.
4. The hairiness of Bamboo yarns much lower than of 50/50 Bamboo/Cotton blended yarns of all the counts.
5. From the results and discussions it is clear that main motive of blending is to cost minimization and to increase the utility of Bamboo with Cotton. The higher percentage Bamboo with blend lesser will be cost of the product.
6. The blending of Bamboo fibers with Cotton in a blended yarn has a strong effect on various properties of all three counts of yarns.

REFERENCES