International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 16
June 2018

A Study on the Thermal Properties Of 100% Bamboo

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***ABSTRACT*:**

A knitted fabric consist of forming yarn(s) into loops, each of which is typically only released after a succeeding loop has been formed and intermeshed with it so that a secure ground loop structure is achieved. In the knitted fabric, bamboo has different loop structure (single jersey, cross tuck, cross miss, twill weave). These fabrics are subjected to the testing air permeability, wicking test, thermal conductivity, water vapour permeability. Bamboo Knit Fabric is naturally bacteria and odor resistant, and is the practical, yet eco-friendly choice. True to a natural fiber, bamboo knits are already absorbent and breathable. The strength of bamboo adds to the durability of the fabric and is found to work well for those who are allergic to other natural fibers. Bamboo textiles are cloth, yarn, and clothing made out of bamboo fibers.

Keywords: knitted, structure, bamboo, tencel.

INTRODUCTION:

Knitting is a method of forming fabric from a single strand of yarn, using two needles. The resulting fabric has given more than woven fabric. It is a technique to turn thread or yarn into a piece of cloth. Knitted fabric consists of horizontal parallel courses of yarn which is different from woven cloth. The courses of threads or yarn are joined together by interlocking loops in which a short loop of one course of yarn or thread is wrapped over another course. Fabric can be formed by hand or machine knitting, but the basic principle remains exactly the same i.e. pulling a new loop through the old loop.

Fabric Structures

A knitted fabric consist of forming yarn(s) into loops, each of which is typically only released after a succeeding loop has been formed and intermeshed with it so that a secure ground loop structure is achieved. There are two different types of knitting, Warp Knitting and Weft Knitting. In Warp Knitting the yarn travels in a predominately vertical direction through the fabric (like the warp threads in a woven fabric). In Weft Knitting the yarn travels in a predominately horizontal direction across the fabric. Weft knitted structure can also be produced using weft knitting machines or by hand knitting techniques, whereas warp knitted structures can only be produced using Warp knitting machines. The structures of Woven fabric and the direction of travel of yarn in warp and weft knitted fabrics.

Structure

- Courses and Wales.
- Weft and warp knitting.
- Knit and purl stitches.
- Right- and left-plated stitches.
- Edges and joins between fabrics.
- Cables, increases, and lace.
- Ornamentations and additions.

METHODOLOG

Bamboo

Bamboo Knit Fabric is naturally bacteria and odor resistant, and is the practical, yet eco-friendly choice. True to a natural fiber, bamboo knits are already absorbent and breathable. The strength of bamboo adds to the durability of the fabric and is found to work well for those who are allergic to other natural fibers. Bamboo textiles are cloth, yarn, and clothing made out of bamboo fibers. While historically used only for structural elements, such as bustles and the ribs of corsets, in recent years a range of technologies have been developed allowing bamboo fiber to be used in a wide range of textile and fashion applications. Modern clothing labeled bamboo is usually rayon. The bamboo yarn can also be blended with other textile fibers such as hemp or even spandex.

e-ISSN: 2348-6848
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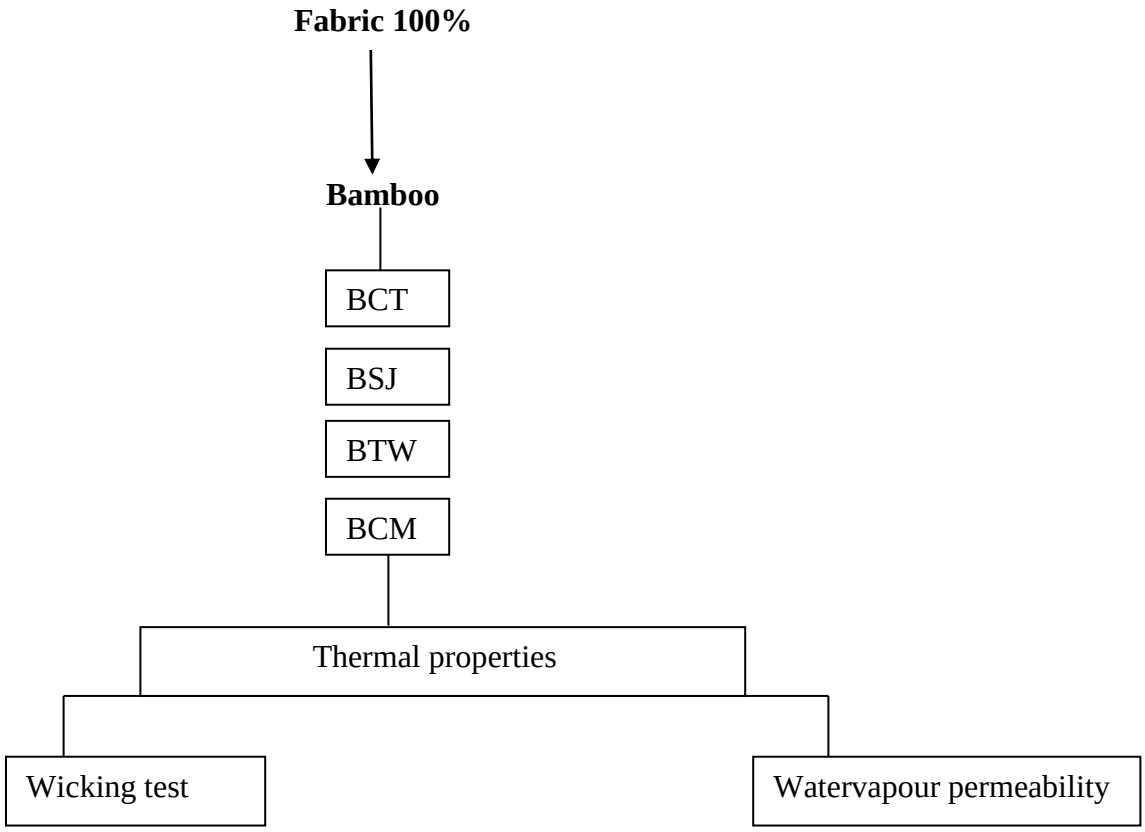
Flow chart



Fabric 100%

In this study, 100% bamboo yarn having linear density 30.2 Ne, 12.5% elongation and tenacity, was applied to knit all the knitted fabric structures. Thermal comfort properties of fabrics are really influenced by major factors like: the fibre type, spinning technology, yarn twist, yarn hairiness, fabric thickness and fabric tightness. The hairiness of bamboo yarns is much lower than that of equivalent cotton yarns.

Fabrics knitted with higher bamboo content have considerably less thickness, mass per square metre, thermal resistance and more water permeability. As the yarn gets finer the thermal resistance and thermal conductivity of the bamboo knitted fabrics decrease, while the water vapour

permeability and air permeability increase. Ucar and Yilmaz investigated the thermal comfort properties of 1x1, 2x2 and 3x3 rib structures and found that the heat loss reduced with the decrease in rib number. According to Tzanov et al [21] material finishing does not affect on the thermal resistance, but it affects water vapour resistance.

3.3Bamboo

Bamboo Knit Fabric is naturally bacteria and odor resistant, and is the practical, yet eco-friendly choice. True to a natural fiber, bamboo knits are already absorbent and breathable. The strength of bamboo adds to the durability of the fabric and is found to work well for those who are allergic to other natural fibers. Bamboo textiles are cloth, yarn, and clothing made out of bamboo fibers. While historically used only for structural elements, such as bustles and the ribs of corsets, in recent years a range of technologies have been developed allowing bamboo fiber to be used in a wide range of textile and fashion applications. Modern clothing labeled bamboo is usually rayon. The bamboo yarn can also be blended with other textile fibers such as hemp or even spandex.

BCT(bamboo cross tuck)

- A tuck stitch is composed of a held loop, one or more tuck loops and knit loops.
- It is produced when a needle holding its loop also receives the new loop.
- The tuck loop assumes an inverted U-shaped configuration.
- Tuck loops reduce fabric length and length-wise Elasticity? because the higher

yarn tension on the tuck loop causes then to rob yarn from adjacent knitted loops, making them smaller and providing greater stability and shape retention.

BSJ(Bamboo single jersey)

Single jersey fabrics are generally used to make underwear and outerwear such as T-shirts. Compared to woven structures, knit fabric can more easily deform or stretch by compressing or elongating the individual stitches that from the fabric. This ability to stretch by stitch rearrangement adds to

wearing comfort that, among other factors, is affected by Properties such as extensibility, air permeability, and heat insulation of garments made from knit fabrics.The knitted loops leave the needles the spacing of courses and wales decrease and the fabric shrinks in both directions thus affecting the properties of knitted fabric.

BTW(Bamboo twill weave)

In a twill weave, each weft or filling yarn floats across the warp yarns in a progression of interlacings to the right or left, forming a pattern of distinct diagonal lines. This diagonal pattern is also known as a wale. A float is the portion of a yarn that crosses over two or more perpendicular yarns.A twill weave requires three or more harnesses, depending on its complexity and is the second most basic weave that can be made on a fairly simple loom.

Twill weave is often designated as a fraction in which the numerator indicates the number of harnesses that are raised (and thus threads crossed: in this example, two), and the denominator indicates the number of harnesses that are lowered when a filling yarn is inserted (in this example, one). The fraction $^{2}/_{1}$ is read as "two up, one down" (the fraction for plain weave is $^{1}/_{1}$.). The minimum number of harnesses needed to produce a twill can be determined by totaling the numbers in the fraction.

BCM(Bamboo cross mix)

A miss stitch or float stitch is composed of a held loop, one of more float loops and knitted loops. It is produced when a needle holding its old loop fails to receive the new yarn that passes, as a float loop to the back of the needle, and to the reverse side of the resultant stich.

A single float has the appearance of a U-shape on the reverse of the stitch.

Miss stitch (float stitch) fabrics are narrower than equivalent all-knit fabric because the wales are drawn closer together by the floats, and reducing width-wise elasticity and improving fabric stability.

Watervapour permeability:

Breathability or also referred to as Water Vapor Permeability can be described as the ability of a fabric to allow moisture vapor to be transmitted through the material. It is an essential supporting property to thermal and Physiological

Comfort clothing, and is hugely important in filtration and medical textiles.

- For the constant head arrangement, the specimen shall be connected through the top inlet to the constant head reservoir.
- Open the bottom outlet.
- Establish steady flow of water.
- The quantity of flow for a convenient time interval may be collected.
- Repeat three times for the same interval.

Wicking test

Vertical wicking tests were performed on the apparatus. Five specimens of 200 mm × 25 mm cut along the wale wise and course wise directions were prepared. The specimen was suspended vertically with its bottom end dipped in a reservoir of distilled water. In order to ensure that the bottom ends of the specimens could be immersed vertically at a depth of 30 mm into the water, the bottom end of each specimen was clamped with a 1.2 g clip. The wicking heights, measured every minute for 10 min, were recorded for a direct evaluation of the fabric's wicking ability.

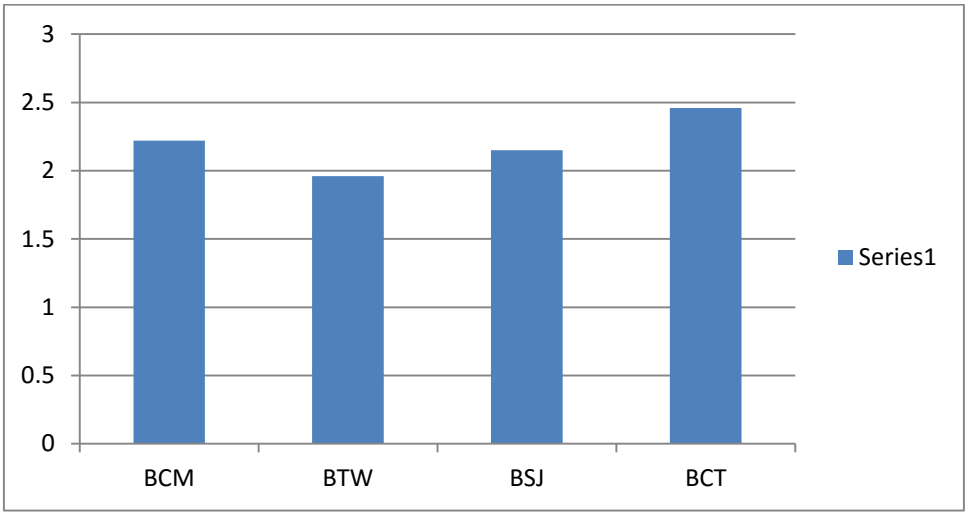
RESULTS AND DISCUSSION

In this study, the results on the thermal comfort properties of air permeability, thermal conductivity, water vapour permeability and wicking test has been seen and discussed. According to testing evaluation, the differences between air permeability, thermal conductivity, water vapour permeability and wicking test values of the fabrics knitted with bamboo, yarns were statistically significant. The result of the study discussed below.

Wicking test of bamboo fabric

Wicking test of bamboo fabric

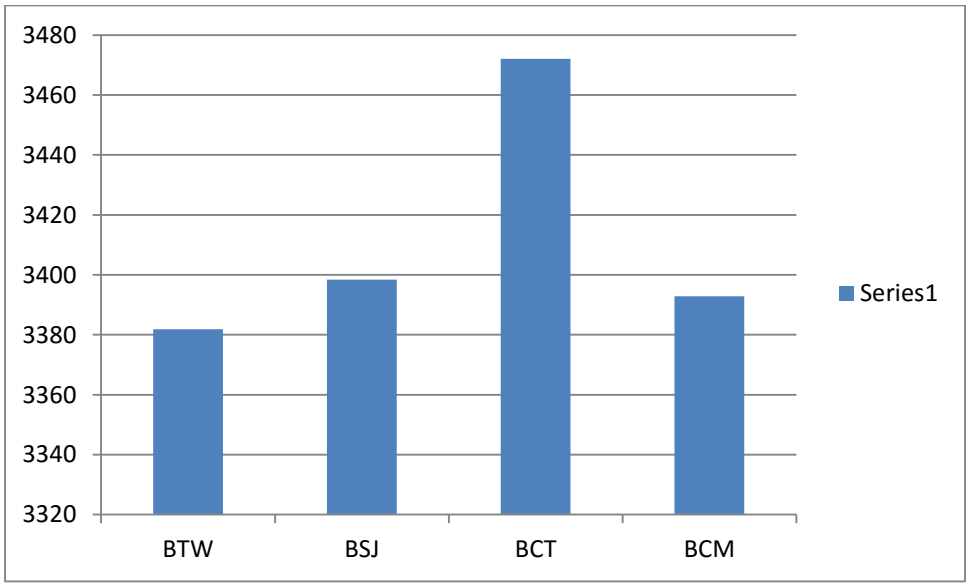
S.No	BCM	BTW	BSJ	BCT
1	2.22	1.96	2.15	2.46



From the above figure show that the bamboo cross tuck gives a higher than other structure of fabric.

Water vapour permeability test for bamboo

S.No	BTW	BSJ	BCT	BCM
1	3381.812	3398.444	3472.099	3392.900



From the above figure show that the it bamboo from the four structures in the test of the Water Vapour permeability of bamboo Cross Tuck gives good result compared to single jersey, cross miss & twill.

CONCLUSION

Knitting is a method of forming fabric from a single strand of yarn, using two needles. The resulting fabric has given more than woven fabric. It is a technique to turn thread or yarn into a piece of cloth. Knitted fabric consists of horizontal parallel courses of yarn which is different from woven cloth. Cotton referred to as the "King of fibers". It is most important textile fiber in the world. Cotton is a vegetable fiber which surrounds the seeds of the cotton plant.

In this study the thermal properties of 100% bamboo fabrics are analyzed. This study has been done to analyze the thermal property of the fabrics bamboo. Also to know the better knit structure between cross tuck, cross mix, twill and single jersey of bamboo.

All the thermal properties; thermal conductivity, watervapour permeability and air permeability are significance level by fabric structure and loop length. The influence of studied parameters on the bamboo thermal comfort properties was investigated.

In that bamboo Fabric we get the result that from the four structures of bamboo Cross Tuck, Twill, Single Jersey & Cross Miss. Bamboo cross tuck gives good result for water vapour permeability testing.

In that the bamboo cross tuck gives a higher than other knit structure. Bamboo has a good absorbency, wicking test gives good result.

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