



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

INVESTIGATING THE EFFECT OF MOISTURE MANAGEMENT OF SINGLE JERSEY AND RIB KNITTED SOCKS

Ms.N.Sangeetha¹, Research Scholar, Department of Textiles and Apparel Design, Periyar University, Salem, Tamilnadu-636011, India.

Dr.M.Latha², Assistant Professor, Department of Textiles and Apparel Design, Periyar University, Salem, Tamilnadu-636011, India.

Abstract:

Key Words: Socks, Cotton, Bamboo, Knit structure, Moisture management properties

Introduction

Material and Methods

The socks were produced using yarns with a 30s Ne count, consisting of two different compositions: 100% cotton and a blend of 60% cotton with 40% bamboo. The 30s Ne refers to the yarn's thickness, indicating a finer yarn suitable for creating comfortable and durable socks. The use of 100% cotton yarn ensures softness, breathability, and moisture-wicking properties, while the cotton-bamboo blend combines the natural qualities of cotton with the added benefits of bamboo, such as enhanced moisture management, anti-bacterial properties, and sustainability. This combination of yarns contributes to the overall comfort and functionality of the socks.

The manufacturing of single jersey socks using the Onati G 614 machine, an advanced model from Italy, involves a highly efficient and precise knitting process. This machine, equipped with 200 needles and a 33/4-inch cylinder, is capable of producing high-quality socks with intricate patterns and superior fabric density. The 22-gauge setting ensures fine, soft stitches, ideal for creating comfortable and durable socks. Manufactured in 2004, the Onati G 614 is a single-cylinder machine, which allows for uniform stitch formation and consistent quality throughout the production. The machine's design and features make it well-suited for producing a wide variety of socks, from basic to more complex patterns, while maintaining high standards of comfort and durability.



Single Jersey



1 x 1 Rib

Figure 2: Image of Socks produced from different knit structures

The 1 x 1 rib socks manufacturing process using the BS BOO Seong Precision machine, built in 2002, incorporates advanced knitting technology to deliver high efficiency and precision. Featuring 168 needles and a 5-feeder system, this machine can produce a wide variety of sock designs, providing flexibility in pattern creation. With a 13.5 gauge and a 4-inch diameter, it generates durable, high-density knit fabrics that are perfect for different sock types, offering a balance of comfort and durability. Operating at speeds ranging from 180 to 300 RPM, the machine ensures efficient production while maintaining quality. The BS BOO Seong Precision model guarantees consistent stitching and is ideal for high-volume sock manufacturing, capable of producing both simple and intricate designs with excellent results.

Experimental Method

S.No	Sample	Fibre Type	Structure	Loop Length	GSM
1	CSJ	100 % Cotton	Single Jersey	0.33 mm	2.19 gm
2	SRB	100 % Cotton	1 x 1 Rib	1.16 mm	2.4 gm
3	BMCSJ	40 % Bamboo / 60 % Cotton	Single Jersey	0.33 mm	1.36 gm
4	BMCRB	40 % Bamboo / 60 % Cotton	1 x 1 Rib	1.18 mm	3.57 gm

Table 1: Technical specifications of socks

The produced socks were tested according to the standard procedure for evaluating their physical and structural properties, such as loop length (ASTM D 3887), and GSM. A summary of the physical and structural properties assessed for the fabrics is provided in Table 1.

Moisture Management Properties

The moisture management properties of the produced socks were assessed using the SDL Atlas Moisture Management Tester (MMT) in accordance with the AATCC 195–2006 test procedure. This tester operates on the principle of electrical conductivity and resistance, which is measured through physical contact with the fabric sample when liquid moisture is applied. A conditioned socks sample placed in the MMT tester, which contains concentric moisture sensors that assess liquid transport on both sides of the socks.

Synthetic sweat is applied to the top surface of the socks, and the moisture management evaluation begins as the moisture sensors detect electrical conductivity changes. Based on the liquid transfer, the following indices are calculated and graded for both the top and bottom surfaces of the socks:

- **Wetting Time (WT):** The duration required for the socks surface to become wet after the application of liquid moisture. This is measured separately for the top and bottom surfaces.
- **Absorption Rate (AR):** The rate at which the sample absorbs liquid moisture. This is also calculated separately for the top and bottom surfaces.
- **Spreading Speed (SS):** The rate at which the liquid spreads across the socks surface to its maximum wetted radius. This is calculated separately for both surfaces.
- **One-Way Transport Capability (OWTC):** A measure of the difference in moisture accumulation between the top and bottom surfaces of the socks.
- **Overall Moisture Management Capacity (OMMC):** An overall index that quantifies the socks overall moisture management performance during testing.

Result and Discussion

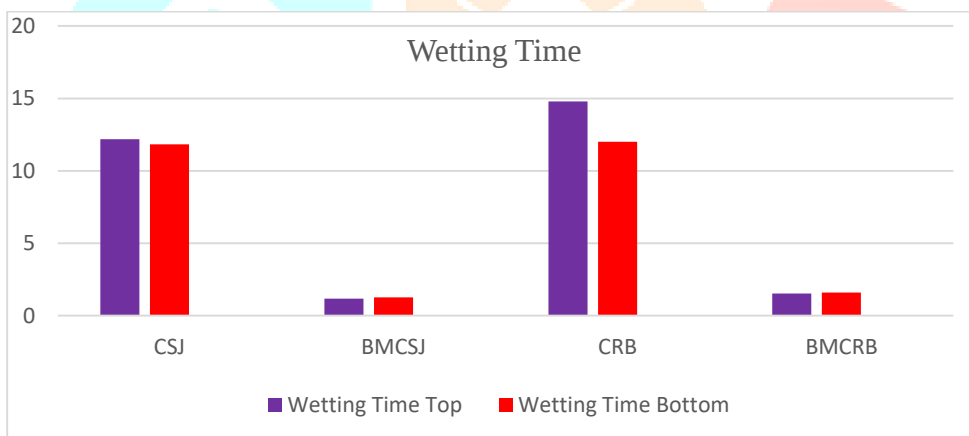


Figure 3: The graph of Wetting time of tested socks

The moisture management properties of the produced socks were evaluated based on the Wetting Time (WT) for both the top and bottom surfaces of the fabric. For the CSJ sample, the wetting times were 12.18 seconds for the top surface and 11.84 seconds for the bottom surface, indicating a relatively slower absorption of moisture. The BMCSJ sample demonstrated significantly faster moisture absorption, with wetting times of 1.18 seconds on the top surface and 1.27 seconds on the bottom surface. Similarly, the CRB sample showed longer wetting times, with 14.79 seconds on the top and 12 seconds on the bottom, suggesting slower moisture uptake compared to other samples. The BMCRB sample also exhibited fast moisture absorption, with wetting times of 1.53 seconds on the top and 1.60 seconds on the bottom. Overall, BMCSJ and BMCRB samples exhibited superior moisture management performance, with faster wetting times on both surfaces, while CSJ and CRB samples showed slower moisture absorption.

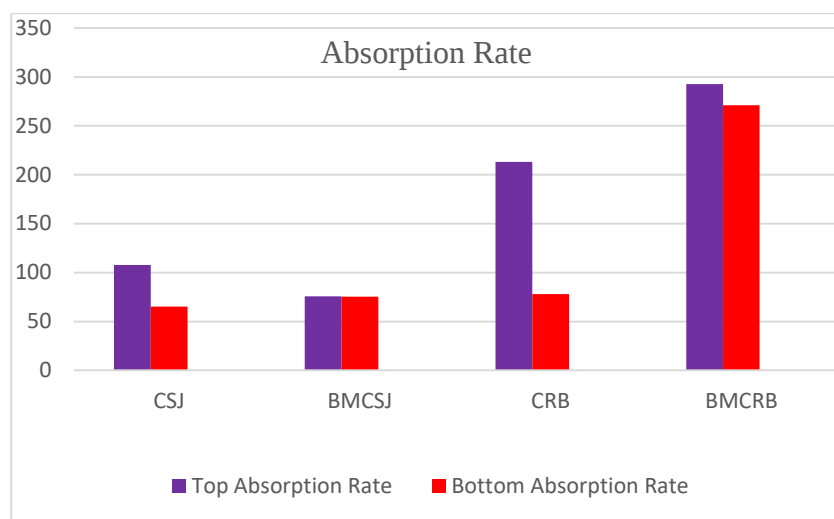


Figure 4: The graph of Absorption rate of tested socks

The absorption rate (AR) of the produced socks was evaluated for both the top and bottom surfaces. For the CSJ sample, the top surface had an absorption rate of 107.7, while the bottom surface showed a significantly lower rate of 65.41, indicating that moisture is absorbed more rapidly on the top surface than the bottom. The BMCSJ sample exhibited relatively balanced absorption rates, with 75.66 on the top surface and 75.23 on the bottom, suggesting consistent moisture absorption across both surfaces. The CRB sample showed a higher absorption rate on the top surface, with 213.12, compared to 78.12 on the bottom, indicating faster moisture absorption at the top. The BMCRB sample had the highest absorption rates, with 292.66 on the top surface and 271.12 on the bottom, demonstrating excellent moisture absorption capability on both surfaces. Overall, the BMCRB sample showed the best moisture absorption performance, followed by CRB, CSJ, and BMCSJ, respectively.

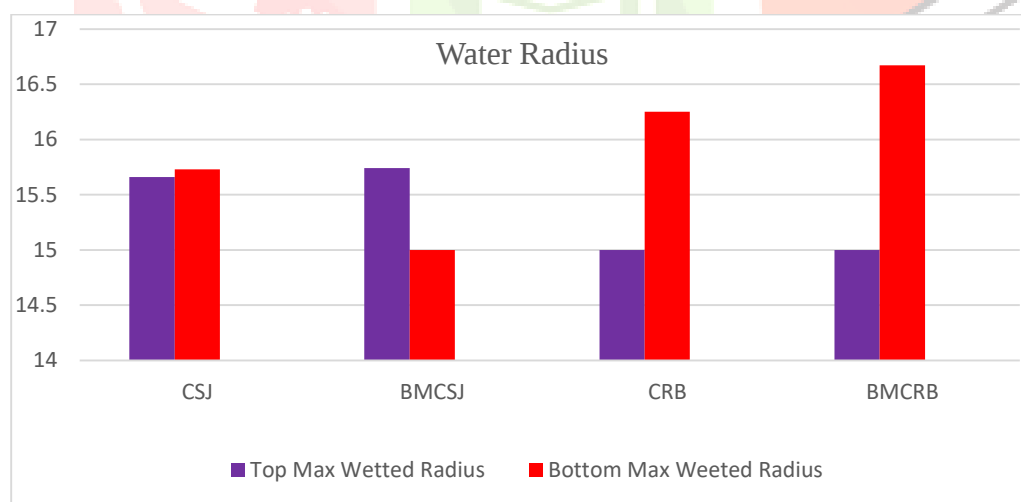


Figure 5: The graph of Wetted Radius of tested socks

The maximum wetted radius (MWR) of the produced socks was assessed for both the top and bottom surfaces. For the CSJ sample, the top surface had a maximum wetted radius of 15.66, while the bottom surface was slightly higher at 15.73, indicating similar moisture spread on both surfaces. The BMCSJ sample showed a slightly higher radius on the top surface (15.74) compared to the bottom surface (15.00), suggesting better moisture spread on the top. The CRB sample demonstrated a lower radius on the top

surface (15.00) but a larger spread on the bottom surface (16.25), indicating a more significant moisture distribution on the bottom. The BMCRB sample displayed a consistent spread, with 15.00 on the top and 16.67 on the bottom, showing a notable increase in the maximum wetted radius on the bottom surface. Overall, the BMCRB sample exhibited the largest moisture spread, particularly on the bottom surface, followed by CRB, BMCSJ, and CSJ.

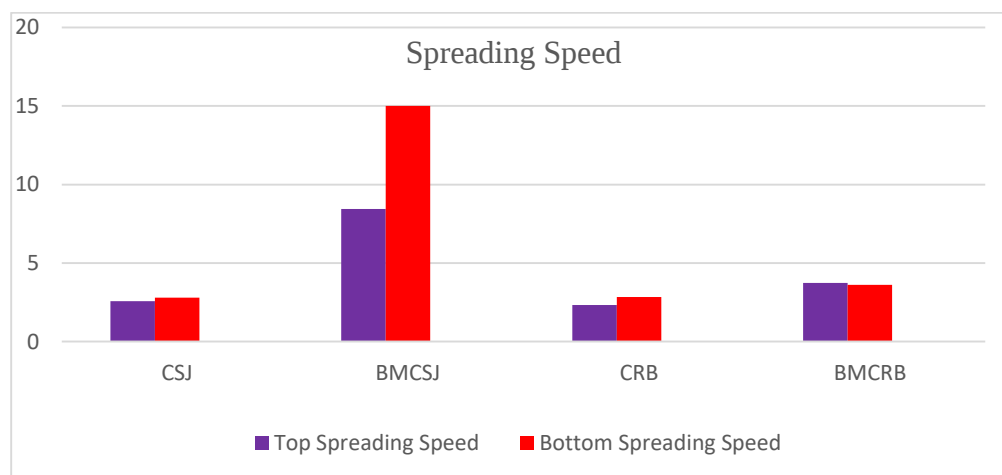


Figure 6: The graph of Spreading Speed of tested socks

The moisture management performance of the produced socks was further evaluated using the accumulative one-way transport index (AOTI) for both the top and bottom surfaces. For the CSJ sample, the AOTI was 2.57 on the top surface and 2.8 on the bottom surface, indicating a relatively low difference in moisture transport between the two surfaces. The BMCSJ sample showed a significantly higher AOTI, with 8.45 on the top and 15 on the bottom, suggesting a considerable difference in moisture transport across the surfaces, with the bottom surface accumulating more moisture. The CRB sample displayed a low AOTI of 2.33 on the top and 2.83 on the bottom, indicating minimal moisture accumulation differences between the top and bottom. The BMCRB sample exhibited an AOTI of 3.74 on the top and 3.61 on the bottom, showing a moderate difference in moisture transport between the surfaces. Overall, BMCSJ showed the highest variation in moisture accumulation, followed by BMCRB, CRB, and CSJ.

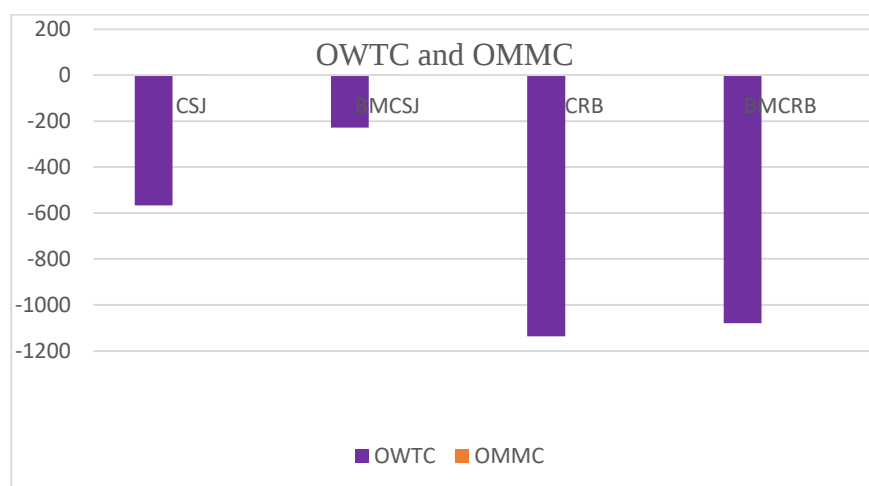


Figure 7: OWTC and OMMC of tested socks

The overall moisture transport capacity (OWTC) and overall moisture management capacity (OMMC) of the produced socks were evaluated for each sample. The CSJ sample exhibited a negative OWTC value of -566.97, with an OMMC of 0.21, indicating poor overall moisture transport and management. The BMCSJ sample showed a less negative OWTC of -228.7 and a higher OMMC of 0.55, reflecting better moisture transport and management performance than CSJ. The CRB sample had the lowest OWTC of -1136.34, suggesting very poor moisture transport, though its OMMC of 0.47 was slightly better than that of CSJ. The BMCRB sample showed an OWTC of -1079.94, also indicating low moisture transport, with an OMMC of 0.40, which was higher than that of CSJ and CRB but still relatively low. Overall, BMCSJ demonstrated the best moisture management capacity, followed by CRB, BMCRB, and CSJ.

Conclusion

The moisture management performance of the produced socks was evaluated across several key parameters, including Wetting Time (WT), Absorption Rate (AR), Maximum Wetted Radius (MWR), Accumulative One-Way Transport Index (AOTI), Overall Moisture Transport Capacity (OWTC), and Overall Moisture Management Capacity (OMMC). The BMCSJ and BMCRB samples exhibited superior moisture absorption and transport characteristics compared to the CSJ and CRB samples. BMCSJ, in particular, showed the fastest wetting times and a balanced absorption rate across both surfaces, along with the highest overall moisture management capacity. BMCRB also demonstrated excellent moisture absorption and spread, especially on the bottom surface, though its overall moisture management capacity was slightly lower than BMCSJ. The CSJ and CRB samples, on the other hand, exhibited slower moisture absorption and less efficient moisture transport, with CSJ showing the poorest overall performance across all parameters.

Overall, BMCSJ emerged as the best-performing sock in terms of moisture management, with faster wetting times, better absorption, and the highest overall moisture management capacity. BMCRB followed closely, exhibiting good moisture absorption and spread, although it showed lower overall moisture transport capacity. In contrast, CSJ and CRB samples demonstrated slower moisture absorption and less efficient moisture management, particularly in terms of moisture transport and spread. These results suggest that BMCSJ and BMCRB are more suitable for applications requiring efficient moisture management, while CSJ and CRB may not be as effective in managing moisture during wear.

References

1. Cimilli, S.; Nergis, B.U.; Candan, C.; Özdemir, M. A comparative study of some comfort-related properties of socks of different fiber types. *Text. Res. J.* 2010, 80, 948–957.
2. Das A Manshahia M 2014. High Active Sportswear – A critical review. *Indian Journal of Fibre & Textile Research* 39 (4): 441-449
3. Das, B., A. Das, V. K. Kothari, R. Fanguiero, and M. De Araujo. 2007. Moisture transmission through textiles part I: Processes involved in moisture transmission and the factors at play. *AUTEX Research Journal* 7 (2):100–10.
4. Ghali K, Jones B, Tracy J. Experimental Techniques for Measuring Parameters Describing Wetting and Wicking in Fabric. *Textile Res. J.* Vol. 64(2), 1994:106-111
5. Goonetilleke, R.S. *The Science of Footwear*; CRC Press: Boca Raton, FL, USA, 2012
6. Hatch K.L.: *Textile Science*, West Publishing Co, New York, 1993
7. Nemcokova R, Glombikova V and Komarkova P. *Autex Research Journal*, 2015, 15, 233.
8. Sampath, M. B., and M. Senthilkumar. 2009. Effect of moisture management finish on comfort characteristics of microdenier polyester knitted fabrics. *Journal of Industrial Textiles* 39 (2):163–73. doi:10.1177/1528083709102922.
9. Uttam D 2013. Active Sportswear Fabrics: *International Journal of IT, and Applied Sciences Research* 2 (1): 34-40

