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Development of Knitted Bi-Layered Fabric in Activewear

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***Abstract*: Development of knitted bi-layer fabric from jacquard interlock knitting machine. The raw material used for bi-layer fabric is viscose cotton blend yarn and polycotton yarn as outer layer of the fabric then the 100% viscose as the inner layer of the common for both type of yarn. Fibers like nylon-spandex, polyester-spandex, polypropylene. Breathability appears to be main issue regarding these fibers and other characteristics like prone to static buildup, resilience, absorptiveness, air permeability are the disadvantages of the polyester. Hence, we are going to differentiate polyester activewear with our developed activewear. This bi-layer knitted fabric having two layers of yarn, outer layer made up of cotton from different spinning techniques which is viscose cotton blend and polycotton. The important characteristics of sportswear are the rapid transformation of perspiration and rapid evaporation to keep fabric non-sticky.**

***Keywords*: Bi-layer fabric, Activewear, Breathability, Viscose cotton blend.**

1. Introduction

In recent times, there has been increase in participation in active sports all over the world. The sports clothing of today have become technically oriented, using highly functional textiles for both casual and performance sportswear. An active sportswear will be one which possesses good amount of transfer properties, thereby enhancing the performance and endurance of a sports person. Bi-layer weft knitted fabric is developed which can transfer moisture from skin to the environment. This bi-layer knitted fabric having two layers of yarn, inner layers made up of 100% viscose and outer layer is made up of cotton from different spinning techniques. The important characteristics of sportswear are the rapid transportation of perspiration and rapid evaporation to keep fabric non- sticky.

2. Materials and Methods

A. Materials

We use two types of yarn viscose cotton blend and polycotton yarn. The 100% viscose yarn of count 20s is sourced from Pallava Groups, Erode. The viscose cotton blend yarn of count 34s is sourced from Pallava Groups, Erode. The polycotton yarn of count 34s is sourced from Pallava Groups, Erode.

B. Methods

The purchased yarns were divided into 2 sample categories, they are sample category 1 includes 100% viscose (inner) (24s count) and viscose-cotton (outer) (34Ne), loop length of 29,30,31. Sample category 2 includes 100% viscose (inner) (24s count) and poly-cotton (outer) (34Ne), loop length of 29,30,31. And the fabrics are knitted by jacquard knitting machine. And then the knitted RFD fabric was processed through scouring and bleaching to the fabric which could interfere with dyeing. Dyeing which is used primarily for fabrics that are to be a solid color. And then the fabrics were compacted using compacting machine called compactor or felt compactor. Then pattern making takes place. Flat pattern drawing method used. And then the garments components from cutting section joined and sewn. The finished garment is then subjected to testing for the quality and comfort parameters to evaluate the efficiency of the finishing and comparing the results.

3. Results and discussion

A. Abrasion Resistance

Abrasion ultimately results in the loss of performance characteristics and also the appearance of the fabric. Sample S2-1 shows higher abrasion resistance.

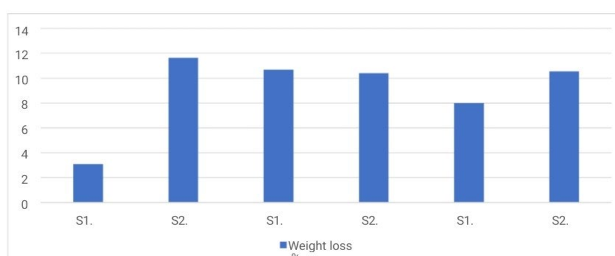

Fig. 1.

B. Bursting Strength

From the chart sample S1-2 has more bursting strength. As loop length increases bursting strength decreases.

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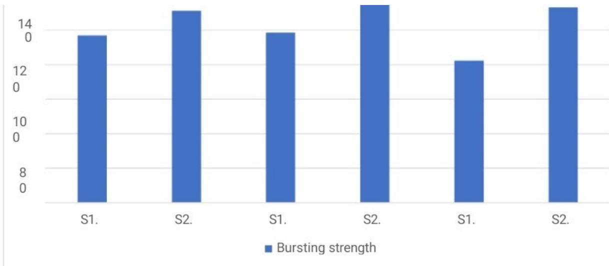

Fig. 2.

C. *Pilling Test*

When the fabric is mechanically abrading, a fiber end comes out from the inside yarn which corresponds to fuzz formation. A fiber having fiber - friction in dry would suppress fuzz formation.

Table 1

Samples	Pilling Property
S1-1	Standard 3
S1-2	Standard 4
S1-3	Standard 3
S2-1	Standard 4
S2-2	Standard 4
S2-3	Standard 4

D. *Air Permeability*

Air permeability test was carried out in two conditions i.e., dry and wet state. Sample S2-1 shows higher air permeability in both dry and wet state.

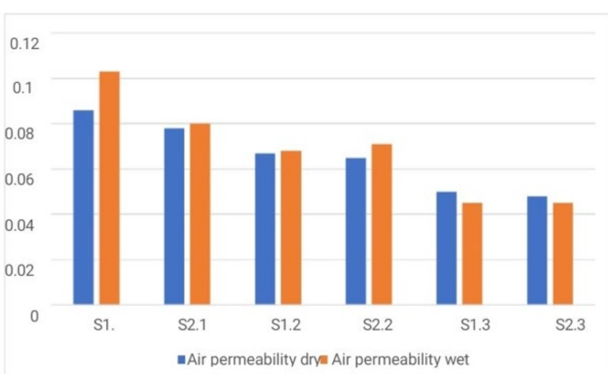

Fig. 3.

E. *Drape Test*

Higher the coefficient value lowers the Drapability of the fabric sample.

From the chart it is inferred that fabric sample S1-1 & S2-1 have higher drapability.

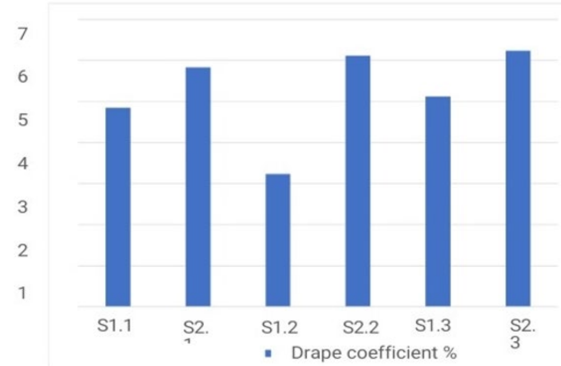

Fig. 4.

F. *Longitudinal Wicking*

The samples S1-2 & S1-3 shows higher wicking rate than other.

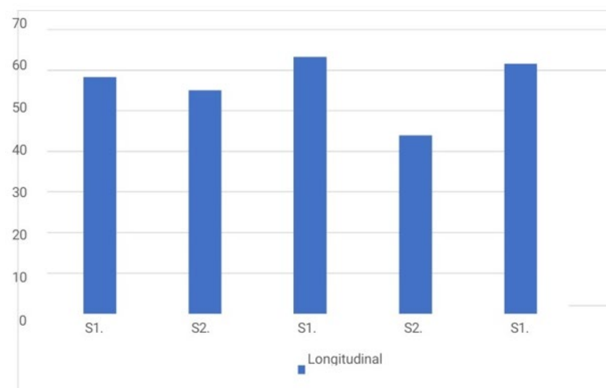

Fig. 5.

G. *Transverse Wicking*

Sample S1-2 has higher transverse wicking compared to other samples.

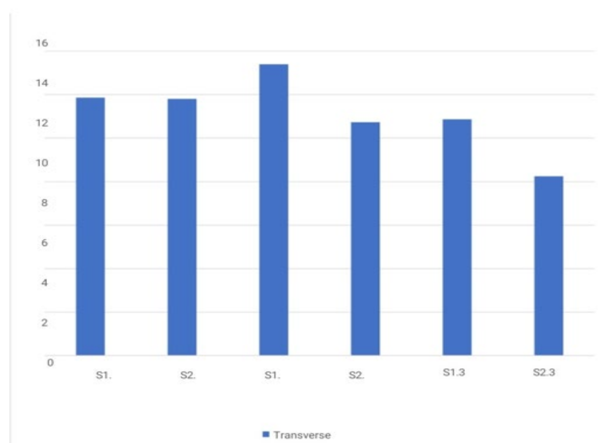

Fig. 6.

H. *Water Vapour Permeability Test*

The water vapour permeability is the ability of clothing to transport water vapour which is an important determinant of physiological comfort.

Table 2

Samples	Water vapour permeability (g/m^2 /day)
S1-1	1666
S1-2	1650
S1-3	1719
S2-1	1820
S2-2	1826
S2-3	1832

I. *Thermal Conductivity*

Thermal conductivity indicates the ability to conduct heat. Sample S2-1 has the highest thermal conductivity among the others developed.

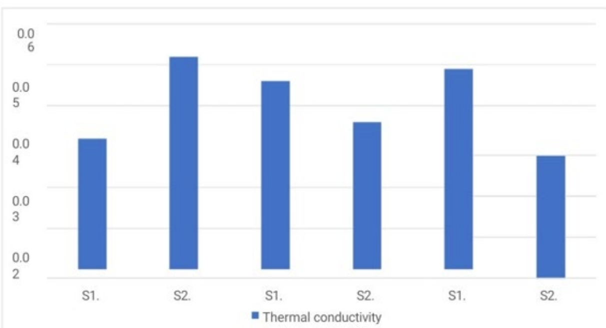

Fig. 7.

J. *Wetting Time*

The top time is always higher because, the top layer is in contact with the liquid and the bottom layer has the ability to absorb it. samples made up of micro denier polyester and air-vortex spun polycotton have slight better wetting time.

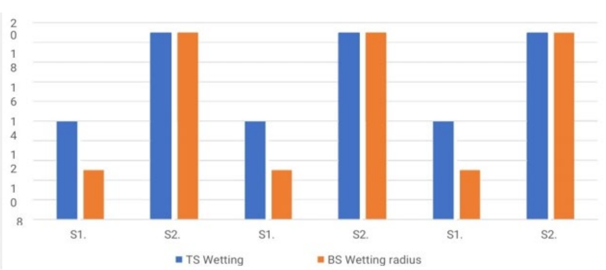

Fig. 8.

K. *Absorption Rate*

The absorption rate will be higher for the bottom layer, as the bottom layer has the tendency to absorb than the top layer. The sample S2-3 has the highest top surface absorption rate, sample S2-1 has the highest bottom surface absorption rate.

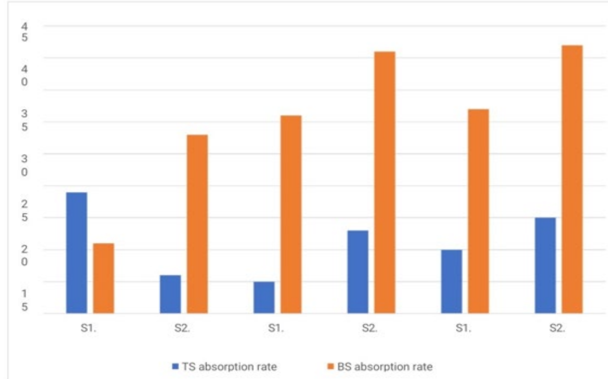

Fig. 9.

L. *Wetting Radius*

In this the top wetting radius is greater than that of the bottom surface. All the samples have the same maximum wetting radius of both top and bottom except the sample S1-2.

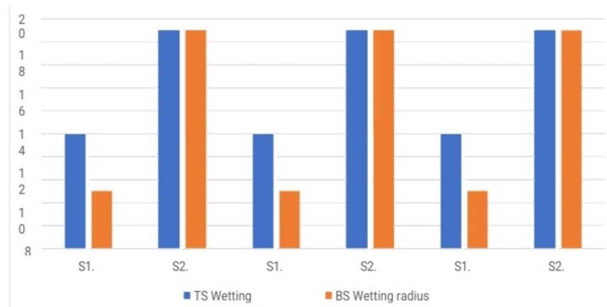

Fig. 9.

M. *Spreading Speed*

The accumulated rate of surface wetting from the center of the specimen where the test solution is dropped to the maximum wetted radius. Sample S13 & S3-3 have the highest top surface spreading speed, sample S1-3 has the highest bottom surface spreading speed.

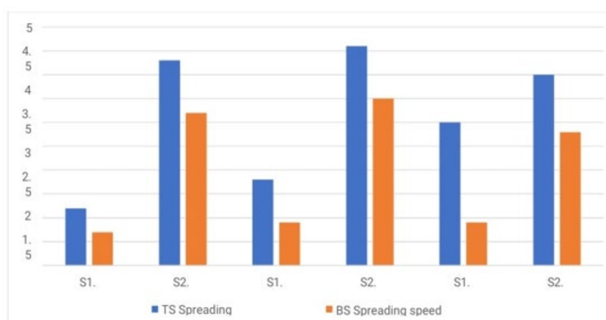

Fig. 10.

N. *Accumulative One-Way Transport Index*

The difference between the area of the liquid moisture content curves of top and bottom surfaces with respect to time. Sample S1-1 has the highest accumulative one-way transport index.

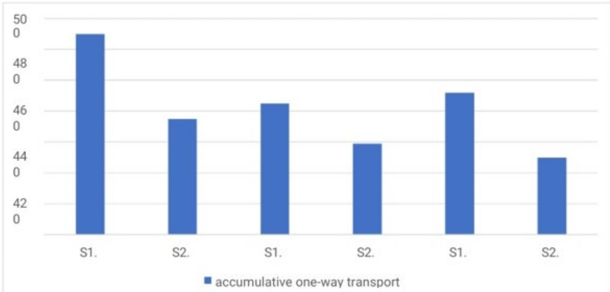

Fig. 11.

O. Overall Liquid Moisture Management Capability (OMMC)

It is calculated by combining three measured attributes of performance i.e., absorption rate, spreading speed, liquid transport capability. Sample S1-2 has the highest OMMC.

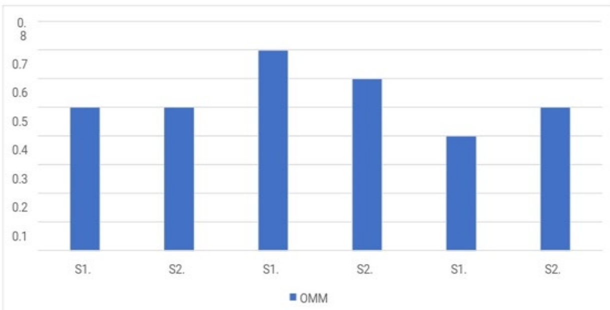

Fig. 12.

4. Conclusion

Bi-layer fabric can be developed with different types of yarn in inner and outer layers and other structures which are suitable for active sportswear. Developed with interpretation of electrical equipment's. Even incorporation of phase change materials and shape memory polymers can be used for adaptation to the environment. Bi-layer can also be developed using different finishes which are appropriate.

By comparing the results of the objective tests, it is clear that each fabric has its own advantages and disadvantages. Sample S1-2 with loop length 0.28 cm proves to be giving enhanced physiological properties. So, it is recommended that while comparing other samples, it can be commercially used as activewear.

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