International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016 [ICSSCCET 2016]

ISBN	978-81-929866-6-1	**VOL**	02
Website	icssccet.org	**eMail**	icssccet@asdf.res.in
Received	25 – February – 2016	**Accepted**	10 - March – 2016
Article ID	ICSSCCET017	**eAID**	ICSSCCET.2016.017

Study of Comfort Characteristics of the Conventional Single Layer Woven Fabrics for Sportswear

Hari Gopalakrishnan[1], Dr T Ramachandran[2]
[1]Research Scholar, Department of Textile Technology,
[2]Principal, Karpagam Institute of Technology, Coimbatore, India.

Abstract: *A study of existing conventional single layer woven fabric for sportswear was studied and their characteristics such as Wickability, Air-permeability, Water- Vapour Permeability, Thermal Conductivity and Thermal Resistance were tested and critically analysed. It was found that polyester cotton (PC) & Polyester Viscose (PV) blended spun yarns with Plain & Matt weave structures were generally used for conventional sportswear fabrics. It was further observed that in both PC & PV, Matt weave structure showed better characteristics on Wickability, Air Permeability, Water Vapour Permeability and Thermal Conductivity, whereas plain weave structure showed better Thermal Resistance when compared to matt weave structure.*

Keywords: *Polyester cotton blend, Plain, Matt, Wickability, Air-permeability, Water-Vapour Permeability*

1. INTRODUCTION

A single layer conventional woven fabric is being used for the sportswear and it was found that majority of them is made up of cotton polyester (PC) & Polyester Viscose (PV) blends. The conventional sportswear woven fabrics are plain or matt weave structures with medium weight of 120 GSM. Since the polyester blends are widely used in conventional sportswear woven fabrics, Polyester/Cotton blend (67/33) & Polyester Viscose blend with plain and Matt weave were selected for the study and their comfort characteristics such as Wickability, Air-permeability, Water-Vapour Permeability, Thermal Conductivity and Thermal Resistance were tested and critically analysed.

2. Material and Methods

The construction details of weave structures such as Plain & Matt weave, linear densities of warp & weft, warp & weft densities and fabric GSM of the existing conventional sportswear fabrics which were used for the study are shown table 1.

Two types of weave structure such as Plain and Matt weave have been used in conventional woven fabrics, which were made up of PC & PV Blend (67/33) and these selected fabrics were coded as PPC & MPC, PPV & MPV respectively as shown in Table 1.

Cite this article as: Hari Gopalakrishnan, Dr T Ramachandran. "Study of Comfort Characteristics of the Conventional Single Layer Woven Fabrics for Sportswear". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 85-89. Print.

Table 1-Material & Construction details of Existing conventional Woven sportswear

S No	Code	Weave Structure	Materials	Blend Ratio	Warp Linear Density	Weft Linear Density	Ends/cm	Picks/cm
1	PPC	Plain	Polyester/Cotton Blend	67 : 33	Ne 30	Ne 30	30	25
2	MPC	Matt	Polyester/Cotton Blend	67 : 33	Ne 24	Ne 24	23	21
3	PPV	Plain	Polyester/Viscose Blend	67 : 33	Ne 30	Ne 30	30	25
4	MPV	Matt	Polyester/Viscose Blend	67 : 33	Ne 24	Ne 24	23	21

Standards for Testing Methodology adopted for the various tests conducted for the study to analyze the comfort characteristics have been given in Table 2.

Table 2-Testing Methodology

S No	Characteristics	Standards for Testing Methodology
1	Wickability	AATCC 198-2011 Horizontal-Weft Way
		AATCC 197-2011 Vertical- Warp Way
2	Air Permeability	ISO 9237
3	Water Vapour Permeability	ASTM E96
4	Thermal Conductivity	ASTM D 1518 (2000)
5	Thermal Resistance	ASTM D 1518 (2000)

All the above tests were carried out, after conditioning the samples as per ASTM D 1776 standard.

3. Results and Discussions

The four varieties of conventional woven sportswear fabrics were tested for comfort characteristics such as Wickability, Air Permeability, Water Vapour Permeability, Thermal Conductivity and Thermal Resistance. Quality analyses of these fabrics are described below.

3.1 Wickability

The Wickability characteristics of woven structures of two different fabric samples such as Plain (PPC) and Matt (MPC) are shown in Fig 1. The wicking heights in warp & weft directions for 1cm, 2cm, 3cm, 4cm & 5cm have been studied.

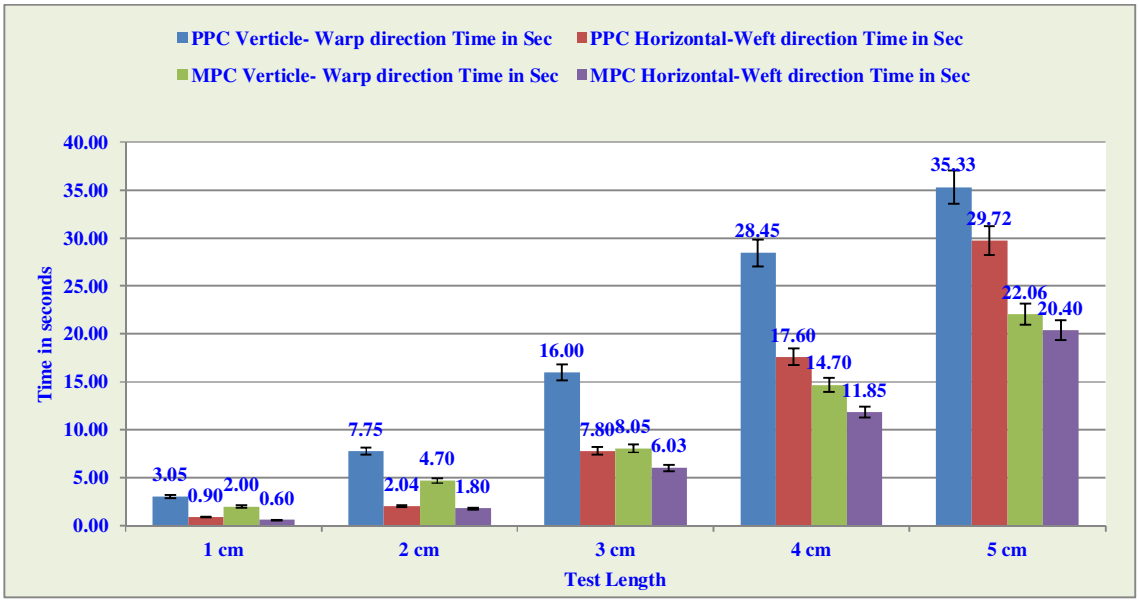

Fig 1- Wickability of Conventional Woven Fabric of PC (67/33) blend

Cite this article as: Hari Gopalakrishnan, Dr T Ramachandran. "Study of Comfort Characteristics of the Conventional Single Layer Woven Fabrics for Sportswear". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 85-89. Print.

The wicking of Matt (MPC) fabric samples having 37.56% & 31.35% better wicking in warp & weft directions respectively in 5 cm wicking height, due to open weave structure than Plain (PPC) fabric samples. The same trend was noticed in all wicking height of 1 cm, 2cm, 3cm and 4cm. The ANOVA test proved that the Wickability values were statistically significant.

Fig 4.2 shows the wicking heights in warp & weft directions of 1cm, 2cm, 3cm, 4cm & 5cm of Polyester Viscose Blended (67/33) fabric in Plain & matt weave structure.

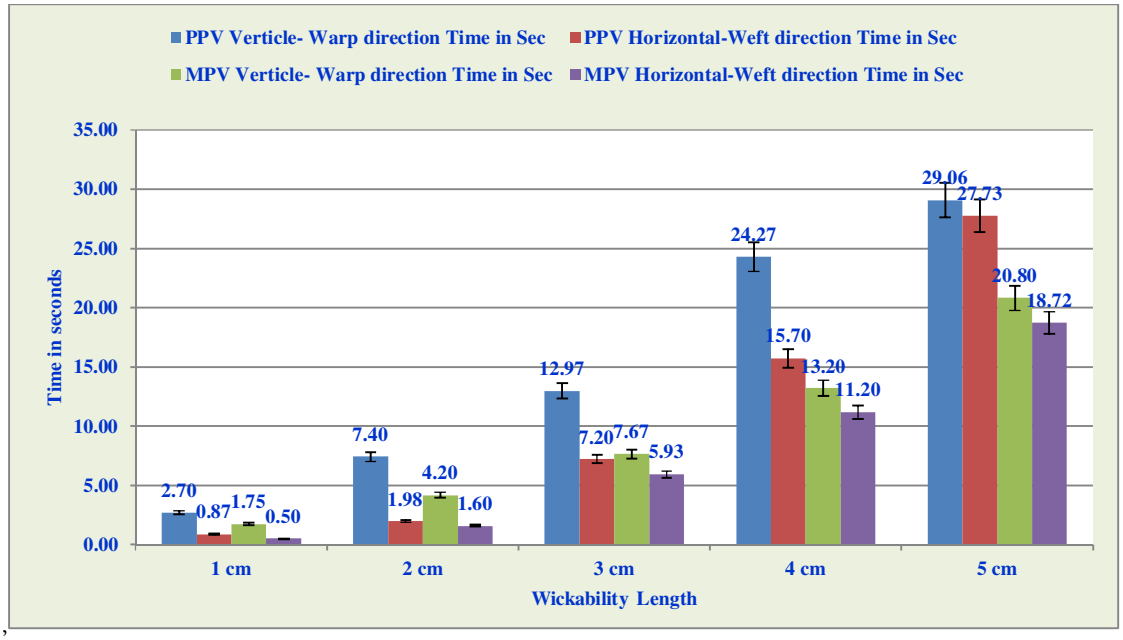

Fig 2- Wickability of Conventional Woven Fabric of PV (67/33) Blend

The wicking of Matt (MPV) fabric samples having 28.4% & 32.5% better wicking in warp & weft directions respectively in 5 cm wicking length, due to open weave structure than Plain (PPV) fabric samples. The same trend was noticed in all wicking height of 1 cm, 2cm, 3cm and 4cm. The ANOVA test proved that the Wickability values were statistically significant.

3.2 Air Permeability

The Air Permeability characteristics of Conventional Woven fabric Plain (PPC) & Matt (MPC) samples were shown in Fig 3

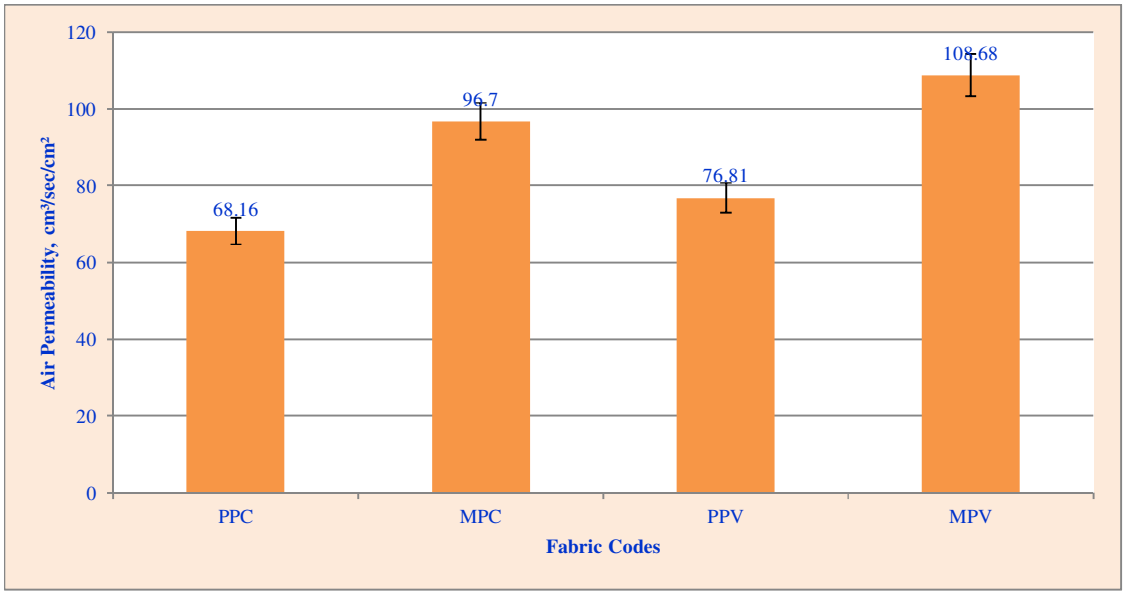

Fig 3- Air Permeability of Conventional Woven Fabric of PC & PV blend

Cite this article as: Hari Gopalakrishnan, Dr T Ramachandran. "Study of Comfort Characteristics of the Conventional Single Layer Woven Fabrics for Sportswear". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 85-89. Print.

The fabric samples Matt-MPC, Matt MPV showed better Air Permeability by 41.9 % & 41.5% respectively than PPC & PPV fabric samples, because of the loose weave structure of Matt weave. The Air permeability data were analysed using Anova and found that the differences in values were quite significant.

3.3 Water Vapour Permeability

The Water Vapour Permeability characteristics for Plain (PPC, PPV) & Matt (MPC, MPV) fabric samples were shown in Table 3.

Table 3- Water Vapour Permeability

Fabric Code	Weight (Before test)	Weight (After test)	Loss of Mass in grams	Water Vapour Permeability
	M1 gm	M2 gm	M=M1-M2	gm/m²/day
PPC	140	137.57	2.43	2155.99
MPC	140	136.73	3.27	2886.12
PPV	140	135.57	4.43	3827.52
MPV	140	134.63	5.37	4639.68

The Matt fabric –MPC, MPV showed 25% & 18% higher Water Vapour Permeability than Plain fabric-PPC & PPV respectively due to open weave structure of Matt Weave. Among Plain fabrics of PPC & PPV, PPV showed better water Vapour permeability by 77.5% and among Matt Fabrics of MPC & MPV, MPV showed better water vapour Permeability by 60.8% due to viscose blend, which has higher moisture regain properties than cotton blend.

3.4 Thermal Conductivity and Thermal Resistance

The thermal conductivity is the property of material's ability to conduct heat. Thermal conductivity is measured in watts per kelvin-meter. The reciprocal of thermal conductivity is Thermal Resistivity. Fig 4 shows the Thermal Conductivity and Thermal Resistance of Conventional woven Plain & Matt, PC & PV blended fabric samples.

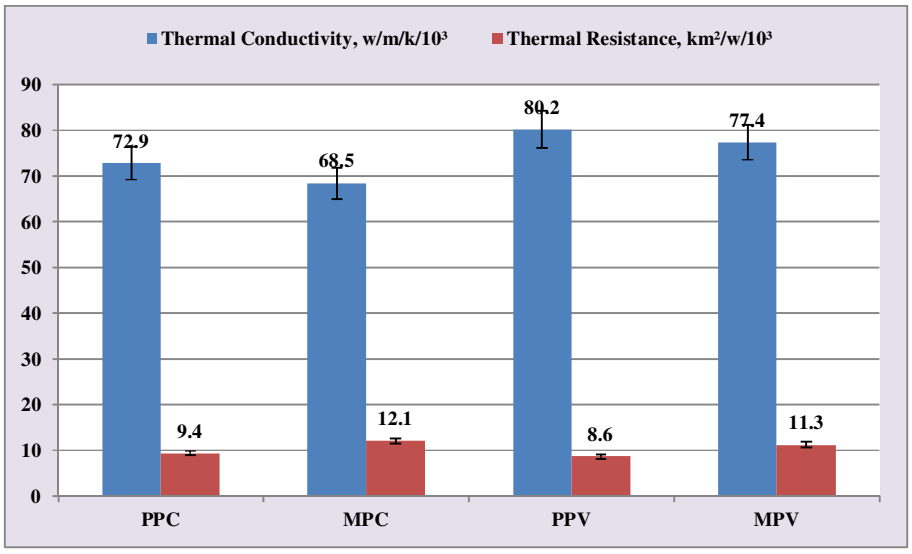

Fig 4- Thermal Conductivity and Thermal Resistance of Three Layered Fabric Samples of PC & PV (67/33) Blend

The Thermal conductivity of Plain (PPC & PPV) was found better by 6.4% & 3.4% respectively than Matt (MPC & MPV) fabrics due to more area of contact for the better conductivity of heat. Obviously, the Thermal Resistance of Matt (MPC & MPV) was found

Cite this article as: Hari Gopalakrishnan, Dr T Ramachandran. "Study of Comfort Characteristics of the Conventional Single Layer Woven Fabrics for Sportswear". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 85-89. Print.

better by 28.7% & 30.12% than Plain (PPC & PPV) respectively. It was further observed that the Thermal Conductivity of both Plain & Matt P/V blended fabrics were higher by 10 to 13% than Plain & Matt P/C blended fabrics respectively due to moisture holding property of Viscose. Obviously the Thermal Resistance of P/V blend is lower by 7% to 8% than P/C blend. The Thermal Conductivity and Thermal Resistance values were analysed using ANOVAs and found that they were statistically significant.

4. Conclusion

The conventional single layer fabric used in the existing sportswear were studied and their constructional details such as Material, Material composition, Linear density of warp &weft, ends/ cm & picks/ cm, fabric weight and weave structure were discussed. The conventional fabrics used in the sportswear were subjected to quality assessment of comfort characteristics such as Wickability, Air permeability, Water Vapor permeability, Thermal Conductivity and Thermal resistance. The comfort characteristics of matt MPC & MPV samples showed better wickability of 37.56% , 31.35% & 28.4%, 32.5% respectively in both warp and weft direction for 5 cm wicking height due its construction and weave structure. The fabric samples Matt-MPC, Matt MPV showed better Air Permeability by 41.9 % & 41.5% respectively than PPC & PPV fabric samples, because of the loose weave structure of Matt weave. The Matt fabric – MPC, MPV showed 25% & 18% higher Water Vapour Permeability than Plain-PPC & PPV respectively due to open weave structure of Matt Weave. Among the Plain fabrics of PPC & PPV, PPV showed better water Vapour permeability by 77.5% and among the Matt Fabrics of MPC & MPV, MPV showed better water vapour Permeability by 60.8% due to viscose blend, which has higher moisture regain properties than cotton blend. The thermal conductivity of the Plain PPC & PPV fabric samples have better conductivity of 6.4% & 3.4% than Matt MPC & MPV fabrics respectively due to its more area of contacts leading to better heat conductivity. Obviously, the thermal resistance of Matt MPC & MPV was found better by 28.7 % & 30.12% than Plain PPC & PPV respectively. In general, Thermal Conductivity was found better in P/V blended fabric and Thermal Resistance was found better in P/C blended fabrics. All the data were found statistically significant.

References

1. Hari Gopalakrishnan & T Ramachandran., 2015, Development of Three Layered Technical textiles in a shuttlessloom, International journal of Polymer and Textile engineering, Vol 2, Issue 6: 1-5
2. Heinrich Firgo, Friedrich Suchomel, Tom Burrow., 2006, Tencel® High Performance Sportswear, Lenzinger Berichte, 85:44-50
3. Indramani Kandi, Prof.Kedar Nath Das and Dr. Sudipt S Mahish., 2013, Thermo-Physiological Comfort Properties of P/B Blended Suiting Fabrics International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 12: 7620-7629
4. Kandhavadivu P, Mellikarjunan., 2011, Comfort and Thermo-Physiological characteristics of Multilayered fabrics for medical textiles, Journal of Textiles and Apparal and Management, vol 7 Issue 1: 1-15
5. Kandhavadivu P, R Rathinamoorthya & R Surjit P., 2015, Moisture and thermal management properties of woven and knitted tri-layer fabrics, Indian Journal of Fibre & Textile Research, Vol. 40: 243-249

Cite this article as: Hari Gopalakrishnan, Dr T Ramachandran. "Study of Comfort Characteristics of the Conventional Single Layer Woven Fabrics for Sportswear". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 85-89. Print.