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Study on Single Jersey Knitted Fabrics Made From Cotton/ Polyester Core Spun Yarns. Part II: Moisture Management Properties

Vidhya M[1] 0000-0001-6036-6117

Parveen Banu K[1] 0000-0001-8497-2752

Vasanth Kumar D[2] 0000-0001-9449-2517

Prakash C[3] 0000-0003-2472-6765

Subramaniam V[4] 0000-0001-5192-9280

[1] Periyar University/ Department of Textiles and Apparel Design / Salem 636 011, Tamil Nadu, India

[2] VIT Fashion Institute of Technology (VFIT)/ Vellore Institute of Technology - Chennai/ Chennai 600 127, Tamil Nadu, India

[3] Indian Institute of Handloom Technology/Department of Handloom and Textiles/ Fulia, Ministry of Textiles, Govt. of India, Shantipur, Nadia 741 402, West Bengal, India

[4] Jaya Engineering College /Department of Textile Technology /Chennai 602 024, Tamil Nadu, India

Corresponding Author: Vidhya M, E-mail: vidhyaarumugam2604@gmail.com

ABSTRACT

Moisture management is one of the essential properties required for knitted fabrics. Generally, the moisture management fabrics regulate the heat and moisture by maintaining the body temperature and keep the wearer cool and comfortable. Cotton fibres are known for their excellent properties in clothing to be worn in a normal situation by managing a limited quantity of sweat. During any sports activity, the human body dissipates a greater amount of sweat for an extended period of time and cotton fibre blended with polyester is generally recommended for its low moisture absorption and durability. In recent years, polyester fibres are most widely used for sportswear applications due to their better moisture transmission properties. This study mainly focuses on the influence of core-sheath ratio, twist and loop length on the moisture management properties of the knitted fabrics made from cotton/polyester core-spun yarns.

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Cotton, core spun yarn, knitted fabrics, moisture management, polyester.

1. INTRODUCTION

The human body needs perfect air condition to regulate its temperature to a constant temperature of 37°C, in order to provide the optimum temperature for maximum performance and better wearer comfort. To protect the body from overheating, a vital control mechanism releases the moisture at the proper moment. Generally, textile material worn next to the skin has got to support this regulative mechanism by maintaining the optimum performance of the human body. To make the wearer feel comfortable, the significant feature of any textile material/ apparel must transport the sweat away from the body [1]. Moisture transmission through the textile material both in liquid and vapour forms are equally important from the comfort point of view. In general, the comfort level of the fabric comfort can be determined by maintaining the body heat exposed to various environmental conditions and moisture management is considered as one of the key performance specifications in this respect [2]. When the human body is at rest, typically it releases roughly about 60ml of water vapour/ moisture during atmospheric conditions. Similarly when the human body performs some activities such as walking, running or playing any sports, usually the body

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gets warm-up and sweats more. During such activities, the sweat from the skin is absorbed less or more by the fabric. The sweat/ moisture from the human body need to be transported to the fabric for quick evaporation and thus resulting in a cooling effect to the wearer [3-4]. The primary duty of such fabric needs to transport the sweat away from the skin surface to the fabric surface quickly and keeps the wearer feel more comfortable by vaporising the moisture very quickly [4-5].

Generally, cotton fibres were known for their novel characteristics keeps the wearer comfortable and feel soft against the skin. Owing to the surface characteristics of cotton, naturally, it attracts moisture/ sweat away from the skin surface through the fabric by improving the evaporation characteristics by dissipating the heat and keeps the wearer cool and comfortable [6]. Likewise, the presence of polyester filament in polyester-cotton core yarn results in faster drying keeps the wearer cool, quick-dry, less electrostatic, easy to dye, finish and washing. Cotton based, polyester-cotton core yarns were most widely used for shirting, skirt, kimono, overalls, and decorative purpose fabrics [7]. The moisture management properties of the knitted fabrics depend on the fibre type, fibre fineness, blend ratio, yarn type, yarn twist, fabric structure and surface finishing [8-10]. Especially micro-denier/ micro-porous, profile/ hollow polyester fibres are most suitable for the intimate blends of cotton fibres. Because of the hydrophobic characteristics of polyester and hydrophilic characteristics of cotton fibres, these two fibres were intimately blended and results in enhanced quick-dry and better moisture transmission properties of the knitted fabrics.

Achour et.al [11] investigated wetting and transport properties of single jersey, 1 X 1 rib and 2 X 2 rib (English rib) fabrics made out of cotton and blended cotton/polyester yarns and concluded that the 2 X 2 rib (English rib) knitted fabric performed better with respect to the moisture transport properties. Uyanik and Baykal [12] concluded that the fabrics containing modal fibres were found to be better in terms of moisture management properties by exhibiting quick-drying characteristics than all the other fabrics made of hydrophilic fibres such as cotton and viscose. Gorji and Bagherzadeh [13] recommended that when the loop density decreases, the moisture management indices got improved except for the accumulation of one-way transport index (AOTI). The moisture management behaviour of textile material is quite complicated and depends a lot on the structural properties. It is also suggested that to attain better moisture management and comfort properties it is very important that the selection of fibre, yarn and fabric properties can be also reasonable and considered. Özkan and Kaplangiray[14] investigated the moisture management properties of polyester and textured polyester knitted fabrics made from staple fibres using ring spinning process and concluded that polyester knitted fabric showed very good moisture management properties with a higher absorption rate (AR) in the top surface and highest accumulative one-way transport index (AOTI). Oner et.al [15] studied the effect of raw material, weave type and tightness on liquid absorption and moisture transmission properties of cotton, viscose and polyester fabrics and concluded that weave type is less influenced, raw materials and tightness factors were strongly influenced and did not have a significant effect between the various factors.Vidya and Prakash [16] analysed the moisture management properties of plasma-treated and untreated knitted fabrics (single jersey structure) made from various types of polyester (spun polyester, continuous filament and micro-denier) yarns with different linear densities and concluded that continuous filament polyester plasma-treated knitted fabrics showed the maximum wetted radius (MWR), and spreading speed. Similarly, the absorption rate (AR) and wetting time (WT) were found to be very faster and the overall moisture management capacity (OMMC) significantly increased in the spun polyester plasma-treated knitted fabrics. Finally, the researchers concluded that the plasma treatment significantly improves the overall performance of the polyester knitted fabrics.

Many published experimental studies focused on the moisture management properties of layered fabrics and treated hydrophobic fabrics. Overall, lycra or elastane was commonly used in the production of core yarns to get the superior performance of knitted fabrics. It is also noticed that from the above literature, polyester fibres were most widely used in recent years for the end uses of sportswear due to the better moisture transmission properties and also reported by many researchers. But a meagre amount of researches were done using the core-spun yarns made from the intimate blends of cotton/ polyester fibres. To address this gap, this research work was carried out to study the moisture management properties of knitted fabrics produced from cotton/polyester core-spun yarns. In continuation to the previous part of our research work (Part I), we studied the thermal comfort properties of knitted fabrics produced from cotton/polyester core-spun yarns. Hence this paper broadly focuses on the influence of core ratio, TPM and loop length on the moisture management properties of knitted fabrics (single jersey structure) produced using cotton/ polyester core-spun yarns.

2. MATERIAL AND METHOD

2.1 Material

This is a fragmented part of our research work; from the previous part of our research work (Part I) the materials used for these studies were common and reported the same here. For this study, MCU 5 cotton fibres with 31mm fibre length, 4.1 µg/in fibre fineness, 22.5 g/tex fibre strength, the linear density of 0.17 tex, 8.5% moisture regain and 6% elongation were used in the sheath (cotton staple fibres), 50 and 65 denier polyester monofilaments were used as core during the core yarn spinning process. Core sheath proportions of 100:0, 80:20 and 60:40 of cotton/ polyester core-spun yarns were produced by varying different levels of the yarn twists (low, medium and high). Single jersey knitted fabrics were produced by varying the stitch length (loose, medium and tight) in the fabric structures and the experimental studies on moisture management properties of the knitted fabrics made from cotton/polyester core-spun yarns were studied.

2.2 Method

2.2.1 Testing of Moisture Management Properties

For the moisture management test, all the samples with a dimension (in cm) of 8 X 8 were prepared from each ratio with various loop lengths of fabrics and then conditioned at a relative humidity of 65% ± 2%and temperature of 27°C ± 2°C. The fabric surface in contact with the skin is referred to as the top surface and the fabric surface exposed to the atmosphere is referred to as the bottom surface. Moisture management tester consists of two horizontal electrical sensors namely upper and lower concentric moisture sensors each with seven concentric pins. A pre-defined amount of test solution is introduced onto the upper side of the fabric. Based on the signals received from the sensors, a set of indexes is calculated based on the indices grades and converted from a value to grade based on a five scale grading as given in Table 1. An average of five readings has been taken and the fabric classification can be categorised according to the moisture management properties as given in Table 2 [17-20].

3. RESULTS AND DISCUSSION

3.1 Physical properties

Table 3 exhibits the physical properties of single jersey knitted fabrics made from 100% cotton and cotton/polyester core-spun yarns. The fabrics were tested for wales/ cm, course/cm, stitch length, GSM and thickness.

Table 1. Moisture management grade scale

Index	Unit	Grade				
		1	2	3	4	5
Wetting time top surface (WT_t)	s	≥ 120 No wetting	20–119 Slow	5–19 Medium	3–5 Fast	< 3 Very fast
Wetting time bottom surface (WT_b)						
Absorption rate top surface (AR_t)	% / s	0–10 Very slow	10–30 Slow	30–50 Medium	50–100 Fast	> 100 Very fast
Absorption rate bottom surface (AR_b)						
Maximum wetted radius top surface (MWR_t)	mm	0–7 No wetting	7–12 Small	12–17 Medium	17–22 Large	> 22 Very large
Maximum wetted radius bottom surface (MWR_b)						
Spreading speed top surface (SS_t)	mm/s	0–1 Very slow	1–2 Slow	2–3 Medium	3–4 Fast	> 4 Very fast
Spreading speed bottom surface (SS_b)						
Accumulative one-way transport ındex (R)	%	< –50 Poor	–50 to 100 Fair	100–200 Good	200–400 Very good	> 400 Excellent
Overall moisture management capability (OMMC)	-	0–0.2 Poor	0.2–0.4 Fair	0.4–0.6 Good	0.6–0.8 Very good	> 0.8 Excellent

Table 2. Fabric classification into seven categories

Type name	Properties
Waterproof fabric	Very slow absorption slow spreading No one-way transport, no penetration
Water-repellent fabric	No wetting No absorption No spreading Poor one-way transport without external forces
Slow absorbing and slow-drying fabric	Slow absorption slow spreading poor one-way transport
Fast-absorbing and slow-drying fabric	Medium to fast wetting medium to fast absorption small spreading area slow spreading poor one-way transport
Fast-absorbing and quick-drying fabric	Medium to fast wetting medium to fast absorption large spreading area fast spreading poor one-way transport
Water-penetration fabric	Small-spreading area excellent one-way transport
Moisture-management fabric	Medium to fast wetting medium to fast absorption large spread area at bottom surface fast spreading at bottom surface good to excellent one-way transport

Table 3. Physical properties of knitted fabrics made from cotton/polyester core-spun yarns

Sample code	Samples	Wales/cm	Course/cm	Stitch length	GSM (g/m^2)	Thickness (mm)
1	100-940-2.7	17	21	0.149	104	0.56
2	100-1020-2.9	16	22	0.133	106	0.57
3	100-1020-2.5	18	23	0.149	107	0.58
4	100-1100-2.7	17	22	0.148	108	0.59
5	80:20-940-2.9	17	21	0.137	103	0.53
6	80:20-940-2.5	19	23	0.145	104	0.54
7	80:20-1020-2.7	18	22	0.138	105	0.53
8	80:20-1020-2.7	18	22	0.138	105	0.53
9	80:20-1020-2.7	18	22	0.138	105	0.53
10	80:20-1100-2.9	17	21	0.133	104	0.54
11	80:20-1100-2.5	18	23	0.145	106	0.55
12	60:40-940-2.7	18	22	0.137	102	0.52
13	60:40-1020-2.9	17	21	0.130	103	0.51
14	60:40-1020-2.5	19	23	0.138	104	0.53
15	60:40-1100-2.7	18	22	0.141	105	0.52

As per the standards, wales per cm, course per cm, stitch length, GSM and thickness of the single jersey knitted fabrics were tested and the below-mentioned data's have been discussed in the previous part of the research work (Part I). The materials used for these studies were common and reported the same here. From the results, it is evidenced that 100% cotton knitted fabrics showed higher weight and thickness compared to core-spun fabrics. Increased polyester content decreases the fabric weight and thickness in core-spun fabrics. Increased polyester content decreases the fabric weight and thickness in the core-spun knitted fabric due to its fineness, less bending rigidity and enhanced packaging fraction which increases the fabric porosity. High twist and low loop length make tightly structured fabrics that have more fibres in the cross-section that increases the thickness and GSM compared to slack structures which agree with the studies [21-22].

3.2 Moisture Management Properties Of Knitted Fabrics Made From Cotton/ Polyester Core-Spun Yarns

Table 4 exhibits the moisture management properties of knitted fabrics made from 100% cotton and cotton/polyester blended core-spun yarns. Moisture management indices of these knitted fabrics such as wetting time (WT - top and bottom), absorption rate (AR - top and bottom), spreading speed (SS- top and bottom), maximum wetted radius (MWR- top and bottom), accumulative one-way transport index (AOTI) and overall moisture management capability (OMMC).

Table 5 represents the ANOVA quadratic model for the moisture management properties of knitted fabrics made from cotton/polyester core-spun yarns. F-values imply that the models are significant and the p-value less than 0.05 indicate that the model terms are significant. The optimized values of design variables were derived as A = 78:22, B= 1060 and C = 2.6.

Table 4. Moisture management properties of knitted fabrics made from cotton/ polyester core-spun yarns

S.No.	Sample code	WT_T (sec)	WT_B (sec)	AR_T (%/sec)	AR_B (%/sec)	MWR_T (mm)	MWR_B (mm)	SS_T (mm/sec)	SS_B (mm/sec)	OTI (%)	OMMC
1	100-940-2.7	4.6186	4.9	18.7548	39.221	27.0	26.0	5.1225	5.1575	471.0594	0.8358
2	100-1020-2.9	4.8312	4.988	17.5904	32.2849	27.0	26.0	5.2583	5.2693	482.22	0.8206
3	100-1020-2.5	4.8248	4.912	19.2349	35.8054	27.0	26.0	5.5615	5.6415	479.3295	0.8144
4	100-1100-2.7	4.6562	4.91	19.2127	38.2493	27.0	26.0	5.7824	5.8958	471.7763	0.8143
5	80:20-940-2.9	4.4674	4.95	22.0233	44.1186	27.0	26.0	5.112	5.2467	469.2269	0.7931
6	80:20-940-2.5	4.4562	4.9562	24.7613	40.7926	26.0	27.0	5.0723	5.4478	427.8641	0.7864
7	80:20-1020-2.7	4.3438	4.8955	22.2692	45.1969	25.0	25.25	5.4943	5.4942	483.0789	0.7813
8	80:20-1020-2.7	4.3438	4.8955	22.2692	45.1969	25.0	25.25	5.4943	5.4942	483.0789	0.7813
9	80:20-1020-2.7	4.3438	4.8955	22.2692	45.1969	25.0	25.25	5.4943	5.4942	483.0789	0.7813
10	80:20-1100-2.9	4.194	4.877	23.6724	43.7868	25.0	25.0	5.7795	5.5283	474.0419	0.7674
11	80:20-1100-2.5	4.1622	4.874	29.9445	52.3921	25.0	25.0	5.2958	4.4345	468.1242	0.7624
12	60:40-940-2.7	3.9603	3.85	32.6037	59.9212	24.33	24.67	4.1311	5.2384	361.9054	0.743
13	60:40-1020-2.9	3.4705	3.8535	29.6603	58.6603	24.25	24.5	4.1843	5.2408	353.3911	0.7362
14	60:40-1020-2.5	3.3843	3.7688	29.7622	55.4869	24.0	24.0	4.3698	4.4159	300.7929	0.715
15	60:40-1100-2.7	3.1878	3.7535	27.3907	52.0117	23.25	23.0	3.6497	3.9167	265.0256	0.7132

Table 5. Analysis of variance (ANOVA)

	Degrees of freedom	F value	p-value
Wetting time top	9	49.39	0.0002
Wetting time bottom	9	996.56	<0.0001
Absorption rate top	9	6.24	0.0289
Absorption rate bottom	9	22.29	0.0016
Maximum wetted radius top	9	21.17	0.0018
Maximum wetted radius bottom	9	12.21	0.0066
Spreading speed top	9	7.92	0.0174
Spreading speed bottom	9	17.68	0.0028
Accumulative one-way transport capability	9	13.31	0.0054
OMMC	9	46.77	0.0003

3.2.1 Wetting time (WT)

Wetting time is the period of time in which the fabric begins to wet from the inner surface to the outer surface. The wetting time of the top and bottom surfaces of the cotton/polyester core spun knitted fabrics are given in Table 4 and Figures 1 and 2.

Response surface equation for the wetting time was derived as,

$$\text{Wetting time top} = 4.34 - 0.6160*A + 0.1941*B - 0.0372*C + 0.1400*AB + 0.0206*AC + 0.0051*BC - 0.2152*A^2 + 0.0208*B^2 - 0.0447*C^2$$

$$\text{Wetting time bottom} = 4.896 - 0.561*A + 0.0424*B - 0.0104*C + 0.0021*AB - 0.0207*AC + 0.0023*BC - 0.5379*A^2$$

$$+0.0153*B^2 + 0.0035*C^2$$

The results indicate that the knitted fabrics (made from cotton/ polyester core-spun yarns) wetting time ranges from 3 to 5 at the top and bottom surface respectively and were graded as fast. It is expected and evidenced that, the wetting time is higher for the bottom surface when compared to the top surface for all the samples of knitted fabrics. It is also revealed that when the cotton fibre content increases the wetting time increases due to the higher thickness value and in the same way the liquid test takes a long time to traverse in the thicker fabrics as water has to go through more fibres. Similarly when the polyester fibre content increases, the fabric weight and thickness decrease and thus takes less time to wet. At a high twist and a low loop length, wetting time decreases. When the twist per meter (TPM) increases, the GSM and the hairiness of the yarn decreases and the fabric becomes more compact with fibres that get wet quickly. Tightly structured fabrics spread liquid faster than slack structures according to the researchers [23-24].

3.2.1 Absorption rate

The absorption rates are the slopes of the water curves from wetting point to peak values on the inner and outer surfaces of the fabric and absorption rates of the top and bottom surfaces of the knitted fabrics made from cotton/ polyester core-spun yarns are given in Table 4 and Figure 3 and 4.

Response surface equation for the absorption rate was yielded as,

$$\text{Absorption rate top} = 22.27 + 5.58*A - 0.3480*B + 1.14*C + 1.59*AB + 0.0310*AC - 0.8835*BC + 0.5914*A^2 + 1.22*B^2 + 1.61*C^2$$

$$\text{Absorption rate bottom} = 45.20 + 10.06*A - 1.26*B + 0.5687*C + 3.71*AB - 1.40*AC - 2.98*BC + 1.22*A^2 - 0.5576*B^2 + 0.6332*C^2$$

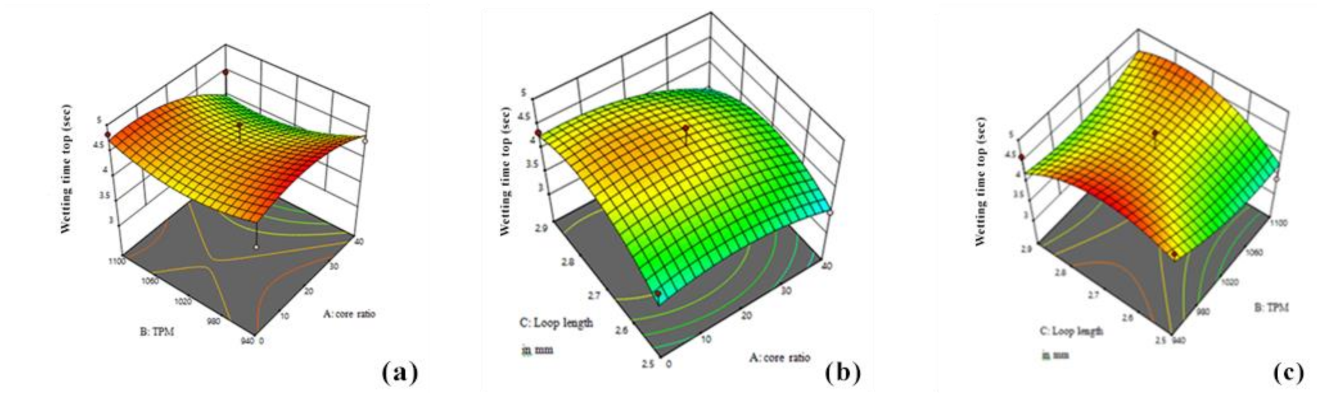

Figure 1. Wetting time (WT top) of knitted fabrics made from cotton/ polyester core-spun yarns

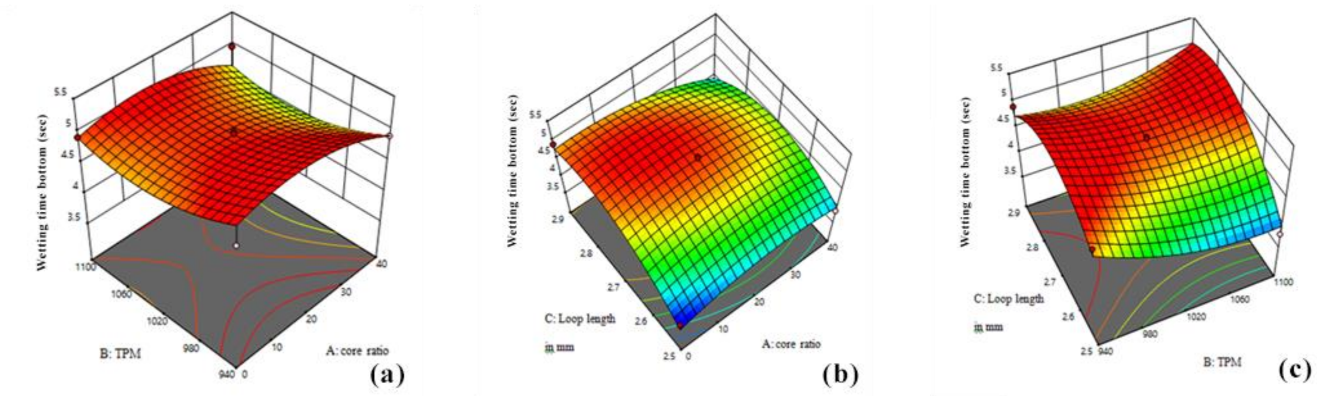

Figure 2. Wetting time (WT bottom) of knitted fabrics made from cotton/ polyester core-spun yarns

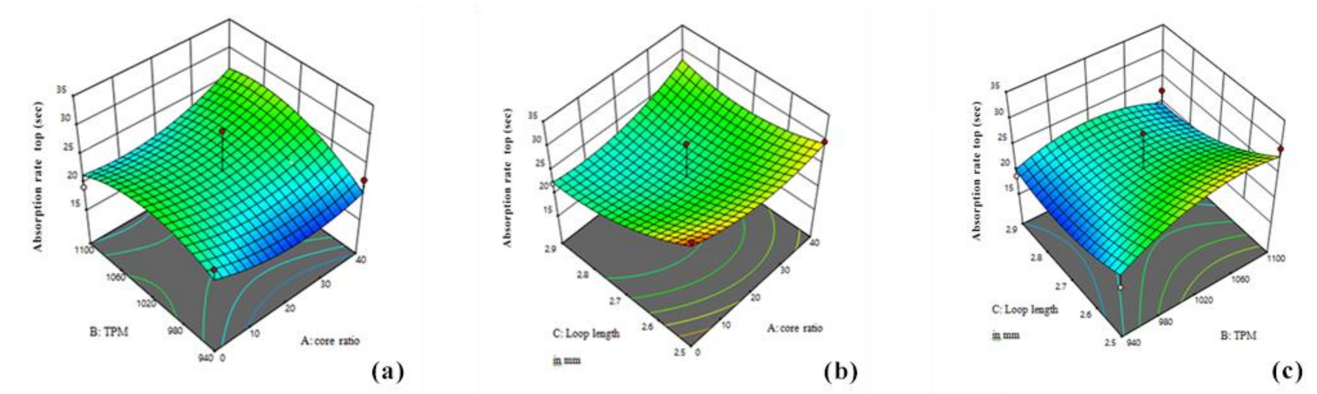

Figure 3. Absorption rate (AR top) of knitted fabrics made from cotton/ polyester core-spun yarns

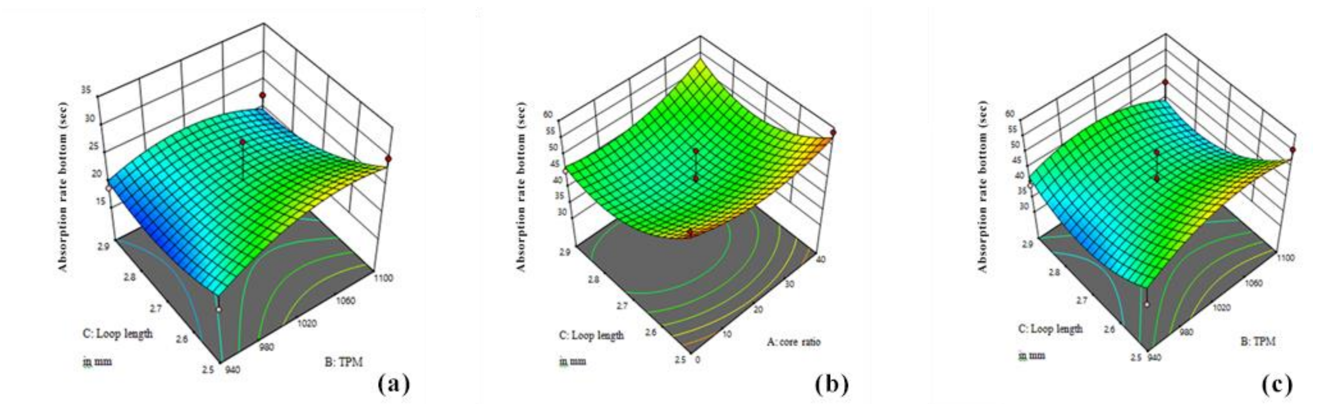

Figure 4. Absorption rate (AR bottom) of knitted fabrics made from cotton/ polyester core-spun yarns

The absorption rate of the bottom surfaces is higher than the top surfaces and this indicates that the sweat diffuses from the next-to-skin surface to the opposite side and is accumulated on the bottom surface of the fabric. As per the grade scale, 100% cotton and 80/20 cotton/polyester core spun knitted fabrics were rated as slow (i.e.10-30) at the top and bottom surfaces were rated as medium (i.e.30-50). 60/40 cotton/polyester core spun knitted fabrics were graded as medium (i.e. from 30-50) at the top and fast (i.e.50-100) in bottom surfaces. High twisted, tight structured cotton knitted fabrics absorb slowly when compared to cotton/polyester knitted fabrics made from core-spun yarns. Top and bottom absorption rates decrease with the increase in thickness and aerial density of the knitted fabric. As the polyester content increases, the liquid passed swiftly through to the fabric and accumulated in the bottom surface thus increases the absorption rate. As the twist increases absorption rate decreases and as the loop length increases absorption rate also increases. The same trend was followed in all the samples and thus correlates to the observations [25-26].

3.2.3 Maximum wetted radius (MWR)

Table 4 and Figures 5, 6 shows the maximum wetted radius of top and bottom surfaces of the cotton/polyester core spun knitted fabrics.

Response surface equation for maximum wetted radius was derived as,

$$\text{Maximum wetted radius top} = 25.00 - 1.52*A + 0.5100*B - 0.1562*C + 0.2700*AB - 0.0625*AC - 0.2500*BC* + 0.1038A^2 + 0.2912*B^2 + 0.4588*C^2$$

$$\text{Maximum wetted radius bottom} = 25.25 - 0.9788*A + 0.5838*B + 0.625*C + 0.4175*AB - 0.1250*AC + 0.2500*BC - 0.4787*A^2 + 0.1462*B^2 + 0.3538*C^2$$

All the fabrics were rated as very large (i.e. >22) at both the top and bottom surfaces as per the moisture management grade scale. The maximum wetted radius of the top surface was higher compared to the bottom surface because the liquid gets absorbed and penetrates the fibre structure, which would result in lower moisture spreading in the fabric. An increase in polyester content spreads less liquid on the surface which decreases the maximum wetted radius of the core-spun fabrics. High twisted and tight structured fabrics absorb more liquid and spread more on the surface. The lowest MWR value for the top and bottom surfaces reflects a good moisture transport property and dry feeling as a result. The lower value of MWR means a less clammy touch, a less chilly sensation and thus overall better comfort close to the skin in accordance to the studies [27-28].

3.2.4 Spreading speed (SS)

Spreading speed is the moisture spreading speed on the inner and outer fabric surfaces to attain maximum wetted radius. Table 4 and Figure 7, 8 shows the spreading speed of top and bottom surfaces of the cotton/polyester core spun knitted fabrics.

Response surface equation for spreading speed was derived as,

$$\text{Spreading speed top} = 5.49 - 0.6737*A - 0.0342*B - 0.0146*C + 0.0864*AB - 0.0089*AC + 0.1110*BC* - 0.6471A^2 - 0.3068*B^2 + 0.1274*C^2$$

$$\text{Spreading speed bottom} = 5.49 - 0.3940*A + 0.2707*B - 0.1829*C + 0.3025*AB - 0.2698*AC + 0.3237*BC - 0.2323*A^2 - 0.3665*B^2 + 0.0366*C^2$$

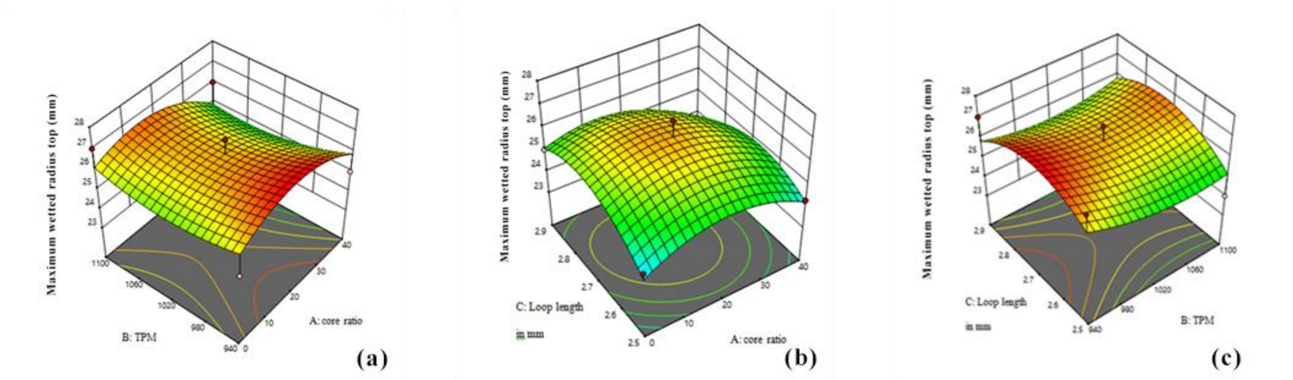

Figure 5. Maximum wetted radius (MWR top) of knitted fabrics made from cotton/ polyester core-spun yarns

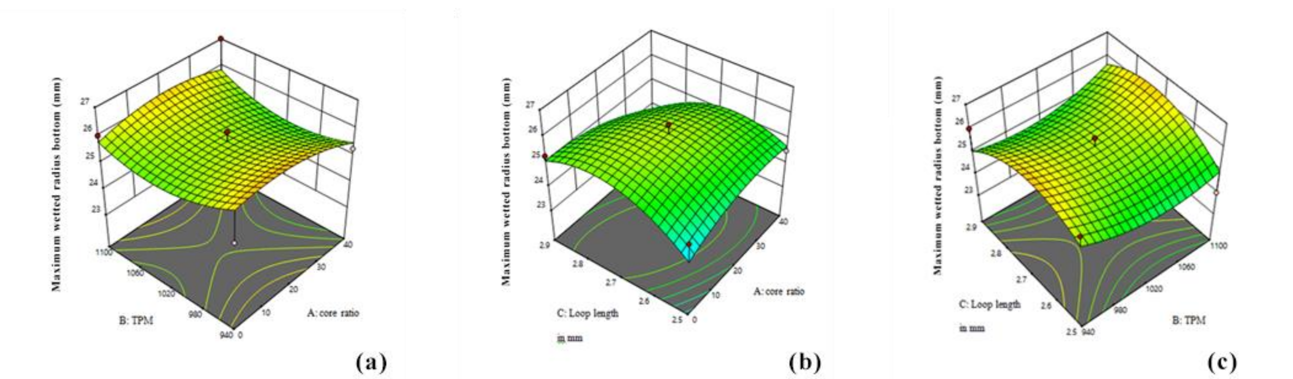

Figure 6. Maximum wetted radius (MWR bottom) of knitted fabrics made from cotton/ polyester core-spun yarns

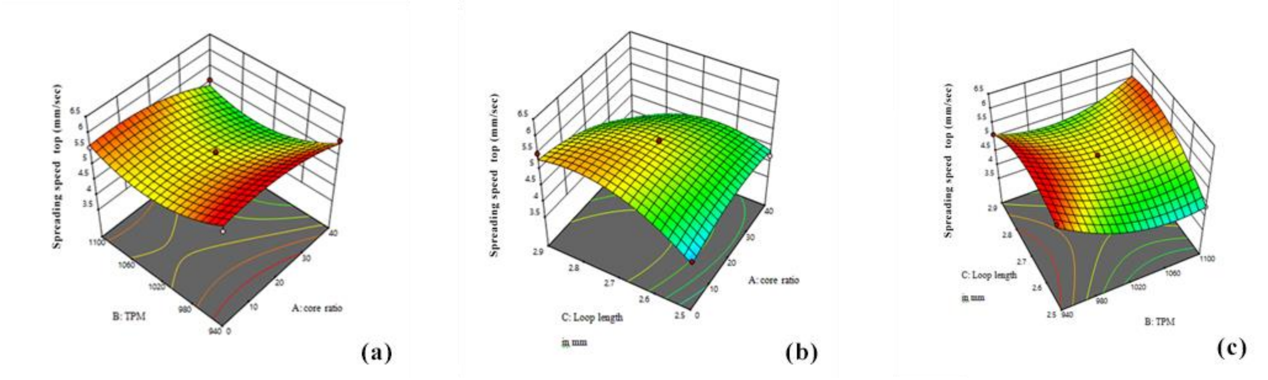

Figure 7. Spreading speed (SS top) of knitted fabrics made from cotton/ polyester core-spun yarns

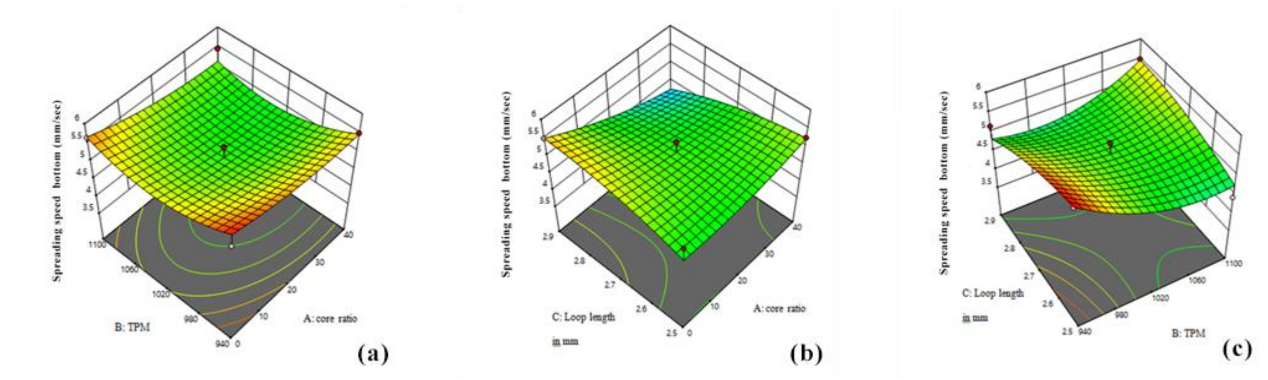

Figure 8. Spreading speed (SS bottom) of knitted fabrics made from cotton/ polyester core-spun yarns

All the fabrics were rated as very fast (>4) at the top and bottom surfaces. The spreading speed of the bottom surface was higher than the top surface. As the cotton content increases spreading speed also increases. Low twist and loose fabrics show faster spreading speed compared to tight structures. High twisted tight structured fabrics hold moisture and spread slowly compared to other samples which agree with the researchers [29-30].

3.2.5 Accumulative one-way transport index (AOTI)

Accumulative one-way transport index is the difference in accumulated moisture between the inner and outer fabric surfaces in the period of test and the values of the cotton/polyester core spun knitted fabrics are shown in Table 4 and Figure 9.

Response surface equation for accumulative one-way transport index was derived as,

$$\text{Accumulative one-way transport index} = 483.08-77.91*A+7.87*B-13.43*C+21.43*AB-11.26*AC-8.86*BC-73.26*A^2-14.77*B^2-8.50*C^2$$

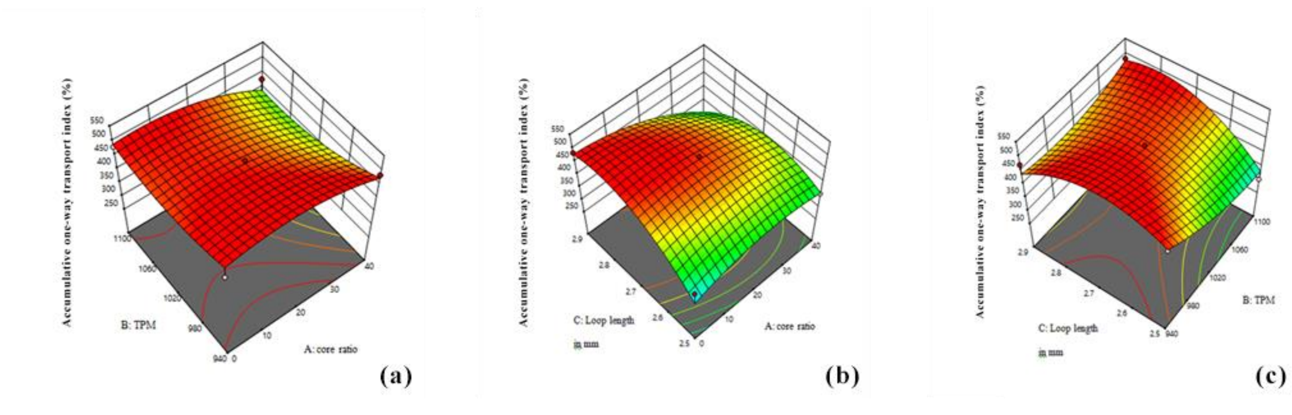

Figure 9. Accumulative one-way transport capability of knitted fabrics made from cotton/ polyester core-spun yarns

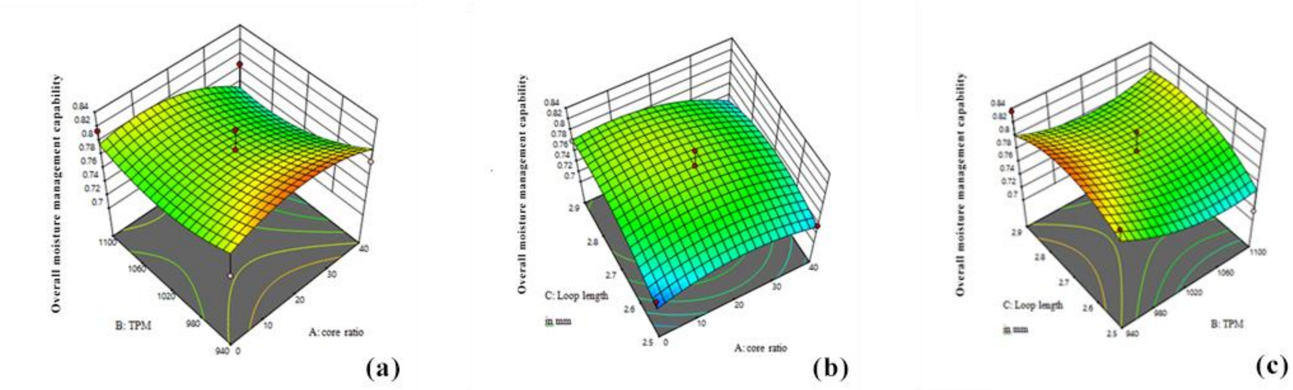

Figure 10. Overall moisture management capability of knitted fabrics made from cotton/ polyester core-spun yarns

100% cotton and 80/20 cotton/polyester core spun knitted fabrics were graded as excellent (>400) compared to 60/40 cotton/polyester core spun knitted fabrics which were graded as very good (200-400) as per grade scale readings. An increase in polyester content absorbs less compared to cotton that decreases the accumulative one-way transport index of the fabrics. Increased loop length with low twist increases the accumulative one-way transport index%. The positive and high values indicate the faster rate of transportation, while negative and low values indicate slower transportation associated with the larger wetted area in the skin surface thus agrees with the findings [31-33].

3.2.6 Overall moisture management capability (OMMC)

OMMC is defined as an index to indicate the overall capability of the fabric sample to manage the transport of liquid moisture, which includes three aspects of performance: moisture absorption rate of the bottom side, one-way liquid transport capability, and the drying rate of the bottom side.

Overall moisture management capability of the cotton/ polyester core spun knitted fabrics are shown in Table 4 and Figure 10.

Response surface equation for OMMC was derived as,

$$OMMC = 0.7813-0.0472*A+0.0080*B-0.0041*C+0.0113*AB-0.0053*AC-0.0004*BC-0.0052*A^2+0.0021*B^2-0.0061*C^2$$

The OMMC is dependent upon the absorption rate, one-way liquid transport index and liquid spreading speed. The higher the OMMC value the better is the liquid performance of the fabric. 100% cotton knitted fabrics were graded as excellent (>0.8) and cotton/polyester core spun fabrics were rated as very good (i.e.0.6- 0.8).The highest value of 0.8358 was observed in 100% cotton knitted fabrics with low twist and medium loop length. As the cotton content increases OMMC increases due to its hygroscopic nature. Increasing hygroscopic content in the fabric increases moisture absorption and results in faster drying of sweat from the skin. 60/40 cotton/polyester core spun knitted fabrics with high twist and medium loop length showed the lowest OMMC value of 0.7132. Increased twist and tight structure retain moisture longer which results in lower OMMC values which correlate with the findings [34-36].

4. CONCLUSION

The interactive effects of core-sheath ratio, twist and loop length on the moisture management properties of knitted fabrics made from 100% cotton and 80/20, 60/40 cotton/polyester core-spun yarns were observed in this study. It was found that the increase in polyester percent increases the moisture management properties. Twist and loop length also plays an important role in moisture management properties. Wetting time, absorption rate, maximum wetted radius and spreading speed of the bottom surfaces were higher than the top surfaces for all the fabrics as expected. Due to the increase in the polyester ratio, the fabric weight decreases and hence dries quickly. High twisted and tight structured fabrics hold moisture and spread more. 100% cotton knitted fabrics show higher wetting time, slow absorption rate, higher wetted radius, excellent accumulative one-way transport index and excellent OMMC values. 80/20 cotton/polyester core spun knitted fabrics shows lower wetting time, medium absorption rate, lower wetted radius and very fast spreading speed compared to 100% cotton fabrics. 60/40 cotton/polyester core spun fabrics shows low wetting time, fast absorption rate, lower wetting radius and very fast-spreading speed makes dry feeling to the wearer. Although cotton/lycra core yarns were commonly used in the knitwear industry, in the near future cotton/polyester core-spun yarns could be used for the common end uses. Finally from the results, it can be concluded that the knitted fabrics made from core-spun yarns come under type 7 which were rated as moisture management fabrics compared to 100% cotton fabrics. As per the findings, core-spun yarns can be used for sportswear purposes by fulfilling the requirements of moisture management fabrics.

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