Effect of polyester cross-section on moisture management properties of knitted fabrics

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Abstract: This study reports an investigation of the effect of the polyester filament cross-sectional along with the lycra content variation on the moisture management properties of Rib knitted fabrics composed of them. The moisture management properties of various knitted structure were measured by using a SDL Atlas Moisture Management Tester. All the properties related to liquid transport in the textile material such as wetting time, Absorption rate, Maximum wetted radius, spreading speed, accumulative one-way transport index and overall moisture management capacity (OMMC), have been studied and analyzed to the polyester filament cross-section. It was observed that rib knitted structure having tri-lobal cross-sectional polyester filament shows increase in the spreading speed, accumulative one-way transport index and OMMC value.\

Keywords: Cross-section, Knitted fabrics, Lycra, Moisture-management transport properties, OMMC, Polyester, Transport index

1. INTRODUCTION

Woven or knitted fabrics from polyester yarn are used extensively in apparel and home furnishings. Since synthetic material is perceived by many as having a less natural feel, it is texturized or blended with other natural fibers to provide specific advantages. One such usage nowadays is sportswear having polyester and lycra. Fabrics used for sportswear should transfer the sweat and transport through and across the fabric.

Water (sweat) absorption determines the capacity and rate of a fabric to mop up the liquid sweat generated by the skin. Wicking determines the capacity and rate of the fabric to transport absorbed sweat away from the point of a contact with the skin. Such fabrics with excellent moisture management properties are claimed to have quick drying rates and the significant movement of moisture away from the skin with excellent breathability. None of the fibres alone can make ideal sportswear. The ideal sportswear can be made either by filament structure modification or blended with the other fibres.

Also cross-sectional area of the polyester filament and the lycra content play a vital role in transfer the moisture away from the skin surface to the atmosphere.

In this work, rib knitted structures having two different cross-sections polyester filament and lycra were examined for Moisture Management properties.

2. MATERIALS AND METHODS

2.1 MATERIALS

Rib knitted fabrics were made using polyester filament and Lycra(40 D). fabric specifications of them were given in Table 1.

Structure	Sample code	Polyester cross-section	WPI	CPI	Thickness (mm)	Gsm	Loop length
Full plated Rib	R2	Circular	27	47	0.083	208	3.1
	R5	Trilobal	30	46	0.084	215	3.1
Half plated Rib	R8	Circular	23	37	0.065	149	3.1
	R11	Trilobal	23	42	0.076	165	3.1

2.2 METHODS

For the study of Moisture Management Transport Properties of polyester/lycra stretch yarn knitted fabric, these rib knitted fabrics were dry-relaxed by keeping on flat surface for ten days. On each sample the wetting time, Absorption rate, Maximum wetted radius, spreading speed, accumulative one-way transport index and overall moisture management capacity (OMMC), were measured under the standard AATCC 195-2011.

The results obtained by this method are based on the wicking behavior of the yarn and the internal structure.

3. Results and Discussion

Ribs knitted samples produced were tested by using MMT tester, SDL Atlas under the standard AATCC 195.

3.1 Effect of cross section of polyester filament on wetting time

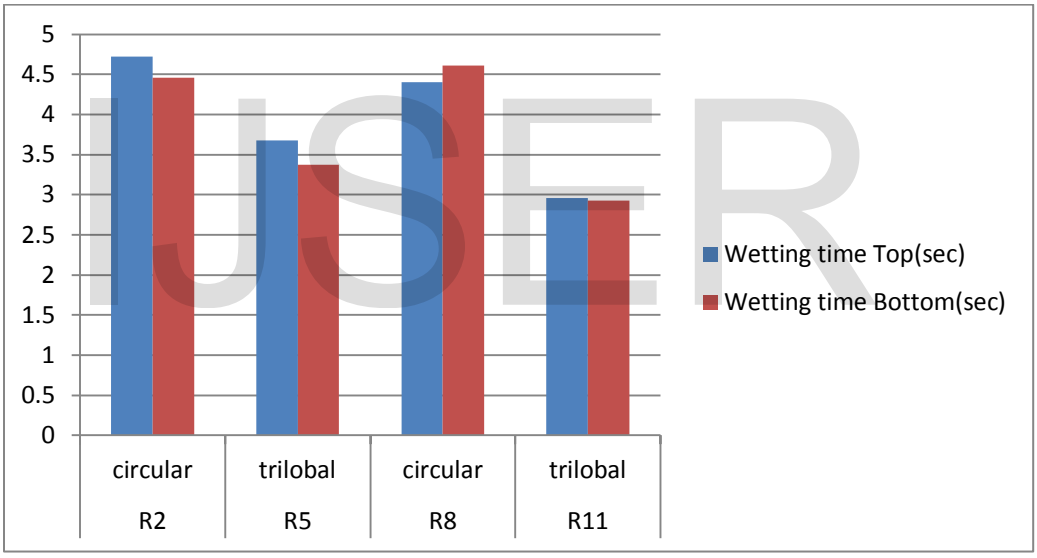
Absorption rate is defined as the average speed of liquid moisture absorption for the top and bottom surfaces of the specimen during the initial change of water content during a test. Maximum wetted radius is defined as the greatest ring radius measured on the top and bottom surfaces.

Wetting time and absorption rate of the samples were tabulated in Table 2 and the graphical representation of the same was shown in graph 1.

Table 2. Wetting time and absorption Rate of knitted fabrics

Sample code	Wetting time Top(sec)	Wetting time Bottom(sec)	Top Absorption Rate(%/sec)	Bottom Absorption Rate(%/sec)	Top Max Wetted Radius(mm)	Bottom Max Wetted Radius(mm)
R2	4.7248	4.4622	50.4763	56.4832	18	18
R5	3.675	3.3752	37.8654	48.9718	17	19
R8	4.406	4.6126	67.1838	66.8569	27	29
R11	2.9624	2.9246	46.83	53.4746	25	25

Graph1. Cross-section Vs Wetting time



The above results shows that fabrics made of tri-lobal polyester had less time to get wet when water starts spread from either from the top or bottom surface. From the graph, trilobal cross section polyester has better performance in terms of transporting the moisture from the skin surface to the atmosphere.

3.2 Effect of cross section of polyester filament on Spreading speed

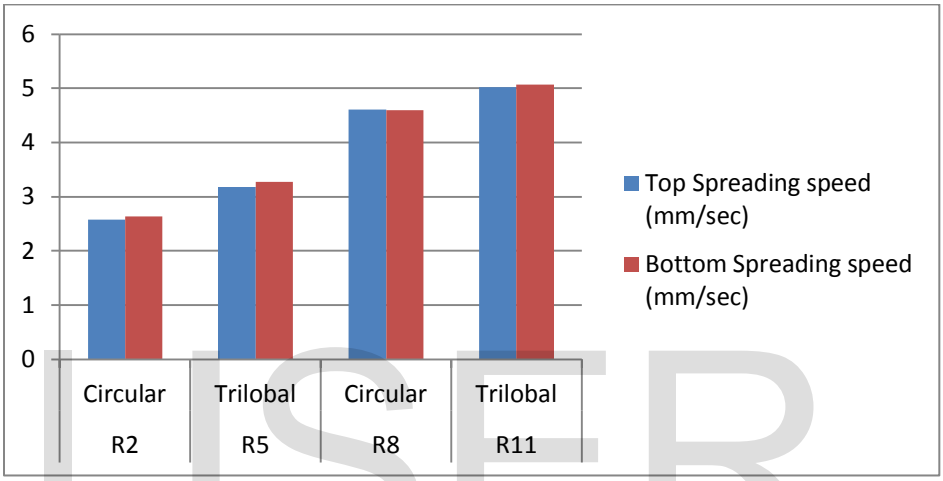
Spreading speed is defined as the accumulated rate of surface wetting from the center of the specimen where the test solution is dropped to the maximum wetted radius. Accumulative one-way transport index is defined as the difference between the area of the liquid moisture content curves of the top and bottom surfaces of a specimen with respect to time. Overall (liquid)moisture management capacity (OMMC) is defined as an index of the overall capability of a fabric to transport liquid moisture .

Spreading speed, Accumulative one-way transport index and OMMC values of the samples were tabulated in Table 3 and the graphical representation of the same was shown in graph 2.

TABLE 3. WETTED RADIUS AND SPREADING SPEED OF KNITTED FABRICS

Sample code	Top Spreading speed (mm/sec)	Bottom Spreading speed (mm/sec)	Accumulative one-way transport index (%)	OMMC
R2	2.5831	2.6399	92.3379	0.4239
R5	3.1793	3.2783	168.5802	0.5391
R8	4.608	4.6028	69.7379	0.5322
R11	5.0244	5.0676	127.325	0.5678

GRAPH2. CROSS-SECTION VS SPREADING SPEED (MM/SEC)



From the above graph, fabrics made of trilobal polyester absorb the liquid and rapidly transport the liquid away from the point of contact with the liquid.

Finger Print of Moisture Management Properties of all the samples were given the Diagram 1, 2, 3 and 4.

Diagram 1. Finger Print of Moisture Management Properties of R2

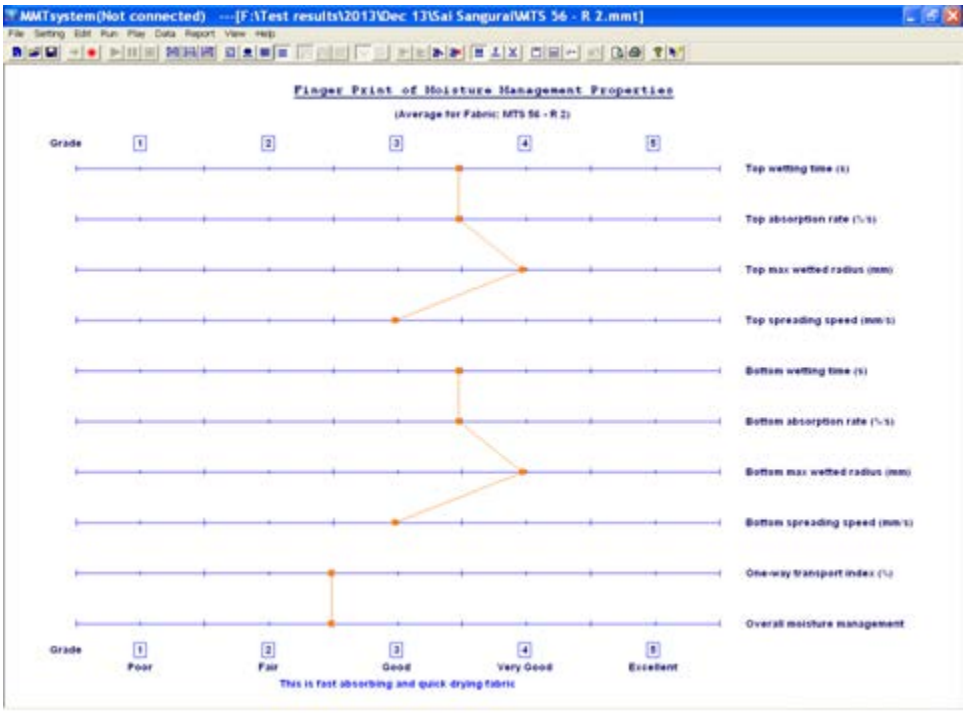


Diagram 2. Finger Print of Moisture Management Properties of R5

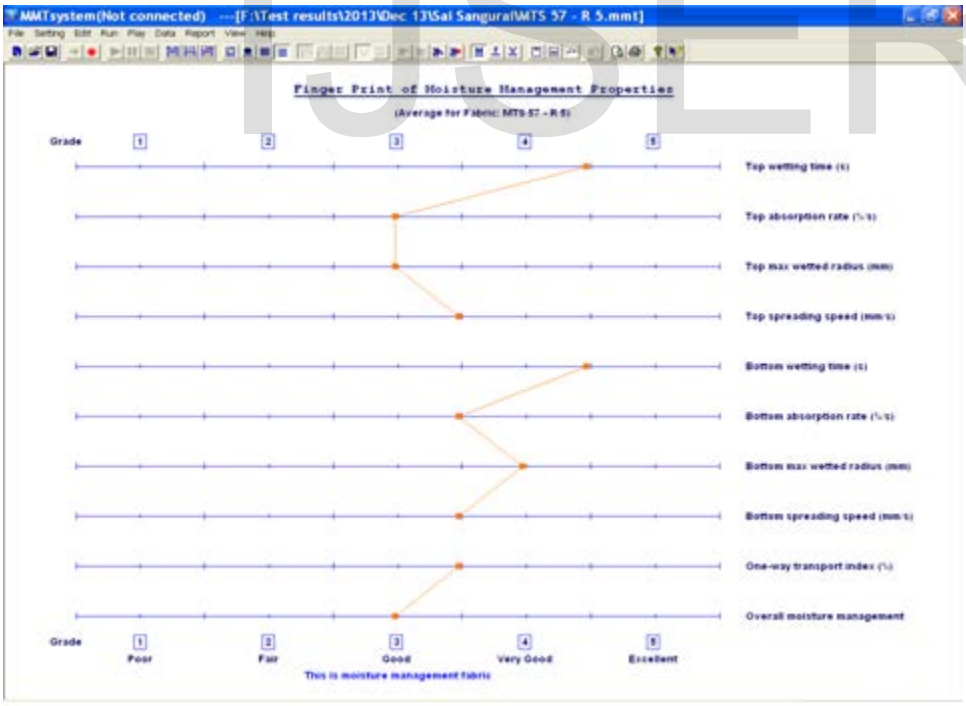


Diagram 3. Finger Print of Moisture Management Properties of R8

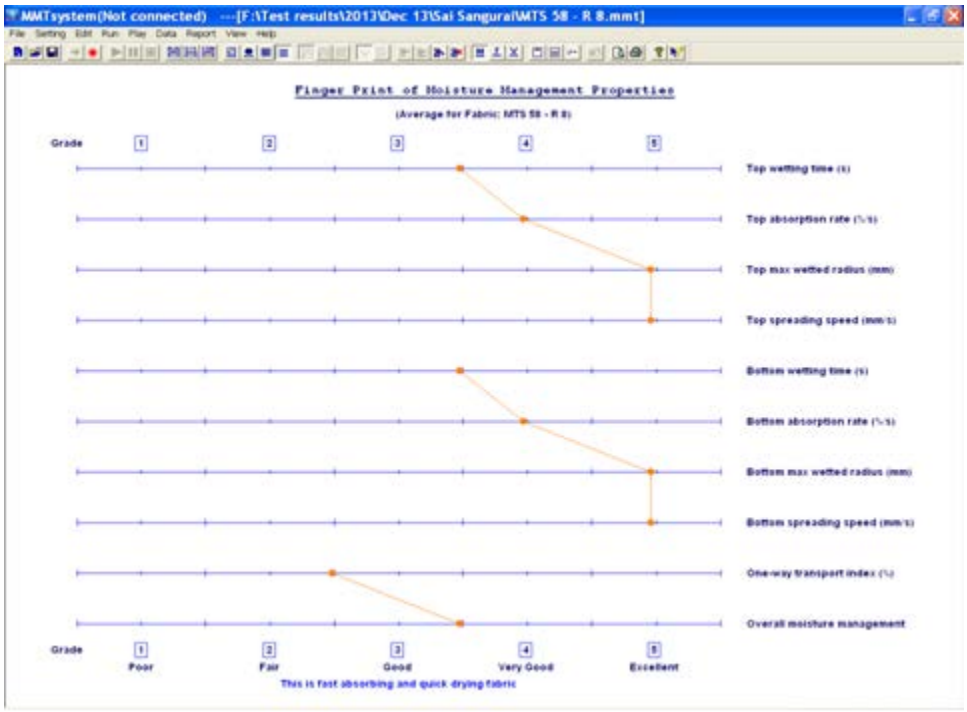
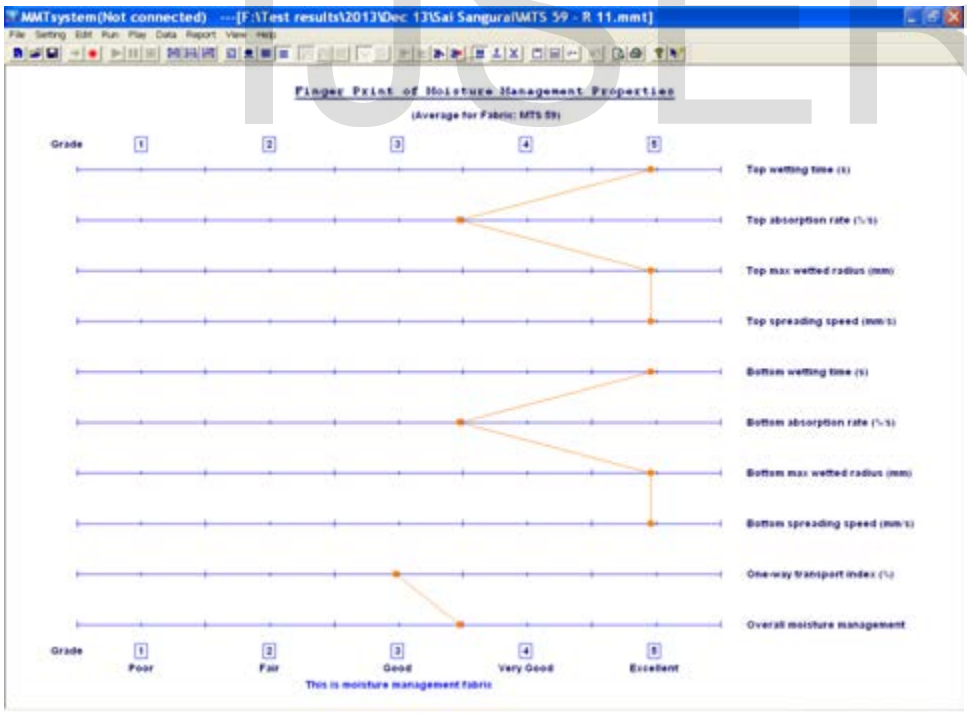


Diagram 4. Finger Print of Moisture Management Properties of R11



R5 and R11 samples were moisture management fabric in which the polyester cross-section was Trilobal whereas R2 and R8 samples were fast absorbing and quick drying fabric.

4. Conclusion

The experimental results showed that the filament cross-section could significantly affect the Liquid transportation of the fabrics. In this study, fabrics

having both the circular and trilobal cross- section polyester filament along with the lycra were examined and found that fabrics having trilobal polyester filament had good liquid transportation properties than the fabrics having circular polyester filament .

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