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DEVELOPMENT OF WOOL POLYESTER BI-LAYER KNITTED FABRIC FOR SPORTSWEAR

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ABSTRACT:- *In current years, development in active sportswear fabrics has been progressing to perform high function and achieves comfort. Today sports demand high performance equipment and apparel. It is very important to produce sportswear with comfort, functionality and cost effective. The sportswear manufacturing textile industries not only keep their eyes on market diversification for fibrous materials but also on textile science and technology. The use of innovative textile science and technology in the manufacturing of sports and leisurewear fabrics is continuously enhancing day by day to fulfill the requirements for athletics and leisure activities for their better performance in the sports. This aim of this project is to develop wool/polyester bi-layer knitted fabric with different combinations and to study the physical aspects and comfort aspects such as wetting, wicking, water absorbency, dryness, moisture vapour transfer, thermal conductivity and air permeability based on objective and subjective evaluation.*

Keywords: *Fabrics, Sportswear, moisture, leisure*

1. INTRODUCTION

Sportswear requires some important functional and comfort properties such as optimum heat and moisture regulation, rapid moisture absorption and conveyance capacity, good air and water permeability, prevention of a long term feeling of dampness, low water absorption of the layer of clothing facing the skin, quick drying fabric to prevent catching cold, pleasant to skin, soft, non-abrasive and non-chafing, dimensionally stable even when wet, durable, lightweight, soft and pleasant touch, easy care, smart and functional design. The demands from fabrics have changed with the developments in technology and the rising living standards. Now the requirement is not only style and durability, but also clothing which includes psychological, sensorial and thermo – physiological comfort. Over last few years, there has been growing interest in knitted fabrics due to their simple production technique, low cost, high levels of clothing comfort and wide product range. Knitted fabrics not only possess stretch and provide freedom of movement, but they also have good handle and ability to transmit vapour from the body.

Wool is hydrophilic fiber, with 13% moisture regain. Wool has good elasticity, with 20–40% elongation at breaking point. Wool has good wicking ability and is a good insulator even when wet. Wool fibers have the highest moisture regain of all fiber at a given temperature and relative humidity. [(1)] It also has higher heat releasing and heat absorption properties accompanying moisture absorption and desorption respectively, which strengthens the buffering effect of the clothing between the human body and the surrounding environment. Hence wool is able to absorb more moisture than cotton before becoming saturated. Also wool has a natural degree of water repellence in gentle or misty rain, which adds to both thermo physiological and sensory comfort.Wool has good wicking ability and is a good insulator even when wet. However, wool is slow to dry and has a high wet surface coefficient of friction. [(2)]

Polyester has outstanding dimensional stability and offer excellent resistance to dirt, alkalis, decay, mold and most common organic solvents. Being durable, yet lightweight, elasticity and a comfortable smooth feel, these are all important qualities to consumers for wide variety sportswear applications. Excellent heat resistance or thermal stability is also an attribute of polyester [(3)]. It is the fiber used most commonly in base fabrics for active sportswear because of its low moisture absorption, easy care properties and low cost.

In this study attempt has been done to made bilayer weft knitted fabric which can able to transfer moisture from skin to the environment. This is achieved by bi layer of fabric construction in which the inner layer is made polyester filament yarn that is hydrophobic and has good wicking rate. The outer layer is made up of natural fibre such as Wool which has more absorption character and rapid evaporation.

2. MATERIALS AND METHODS

2.1 SELECTION OF YARN

Wool: 40's count Wool was selected for the study.

Polyester: 80 Denier was selected.

The prerequisites of ideal sportswear are rapid transport of preparation away from the body and then its rapid evaporation to keep the fabric dry. This is achieved by bi layer of fabric construction in which the inner layer is made polyester filament yarn that is hydrophobic and has good wicking rate. The outer layer is made up of natural fibre such as Wool which has more absorption character and rapid evaporation.

2.2 KNITTING MACHINE PARAMETERS

1. Type : Interlock jacquard knitting machine
2. Feeders 1 & 3 : polyester
3. Feeders 2 & 4 : Wool
4. Gauge : 18 needles/inch
5. Diameter : 28 inches
6. Total needle count : 1582
7. No of feeders : 68
8. Knitting speed : 18 rpm

Dial	V	-	V	-	V	-	V	-	V	-	V	-	V	-	V	-
	V	-	V	-	V	-	V	-	V	-	V	-	V	-	V	-
Cylinder	-	^	-	^	-	^	-	^	-	^	-	^	-	^	-	^
	-	^	-	^	-	^	-	^	-	^	-	^	-	^	-	^
	Γ	^	-	^	-	^	-	^	-	^	-	^	-	^	-	^
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Needle set out

Dial : **ABABABABABAB….**

Cylinder : **ABABABABABAC….**

3. RESULT AND DISCUSSION

The knitted fabric is tested for various properties like structural and comfort properties.

1. Structural fabric is tested for structural properties such as course per inch, wales per inch, GSM, loop length; Tightness factor, Fabric thickness and Dimensional stability and the results are obtained using the standard methods.
2. The knitted fabric is tested for various comfort properties such as wick ability, absorbency, water vapour permeability, air permeability, air resistance, thermal conductivity, thermal resistance using the standard test methods and the results are obtained.
3.

3.1 PHYSICAL PROPERTIES

Table 1: Physical Parameters

S.no	Properties		Wool/Polyester
1	Course per inch	Face	48
		Back	48
2	Wales per inch	Face	32
		Back	31
3	GSM(*ISO9073-1:1989*)		203.3
4	Loop length(cm)	Face	0.329
		Back	0.290
5	Tightness Factor	Face	13.61
		Back	9.44
6	Fabric Thickness		0.506
7	Stretch ability	Length	5.33
		Width	9.33

3.2 COMFORT PROPERTIES

3.2.1 Air Permeability *(ASTM D 737:04) (2012)*

Fabric air permeability is the rate of air flow through the material under a differential pressure between the two faces of the fabric; it is expresses as the quantity of air, in cubic centimeter of fabric.

Table 2 :Air Permeability

Description	P/W
Air permeability	131$cm^3/cm^2/s$

3.2.2 Wick ability *AATCC79:2014*

Wicking is the most effective process to maintain a feel of comfort. It mainly depends upon the fabric construction, yarn regularity and the type of fibre and its characteristics.

Table 3 :Wick ability	
Description	Wickabilty(mm)
Wool/Polyester	150

3.2.3 Water Absorbency *AATCC79:2014*

Water Absorbency is measured by allowing one drop of water on the fabric and time taken to absorb the water has been tabulated. Water absorbency mainly depends upon the porosity of fabric and the type of fibre and yarn.

Table 4 :Water Absorbency	
Description	Absorbency(sec)
Wool/Polyester	300

3.2.4 Moisture Vapour Trasmission *ASTM E96-95 Option B*

The moisture vapour transfer rate is the difference between the intial height of the water and the actual height of the water in the cups. Unit of water vapour is measured in $g/m^2/24h$.

Table 5 :Moisture Transfer	
Description	$g/m^2/24h$
Wool/Polyester	1821.36

3.2.5 Moisture Management *AATCC195:2012*

In this sweating moisture transfer occur in both state i.e vapour state and liquid state. To feel the wearer comfortable this sweat in both state must be transfer away from the skin through the fabric structure. Thus the ability of the fabric to transfer water vapour to atmosphere is of prime importance.

Table 6 :Moisture Management Test		
Description	Top Layer(sec)	Bottom Layer(sec)
Wool/Polyester	21.715	19.899

3.2.6 Thermal Resistance *ISO 11092*

Thermal resistance expresses the thermal insulation of fabrics and is inversely proportional to thermal conductivity. In a dry fabric or containing very small amounts of water it depends essentially on fabric thickness and, to a lesser extent, on fabric construction and fiber conductivity[4].

Table 7 :Thermal Resistance	
Description	Metre^{2}Kelvin/Watt
Wool/Polyester	1821.36

3.2.7 Dimensional Stability

The dimensional stability of a fabric is a measure of the extent to which it keeps its original dimensions subsequent to its manufacture. Fabric sample with initial dimension was taken. It is dipped in water. After drying the measurement of change in length and width is noted.

Table 8 : Dimensional stability		
Description	Expressed in %	
Wool/Polyester	Length	**+2.10**
	Width	**-2.05**

4. CONCLUSION

The research work mainly focuses on the structural and comfort properties of bi-layer knitted structures. The air permeability and thermal conductivity of bi-layer wool fabric with plaited fabric are greatly influenced by the thickness of the fabric. The structure of bi-layer fabric has the greatest impact on the water permeability of the knitted fabrics.
It is observed that the moisture absorbency of the bi-layer knitted structure increases with an increase in the stitch density and tightness factor. It has the ability to transfers perspiration from the inner layer of the fabric to the outer layer, and it easily gets evaporated and dried. This can be achieved by a bi-layer knitted fabric structure made up of polyester as the inner layer and wool as the outer layer, recommended for sportswear.

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