Faculty of Engineering
Department of Textile Engineering

PROJECT REPORT ON

Factors that affecting Air Permeability of 100% cotton singlejersey fabric.

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Declaration

We are declaring that this is a project thesis report has done by me under the supervisor of **Sarmin Akter, Lecturer, Department of Textile Engineering**. This report is submitted for fulfillment of the requirement of BSc in Textile Engineering Degree of Daffodil International University. We completed the paper with the help knit composite industry. We collected all information, reports from different industry. All information in this paper is genuine & correct. We also declare that neither this report nor any part of this report has been submitted elsewhere for award of any courses.

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At the very beginning We acknowledge the infinite blessing and deep kindness of "Almighty Allah"-the supreme authority of the universe.

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Abstract

The goal of the study was to determine the effects of WPI, CPI, loop length, GSM, thickness of knitted fabrics on comfort parameters including air permeability. For this purpose, comfort properties of 100% cotton single jersey fabrics were determined. The air permeability of a fabric is defined as the amount of air passed over a surface under a certain pressure difference in a unit time. This worth has significance with respect to the usage area. Then knitted fabrics have a loop construction, they have extra pores than woven fabrics; therefore, in general, the air permeability of knitted fabrics is higher than that of woven fabrics of the same weight. It was found that knitted fabric of tighter structure has high weight and thickness but lower the value of air permeability. During my work we get some excellent test results which really help us to done our work perfectly.

Keywords:

- Knitted fabric
- Airpermeability
- WPI
- CPI
- Loop length
- Thickness
- Stitch density
- GSM

Approval Sheet

The research entitled "Analysis on different types of flaws identification in knit manufacturing sewing floor and regulating method for quality and productivity improvement." At Daffodil International University. A. Y. 2019 prepared and submitted by Md. Arif Hosen Pranta (133-23-129) Afsan Mahamud Shanto (161-23-277) , in partial fulfilment of the requirement for the degree of BACHELOR IN SCIENCE IN TEXTILE ENGINEERING has been examined and hereby recommended for approval and acceptance.

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CHAPTER ONE

1.Introduction

Knitting is the process fabric is forming by interloping yarn in a series of connected loops using needles. Knit fabrics provide outstanding comfort qualities and it also have long been preferred in many types of clothing. In adding to comfort imparted by the extensible looped construction, knits also provide lightweight warmth, wrinkle resistance, and ease of care [1]. With comparing other textile fabric structures, like woven and braided, knitted structures have more open character [2].

Knitted fabrics are mostly used for their easy care properties and high degree of clothing comfort. Liquid moisture transport and breathability of the fabric are the two most significant factors of fabrics that highly affects the thermo-physiological comfort of a fabric. Thermo-physiological comfort properties of fabric have some affecting parameters by which they are mainly influenced and the parameters are fiber type, yarn parameters, fabric characteristics and finishingprocesses.

For evaluating and comparing the 'breathability' of various fabrics for such end uses as raincoats, tents and uniform shirting air permeability is often used. It helps to evaluate the performance of parachutes sails, vacuum cleaners, air bags, sail cloth and industrial filter fabrics.

Air permeability is defined as "vertical air flow rate through a test subject" by Turkish Standards Institute [3]. For the performance of useful textile products such as industrial filters, tents, sails, parachutes, airbags, raincoat fabrics and outdoor clothing, it is especially critical. For outdoor clothing in order to enable protection against the wind low air permeability fabrics are preferred [4]. Thermal resistance and moisture permeation is directly associated with air permeability. An air permeable fabric also lets the transition of liquid and vapor. The level of air permeability varies depending on type of yarn, fabric structure, fiber parameters. Furthermore, thermal resistance is related with the air trapped between the skin and the clothing. Air permeability affects the comfort aspects of a garments according to passing air through the garments. Fabrics can be divided as high air permeable and low air permeable fabric according to air permeability. High air permeable fabric gives lower protection against winds and low air permeable fabrics causes heavy body perspiration. Knitted fabrics are more air permeable than woven fabrics so knitted fabrics are preferred for human clothing. Loosely knitted fabric samples which has higher amount of entrapped air and shows good air permeability property but poor moisture management properties. So we can say that, it is important for the textile industry to determine the air permeability of knitted fabrics. For all types of knitted fabrics, bursting strength values increased and fabric spirality values decreased with the increase elastane amount and elastane yarn count. There is a significant relationship between elastine amount and count with airpermeability, spirality, bursting strength and drape.

Today, the production of high performance knitted goods has been expanded by changing the fibers, yarns, and knitting parameters. They are used to create new fabric designs as well as by the appropriate selection of post-knitting finishes to produce multifunctional knitwear (e.g., sportswear, high-tech active-wear, casual-wear, swimwear, outerwear, etc.), with outstanding features, such as soft and smooth handle, air permeability, strength etc. [5]. Due to the frequent changes in fashion trends and leading to the production of knitted apparels using different yarn types, fabric types, designs and style variations knit fashion industry has become inevitable. These elements play a very important role in fashion trends, especially in segments such as casual wear and sportswear. Plain knitting takes up about 90% of all knitted fabric consumption [6]. The knitted fabrics are used for the production of underwear or any kind of next-to skin wear which are normally in contact with human skin, that's why it is especially important for them to provide a sensation of comfort. Due to their looped structure, knitted fabrics have good stretch ability and it is an important element in optimal sensorial comfort. Majority of the mechanical and physical properties of knitted fabrics and the structural parameters of the knitted fabrics are highly depend on the technical characteristics of knitting machines, the properties of yarns (such as the linear density) and the twist level of yarn, as well as the raw material used to produce the fibers.

Objective of the Study:

Without objective nothing can be counted as a successful one. Our internship program was also directed to serve some particular objectives. The main objective of the study is to get an overall idea about the factors affecting air permeability of 100% cotton single jersey fabric

Specific objectives of the Study:

- To identify the factor's affecting air permeability of 100% cotton single jersey fabric
- To measure the WPI and CPI of 100% cotton singlejersey fabric
- To determine the stitch density of the experimental samples of 100% cotton single jersey fabric
- To measure the thickness and loop length of the experimental samples of 100% cotton singlejersey fabric
- To determine the air permeability of all the experimental samples of 100% cotton singlejersey fabric

Limitation:

- First of all, there are some information's that are thought to be confidential to be disclosed to others that's why some people were found to be hesitant to share those and showed negative impression.
- Secondly, Time constraint was another difficulty for the completion of the report because due to the limitation of the time it was not possible to study a big sample size for which we had to deal with a small sample size in case of research. We had only three months to complete our internship program there.
- More time is necessary to understand all the complexities involved in the processes;
- Difficulty in relating theory to practice;
- Limited knowledge and ability on this portion to conduct the study more effectively.

CHAPTER TWO

2.Literature Review

2.1 WPI:

A wale is a vertical column of loops which is created by the same needle during the same knitting at successive knitting cycles. The number of wales determine the width of the fabric and theyare measured in units of wales per inch.

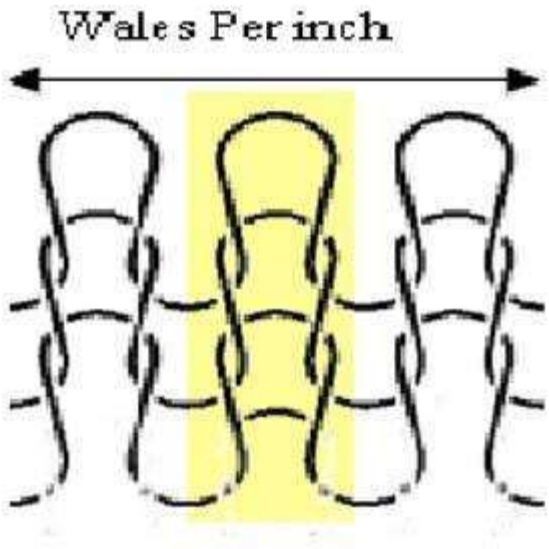


Fig: 2.1 Wales per inch

Features of wales

When loop transfer happens it is possible to transfer awale of loops from one needle A to another B.

- In warp knitting a wale can be created from the same yarn if the same warp guide laps the same needle at successive knitting cycles.

- Wales are associated together across the width of the fabric by sinker loops (weft knitting) or underlaps (warp knitting).
- Wales display most visibly on the technical face and courses on the technical back of single needle bed fabric.

2.2CPI:

Courses are rows of loops across the width of the fabric produced by the adjacent needles during the same knitting at same knitting cycles. The number of wales determine the width of the fabric and they are measured in units of courses per inch.

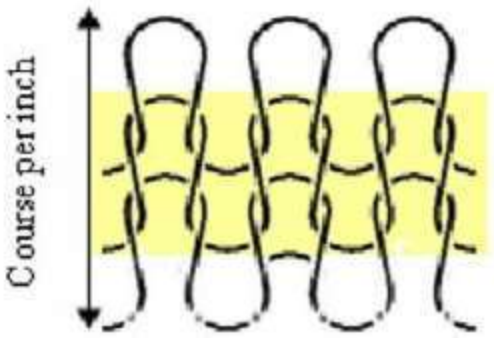


Fig: 2.2 Cours per inch

2.3 Stitch density:

Stitch density refers to the total number of loops in a measured area of fabric.

It is the total number of needle loops in a given area (such as a square inch).

Stitch density = Wales density x Courses density

=Wales per inch X Courses per inch

=WPI X CPI

Unit: number of loops per square inch

Or, SD= CPC x WPC (cm scale)

2.4 Thickness

Thickness is a parameter of a fabric which is related to controls handle, creasing, thermal resistance, heaviness or stiffness in use and many other properties.

Principles:

- The Standard of the measurement of fabric thickness is expressed in B.S. Hand book as follows.
- "Essentially, the determination of the thickness of a compressible material such as a textile fabric involves of the precise measurement of the distance between two plane parallel plates when they are separated by the cloth, a known arbitrary pressure between the plates are applied and maintained. It is convenient to regard one of the plates as the pressure foot and the other as the anvil."

Points to be considered in measuring thickness

- **The shape and size of pressure foot:** A circular foot of diameter inch is regularly used. The proportion of foot diameter and cloth thickness should not be less than 5: 1.
- **Shape and size of Anvil:** If a circular anvil is used it should be at least 2 inch greater in diameter than the pressure foot. Where the sample is larger than the anvil, the anvil should be surrounded with a suitable support e.g. a smooth plane board.
    - **Applied pressure:** Recommended pressure is specified e.g. 0.1 lb/inch$_2$or 10.0 lb /inch^2. Appropriate weights may be added to pressure foot to obtain these pressures.
- **Velocity of pressure foot:** The pressure foot should be dropped slowly on sample i.e. it

needs slow and careful movement.

- **Time:** The thickness is read from the dial of the instrument when the movement of pointerhas stopped.

- **Indication of thickness:** A clock type dial is usually constructed into a thickness tester.

Instruments for measuring fabric thickness

- Reynolds and Branson thickness tester.
- Shirley thickness gauge.
- Mag Ana thickness tester
- Heal's thickness gauge.

2.5Loop length:

- Loop length is defined as the quantity of yarn used to form one unit loop.
- The loop length is the absolute quantity of any knitted fabric and is directly related to the loop density.

2.6 Air permeability:

Air permeability can be defined as the properties of a fabric that permit the passage of air through the fabric's interstices. The air permeability of fabrics for active wear is very much important, as it will directly affect the thermal properties, and to some degree, the moisture management of a clothing garment or ensemble.

There are many factors that can affect the air permeability of a fabric. Several early studies of air permeability of different materials showed the followingfactors to affect air permeability:

- **Porosity:** Defined as the ratio of free space to fiber in a given volume of fabric.
- **Number, depth, and size of pores:** These are governed by fiber, yarn, and weave

characteristics. Studies have revealed that when all of the above factors are kept constant, otherparameters will affect the air permeability of a textile fabric.

- **Fabric thickness:** Air permeability will decrease as fabric thickness increases (although this is a purpose of porosity, as thickness will affect pore size).
- **Yarn linear density or fabric count:** As either of these is increased, air permeability willdecrease.
- **Yarn twist:** An increase in yarn twist will lead to an increase in air permeability.
- **Yarn crimp:** As yarn crimp increases, so also does air permeability due to the increased extensibility of the fabric.
- **Fabric construction:** A thesis of fabric structures (Dhingra & Postle, 1977) found that air permeability was directly connected with fabric extensibility. Knitted fabrics were found to have higher air permeability than woven fabrics due to the inherent extensibility of knitted fabrics.
- Layering in garment ensembles.
- **Moisture within garment ensembles:** Absorption of atmospheric water can happen swelling of hydrophilic/hygroscopic fibers such as cotton and wool, which in turn changes fabric porosity and thickness, resulting in changes in air permeability

2.7 GSM:

The GSM of fabric is very important specification of fabric which is necessary for a textile engineer for understanding and production of fabric. 'GSM' means 'Gram per square meter' that is the weight of fabric in gram per one square meter. By this one can compare the fabrics in unit

areawhich is heavier and which is lighter.

Twoways of expressing paper density are commonly used:

- Presented in grams per square meter (g/m^2), paper density is also known as grammage. This is the most general measure that is used in most parts of the world.
- Presentedd in terms of the mass (expressed as weight) per number of sheets, it is known as basis weight. The agreement used in the United States and a few other countries using US paper sizes is pounds of a ream of 500 (or in some cases 1000) sheets of a given (raw, stilluncut) basis size. Japanese paper is expressed as the weight in kg of 1000 sheets.

2.8 Yarn Count:

Count is a numerical value, which present the coarseness or fineness of the yarn and its specify the relationship between length and weight of that yarn. Therefore, the concept of yarn count has been presented which specifies a certain ratio of length to weight.

The fineness of the yarn is normally Presented in terms of its linear density or count. There are a number of methods and units for expressing yarn fineness. But they are classified as follows.

Types of Yarn Count:

1. Direct Count System
2. Indirect Count System

CHAPTER THREE
3.Materials and Method

In knit fabric yarn is measure in course and wales direction. CPI means yarn is incourse per inch and WPI means Wales per inch.

3.1 Measurement of WPI:

Measure the WPI with the magnifying glass setting multiplier:

1. At first, take the fabric which to be measured & marking 1 inch with the ball pen according to the Course & Wales wise of a knitted fabric.
2. Then set the marking point with the multiplier scale & counting the WPI of knitted fabric in 1inch.
3. Wales per inch is counted by the magnifying counting glass.

Fig: 3.1 Counting Glass

3.2 Measurement of CPI:

Measurethe CPI with the magnifying glass setting multiplier:

1. At first take the fabric which to be measured & marking 1 inch with the ball pen accordingto the Course & Wales wise of a knitted fabric.
2. Then set the marking point with the multiplier scale & counting the CPI of knitted fabric in 1inch.
3. Courses per is counted by the magnifying counting glass.

Fig: 3.2Counting Glass

3.3 Measurement of Thickness:

Thickness is a parameter of a fabric which is connected to controls handle, creasing, thermal resistance, heaviness or stiffness in use and many other properties of fabric.

Points to be considered in measuring thickness:

1. **The shape and size of pressure foot:** A circular foot of diameter inch is generally used. Theratio of foot diameter and cloth thickness should not be less than 5: 1.
2. **Shape and size of Anvil:** If a circular anvil is used it should be at least 2 inch greater in diameter than the pressure foot. Where the sample is larger than the anvil, the anvil should be surrounded with a appropriate support .e.g. a smooth plane board.
3. **Applied pressure:** Suggested pressure is specified e.g. 0.1 lb/inch^{2}or 10.0 lb /inch^2. Appropriate weights may be added to pressure foot to obtain these pressures.
4. **Velocity of pressure foot**: The pressure foot should be lowered slowly on sample i.e. it needs slow and careful undertaking.
5. **Time:** The thickness is read from the dial of the instrument when the movement of pointerhas stopped.
6. **Indication of thickness:** A clock type dial is usually made into a thickness tester.

Instruments for measuring fabric thickness:

1. Reynolds and Branson thickness tester.
2. Heal's thickness gauge.
3. Shirley thickness gauge.
4. Mag Ana thickness tester

MagAna thickness tester:

This instrument is proper for most of fabrics like woven fabric, knitted and layered fabric, pile fabric, un-sized, heavily sized fabric, coated fabric and resin treated fabric.

Fig: 3.3Mag Ana thickness teste

Partsof Mag Ana thickness tester:

1. Pressure weight
2. Weight pan
3. Indicator
4. Lifter to place the sample piece
5. Dial to indicate thickness
6. Support column
7. Pressure foot
8. Testing base
9. Base
10. Rubber bush to place on the table

Procedure of Mag Ana thickness tester:

1. The sample should be conditioned at standard atmospheric condition.
2. The pressure foot is raised with the help of the lifting lever.
3. The sample is placed on the anvil just below the pressure foot and the pressure foot is softly lowered on to the sample.
4. The reading of the dial gauge is noted to get the thickness of the sample at normal load.
5. Then, the weights are placed in the top pan of the tester in an increasing order and readings are noted.
6. The above process is repeated for at least five locations to obtain the value of thickness ofrandomly distributed location over the whole of the sample.
7. Selvedges, wrinkles, folds, knots, missing ends, missing picks, float, starting marks, irregularity and some of visible defects should be rejected.
8. The mean value of all the readings of thickness is calculated and the average thickness of the sample is conveyed.

3.4 Measurement of Loop length:

The knitted fabric is made by the formation of loop. Some of the fabric properties depend on loop length. So, we need to know loop length of the fabric that we are going to use in

To measure loop length of a knits fabric sample we can use following steps-

Step 1: Take sample. Cut fabric sample of 10 cm X 10 cm from the fabric sample. While cutting fabric sample, consider cutting on the wales line. Count number of wales in the 10 cm of fabric swatch.

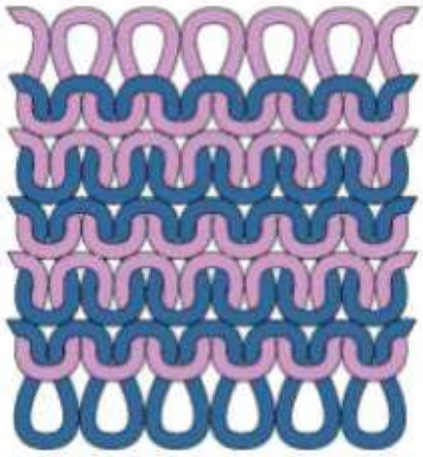


Fig: 3.4 Looplength measurement

Step 2: Take out yarns by pulling the loop. Don't consider yarns those are not the full length of a sample. Take five yarns of complete length and stretch yarns to remove curling on yarns.

Step 3: Measure yarn length. Use measuring tape or scale to measure yarn length. Measure all 5 sample yarns. Note yarn lengths in a paper or pad. Calculate average length of the sample yarns.

Step 4: Calculate the loop length. Now divided the average length of the yarns by no. of loops on the fabric sample.

Suppose 'X' no. of loops (wales) in the swatch and average length of the stretched yarns are 'Y' cm. Therefore loop length of the sample fabric will be equal to Y/X centimeters.

3.5 Measurement of Air permeability:

Fabric air permeability is a nature of air passing through fabric, normally below the condition that two sides of fabric exist pressure difference, that is to say, it is speed that airflow vertically goes through fabric in a prescribed test area, pressure drop and time, whose unit is “”mm/s” or “m/s”. Air permeability tester is the common used to measure it. The standard is that in a prescribed pressure difference, amount of airflow passing through a certain area of fabric in a certain time is measured, so that air permeability is calculated.

Air Permeability Tester FX3300-IV

The TEXTEST Air Permeability Tester is used for fast, simple, and accurate determination of the air permeability of all kinds of flat materials and of foam cubes. The measuring range covers dense papers and airbag fabrics as well as extremely open non-wovens and forming fabrics.

Advantage of FX3300-IV

- Advantage thanks to clever design
- Advantage thanks to clever design
- Advantage thanks to evaluation and printing options
- Advantage thanks to automatic selection of the measuring range

Fig: 3.5Air Permeability Tester FX3300-IV

Airpermeability test

a)Apparatus and materials

Airpermeability tester, scissor, avariety of fabric.

b) Test principle

Order to the method and test parameter, sample is clamped on the air inlet and then adjusting winder's speed to make two sides of fabric achieve certain pressure drop. In accordance with nozzle aperture and two sides' pressure change, fabric air permeability is measured. Air permeability is that amount of airflow vertically goes through per area of fabric in perunit time, below a certain pressure difference of two sides of fabric, whose unit is "mm/s".

c) Test method

1. Sample preparation

The whole piece of fabric at least 1m is cut from a cloth, as test sample. It should be chosen randomly from 3m or above edge of cloth, without wrinkle and apparent spots.

2. Test preparation

Adjust the balance of machine; checked tightness and air tightness of each connecting link of air permeabilitytester.

3. Test procedure

- At first choose suitable nozzle for fabric, test area and pressure drop. Set parameter, calibrate, clear. Pressure drop for garments use is 100Pa, and for industry use is 200Pa. if the mentioned pressure drop can be reached or un-applicable, one can choose 50Pa or 500Pa after negotiation, or test area can use 5 cm^2, 50 cm^2, 500 cm^2. For comparing the test result, same test area and pressure drop should be adopted.
- Then sample setting circle is chosen to mount on test bench and nozzle is chosen to mount into air measured cup.
- Machine is power-on.
- After that press "Set" to set nozzle No. when the indicator light is on at the top left corner ofnozzle number-displayed screen. Press "Set" again to set test area when the indicator light is on at the upper left corner of air permeability/pressure drop displayed screen. Press

the button again to set pressure drop of two sides of fabric when the indicator light is on at the upper left corner of pressure drop displayed screen. Then press "Set" to quit.

- Sample is placed on the testbed, with straight pressure ring pressed and pressure handle pulled press it tightly. In the moment the sample fixture is installed well, press "Start" to start the test (During the test processing, pressure difference is shown on the air permeability volume displayed screen. The pressure difference should be "600~3300" when it achieves set value as displayed on pressure drop screen. Otherwise, nozzle or test area should be adjusted until it is in this range, but in general, size of nozzle is adjusted). When the pressure difference achieves the set value, air permeability will be shown automatically on the screen of pressure drop, and then the machine will stop automatically. Data of air permeability rate are recorded.

- After finishing the test, pushing down the pressure handle and pushing the ball on the handle toward inside, the handle is lifted, loosening sample pressure head to change the sample to do another same test. Under the same conditions, different parts of the same sample should be tested repeatedly for at least 10 times, recording it and calculating its average value.

3.6 Measurement of GSM:

The weight of a fabric can be expressed in two ways, it can be the 'weight per unit area' or the 'weight per unit length'; the former is self-explanatory but the latter requires a little explanation as the weight of a unit length of fabric will obviously be affected by its width. For the woven fabric, the weight per unit length is normally referred to as the 'weight per running yard'. It is necessary therefore to know the agreed standard width upon which the weight per running yard is based. Usually this width depends upon the width of loom. Before coming the term 'GSM' there was another term called 'lb/100 yards'. This expression is used by British Standard. For measuring this there are a template and a quadrant balance. The template area is 1/100 square yards of which each arm is 1/10 yards in length. For measuring GSM, a GSM cutter is used to cut the fabric and weight is taken in balance. Both of these measurement and method is equally used for both woven and knitted fabrics.

Apparatus:

1. GSM cutter
2. Electric balance.

GSM cutter:

- Made of high quality Aluminium pressure die
- Light weight and resilient
- Deliver highly accurate results
- Equipped with heavy duty German cutting blades

Fig: 3.6 GSM cutter

Electric balance:

- Superior shock resistance and overload Protection
- High constant LCD display
- Software lock switch and integrated transportation lock
- Adjustable foo test with level indicator
- Airproof shield cover available on request

Fig: 3.7Electric balance

Working Procedure of Measuring GSM of a Fabric:

1. For Measuring GSM, fabric sample is cut by GSM cutter
2. Then weight is taken by electric balance.
3. By this way we get the weight in gram per one square meter fabric.
4. Here GSM of the fabrics by the GSM cutter is obtained by the multiplying the sample weight with 100.

Fig: 3.8GSM measuring system

3.6 Measurement of Yarn Count:

The fineness of the yarn is usually expressed in terms of its linear density or count. There are a number of systems and units for expressing yarn fineness. But they are classified as follows.

Types of Yarn Count:

1. Direct Count System
2. Indirect Count System

Direct Count System:

The weight of a fixed length of yarn is determined. The weight per unit length is the yarn count. The common features of all direct count systems are the length of yarn is fixed and the weight of yarn varies according to its fineness.

The following formula is used to calculate the yarn count:

N= (W×l) / L

Where,

N=Yarn count or numbering system

W=Weight of the sample at the official regain in the unit of the system

L=Length of the sample

l=Unit of length of the sample

Indirect Count System:

The length of a fixed weight of yarn is measured. The length per unit weight is the yarn count. The common features of all indirect count systems are the weight of yarn is fixed and the Length of yarn varies according to its fineness.

The following formula is used to calculate they are count:

N= (L×w) / (W×l)

Where,

N=Yarn count or numbering system

W=Weight of the sample at the official regain in the unit of the system

L=Length of the sample

l=Unit of length of the sample

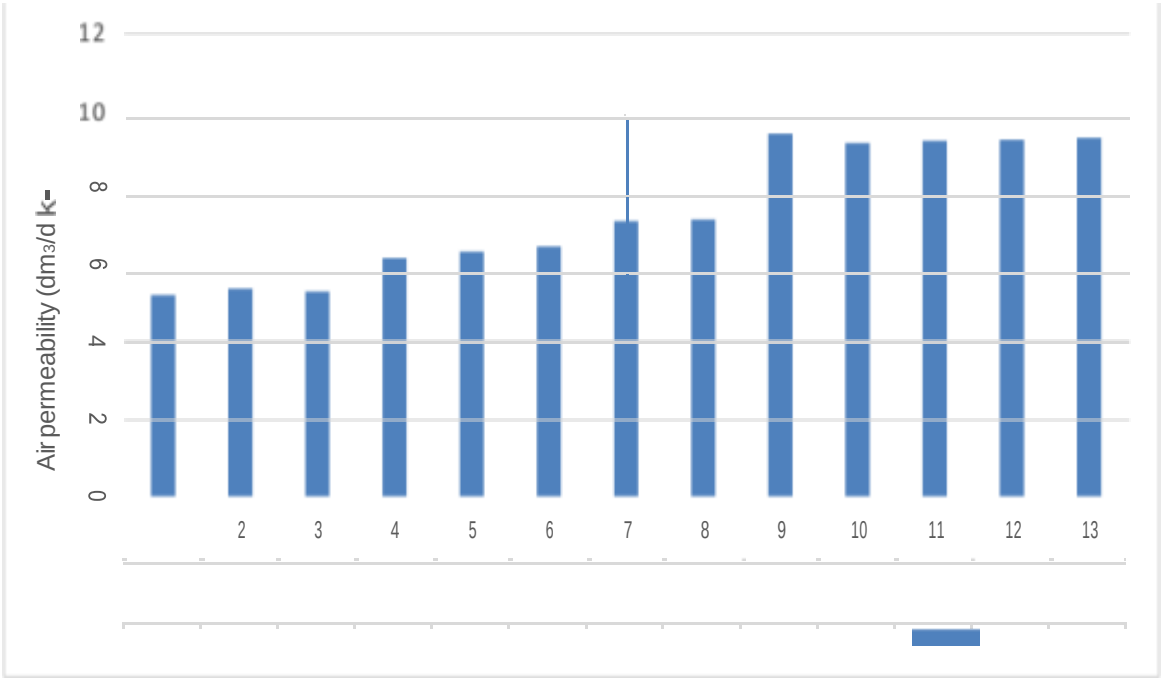
w= Unit of weight of the sample.

CHAPTER FOUR
4.Result and discussion

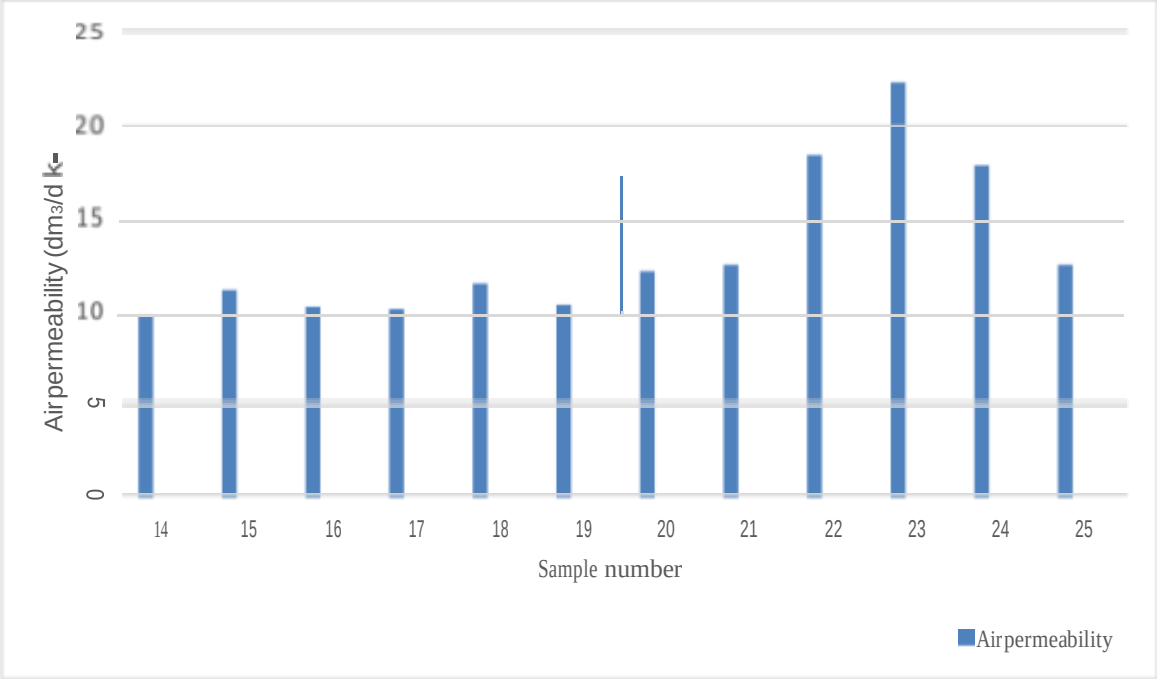
Sample Number	Fabric type	Yarn count (Ne)	GSM	Yarn type	Loop length (mm)	Course count per inch	Wale count per inch	Stitch density	Thickness (mm)	Air permeability (dm^3/dk-cm^2)
1	100% cotton, S/J	24	170	Ring	1.84	54	30	166.58	0.41	5.19
2	100% cotton, S/J	26	160	Ring	2.18	60	28	169.00	0.40	5.36
3	100% cotton, S/J	26	165	Ring	2.78	56	30	169.89	0.40	5.28
4	100% cotton, S/J	26	168	Ring	2.77	59	31	171.52	0.39	6.14
5	100% cotton, S/J	28	150	Compact	2.84	58	35	178.22	0.40	6.31
6	100% cotton, S/J	28	155	Compact	2.84	56	32	177.00	0.39	6.44
7	100% cotton, S/J	28	153	Ring	2.18	54	35	176.00	0.39	7.10
8	100% cotton, S/J	30	140	Ring	2.25	52	34	277.78	0.38	7.14
9	100% cotton, S/J	30	142	Ring	2.83	66	32	314.30	0.39	9.35
10	100% cotton, S/J	30	140	Ring	2.85	64	34	278.00	0.38	9.11
11	100% cotton, S/J	30	140	compact	3.12	59	38	311.43	0.37	9.17
12	100% cotton, S/J	31	135	Ring	2.84	62	58	246.28	0.37	9.19

13	100% cotton, S/J	32	130	Ring	3.21	65	32	292.28	0.34	9.24
14	100% cotton, S/J	32	138	Ring	3.22	63	35	313.45	0.34	9.76
15	100% cotton, S/J	32	134	Ring	3.12	56	32	313.00	0.31	11.10
16	100% cotton, S/J	34	120	Ring	3.28	63	34	277.00	0.30	10.20
17	100% cotton, S/J	34	122	Ring	3.24	66	61	216.89	o.29	10.08
18	100% cotton, S/J	34	126	Ring	3.32	65	59	187.98	0.27	11.44
19	100% cotton, S/J	34	121	Ring	2.89	67	58	211.10	0.23	10.31
20	100% cotton, S/J	40	100	Ring	3.41	56	35	177.60	0.28	12.10
21	100% cotton, S/J	40	105	Ring	3.11	62	74	221.20	0.19	12.44
22	100% cotton, S/J	40	110	compact	3.26	62	34	179.00	0.26	18.32
23	100% cotton, S/J	40	110	compact	3.18	64	32	189.00	0.20	22.20
24	100% cotton, S/J	40	105	compact	3.12	62	31	231.40	o.19	17.76
25	100% cotton, S/J	40	108	Ring	2.92	61	67	223.20	0.21	12.44

Table: 1

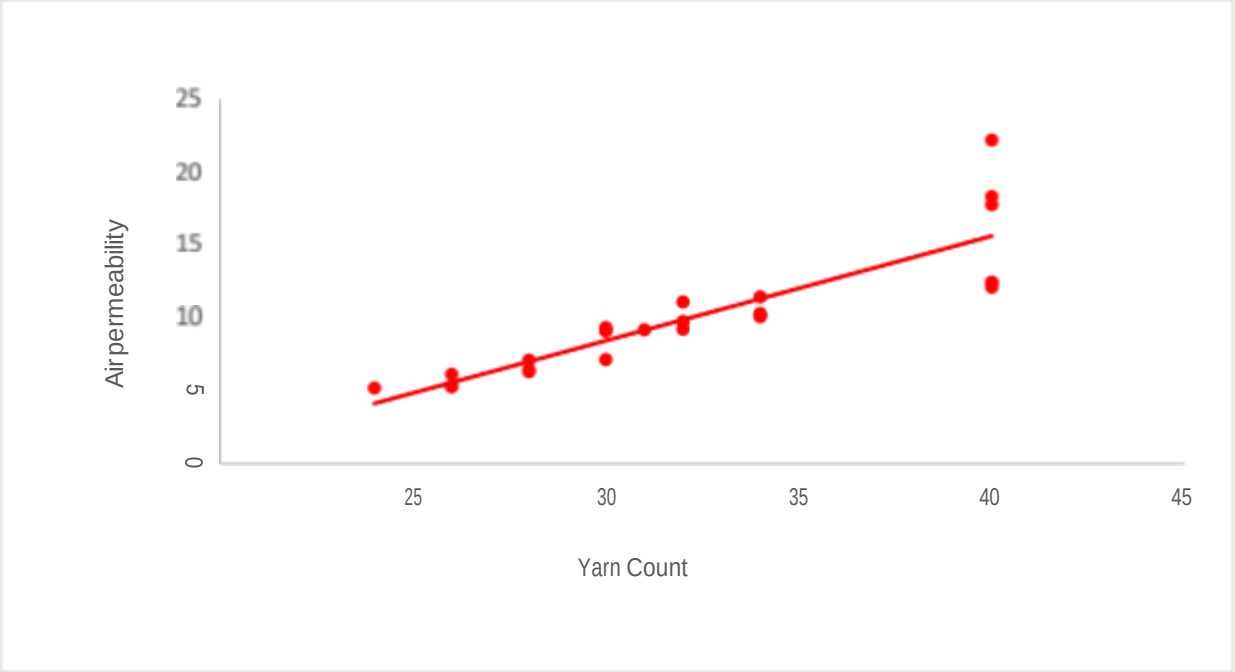


In the above graph we take 13 sample of 100% cotton single jersey fabric and test the air permeability values for every fabric. From our test result we can see that the air permeability value of 100% cotton single jersey fabric has been increased with the increasing of yarn count that is used to contract the fabric. Here we see the air permeability value of 24 Ne is 5.19. For 26 Ne we test three sample and the air permeability values are 5.36, 5.28 and 6.14 respectively. For 28 Ne we also test three sample and the air permeability values are 6.31, 6.44 and 7.10 respectively. For 30 Ne we test four sample and the air permeability values are 7.14, 9.35, 9.11, 9.17 respectively. For 31 Ne the air permeability value is 9.19. And for 32 Ne the air permeabilityvalue is 9.24.



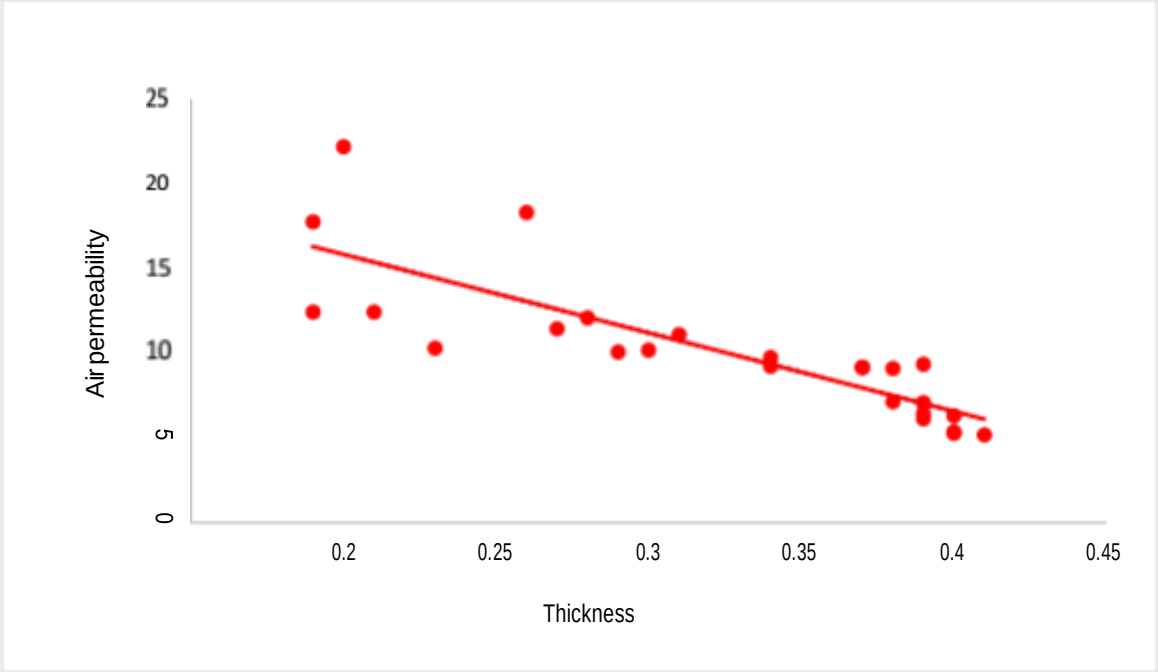
In the above graph we take 12 sample of 100% cotton single jersey fabric and test the air permeability values for every fabric. From our test result we can see that the air permeability value of 100% cotton single jersey fabric has been increased with the increasing of yarn count that is used to contract the fabric. Here we see the air permeability value of 32 Ne is 9.76 and 11.10 respectively. For 34 Ne we test four sample and the air permeability values are 10.20, 10.08, 10.44 and 10.38 respectively. For 40 Ne we test six sample and the air permeability values are 12.10, 12.44, 18.32, 22.20, 17.76, 12.44 respectively. Here we cannot found even result becausehere we use compact yarn also.

Air permeability vs Count



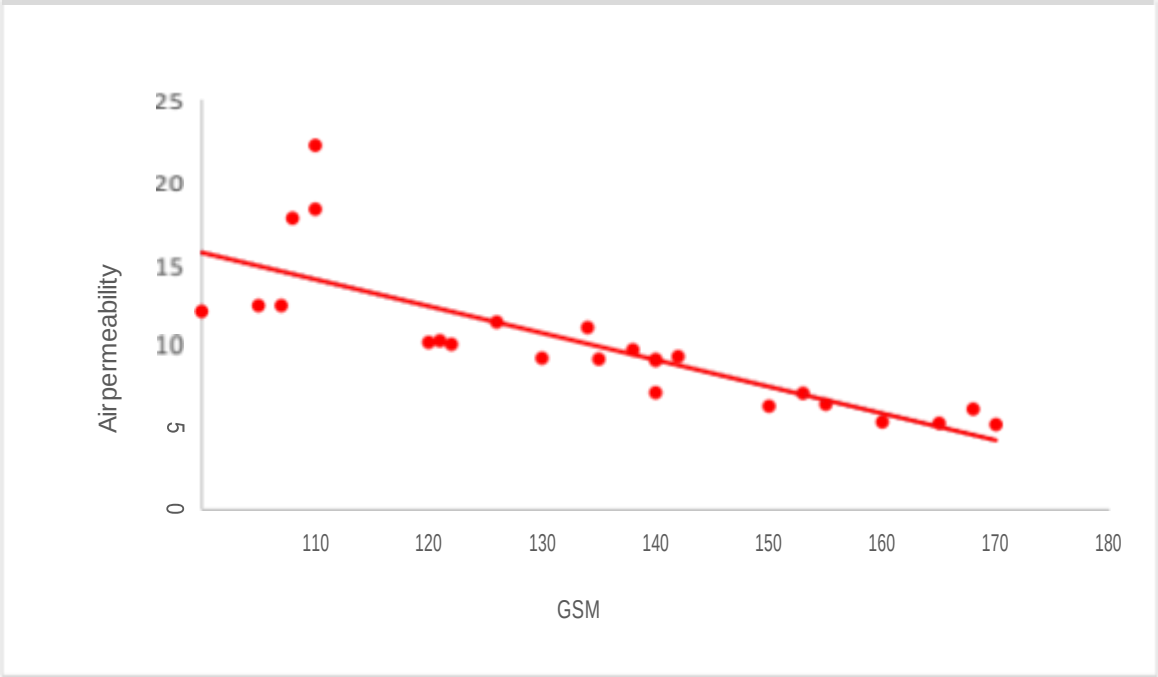
Fromthe above graph we can see that the air permeability value of 100% cotton singlejersey fabric is increased with the increasing of yarn count. From theoretical knowledge we also know that air permeability is increased with the increasing of count. So we can say that our test result isbeen very good.

Air permeability vs Thickness



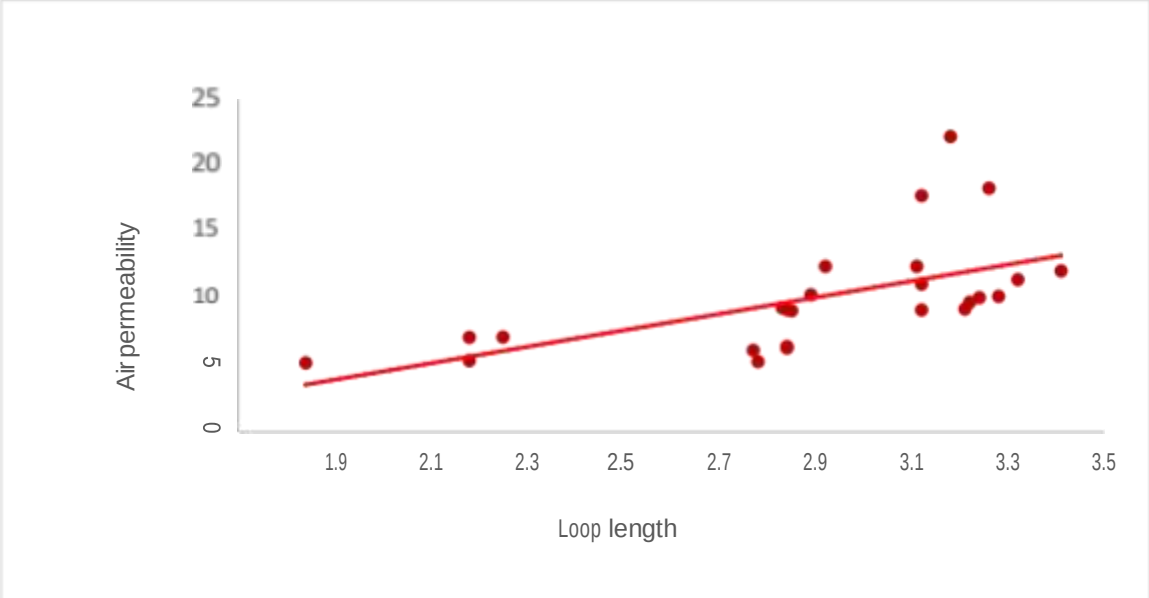
From the above graph we can see that the air permeability value of 100% cotton single jersey fabric is decreased with the increasing of thickness. From theoretical knowledge we also know that air permeability is been decreased with the increasing of thickness. So we can say that our test result is been very good.

Air permeability vs GSM



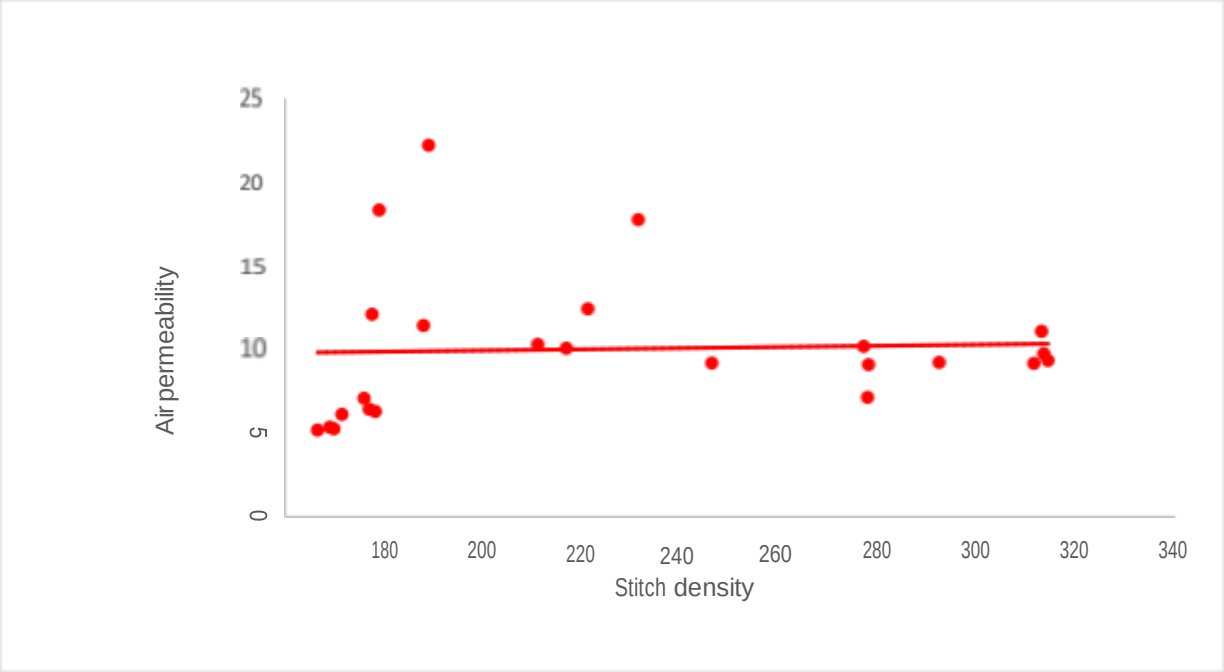
We know that with the increasing of GSM air permeability is decreased. In the above graph we also see that the air permeability value is decreased with the increasing of GSM. More GSM means more less in loop length and as a result air permeability is decreased. So we can say that ourtest method and procedure is been perfect that's why we get very good test result.

Air permeability vs Loop length



From the above graph we can see that the air permeability is increased with the increasing of loop length. Increasing of loop length means looseness of fabric structure and that's why more pores is been obtained on the fabric. As a result, air permeability is increased. From our test result we get very even result that indicates the perfectness of our work.

Air permeability vs Stitch density



From this graph its shown a relationship between stitch density and Air permeability. Stitch density of single jersey 100% cotton knitted fabric is measured by the number of stitches per unit area on these fabric. Air permeability may be changed based on the stitch density. We took 25 sample and checked stitch density then we measured Air permeability. With the change of stitch densitythere Air permeability also changed. And we got a very good result.

CHAPTER FIVE

5.Conclusion

Air permeability is one of the most important properties of knit fabric. In my report we work on 25 sample of 100% cotton single jersey fabric of different count and GSM. We work on different factors which affecting the air permeability. After completing my task we see that if yarn count is increased then air permeability is also increased, if fabric thickness is increased then air permeability is decreased, if GSM increased then air permeability is decreased, if loop length increased then air permeability is also increased. There are some limitation during completing our work that's really hampers our work result. If we get more friendly work environment we think our test result will more even and perfect. Still our test result is near about perfect. We think this thesis report important for garments industry and textile students to know how line balancing is helped to reduce the idle time of a worker .Hopefully this will help us in the future.

6. REFERENCES

1. Tou N. A.; An Investigation of Arcing in Two Structure Weft Knit Fabrics, MSc Thesis, North Carolina State University, Textile & Apparel Technology & Management, 2005.

2. Dias T., Delkumburewatte G. B.; Fibers and Polymers, Vol. 9, No. 1 (2008) pp. 76-79.

3. Institute T.S., 1999, "Kumaşlarda hava geçirgenliğinin tayini", ICS 59.080.30., TSE 1996, TS 391,

4. Turan R.B., Okur, A., 2005, "Air permeability of fabrics", The Journal of Textile and Engineer, 15, 16-25.

5. Li, Y.; The Science of Clothing Comfort; Textile Progress 2001, 31(1/2), 1-135.

6. Başer, G.; Technique and Art of Weaving Vol.1; Punto Publishing: İzmir, 2004 (in Turkish).

7. Karaguzel B.; Characterization and Role of Porosity in Knitted Fabrics, MSc Thesis, North Carolina State University.