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Durability of Woven and Knitted Fabrics

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Abstract - The life of the garment is very important in wear. Customer wishes to purchase garments which has longer life. Woven garments and knitted garments have different structure. So to determine the durability of woven and knitted garment suitable test should be carried out. Perspiration is the main criteria for the degradation of cloth. The perspiration chemicals erode the fibres and hence strength of the fabric is reduced. The perspiration chemicals are made in the laboratory and it is treated with plain woven fabric and single jersey knitted fabrics. The tear test was carried out and the durability of woven and knitted fabrics are found out. Shrinkage is another criteria for determining the life of garments. The shrinkage of woven and knitted fabrics are determined and the life of the garments were found out. The other comfort properties of thickness, bending length, crease recovery and other calculations were carried out. From the results the method for deciding durability of garments is found out.

***Key Words*:** Perspiration, Knitted fabrics, Woven fabrics, Durability.

1. INTRODUCTION

1.1 Durability of different kinds of knitted and woven fabrics

The different types of weft knitted fabrics are single jersey and double jersey. The types of woven fabrics are plain, twill and satin or sateen fabrics. Woven fabrics have long life Medium weight woven shirting fabrics have lesser life. Knitted fabrics have lesser life. So to have good life suitable fabric parameters should be selected and fabrics must be produced.

1.2 Statement of the problem

The fabrics are subjected to perspiration chemicals. To remove the odour and chemicals it is washed. So soaping treatment is given after the wear. To have good durability the fabrics can be treated with laboratory perspiration solution and then given washing treatment. Then they are tested for tear strength, bursting strength, abrasion resistance and air permeability. For comfort properties estimation, fabrics can be tested for bending, crease and drape tests. The water absorbency tests can be carried out for different fabrics. Then they can be interpreted for various parameters and suitable recommendations could be made.

2. Perspiration composition

Water given off by the skin is classified as insensible and sensible perspiration. Under normal conditions about 600 to 700 c.c. is evaporated from the skin in twenty-four hours. The chief physiological significance of the perspiration is to assist in regulatingthe body temperature.

The constituents of perspiration are very variable. The average values calculated fromthe examination of fourteen male specimens and ten female specimens are given below:-

Table -1:

	pH	NH_3.N mgm./100c.c.	Urea-N mgm./100 c.c.	Amino acid-N mgm./100 c.c.	Glucose. mgm./100 c.c	Chlorides NaCl/1000 c.c.
Average from 10 normal female subjects	6.57	6.0	19.23	6.5	20.0	3.0
Average from 14 normal male subjects	6.14	4.7	21.44	5.0	12.6	3.7

Examination of the figures obtained for the sweat shed by rheumatic subjects shows no marked divergence from those recorded for normal subjects.

Lactic acid is stated to be present in relatively large amounts in sweat, but these results have not been confirmed.

3. Sweat glands

Sweat-glands.-The sweat-glands consist of long tubes, of which the secreting part is coiled up into a ball seated at various depths of the corium and in the first layer of the subcutaneous adipose tissue. The excretory duct is continued through the corium, and in a spiral course through the epidermis, opening between two adjacent papillae, into a large orifice. Although direct evidence is wanting, it is probable, on analogy, that the secretion of these glands is principally, if not exclusively, the work of cells in its coiled section. The relative distribution of the sweat-glands in man is given as follows:

Forehead	: 140
Palm of hand	: 310
Cheek	: 60
Back of hand	: 170
Chest, abdomen	: 225
Sole of foot	: 300
Neck, back, rump	: 50
Back of foot	: 100
Upper arm, leg	: 55 to 70.

4. Perspiration matters

Composition of perspiration.-Perspiration is said to represent 25% (600 c.c.) of the total amount of water given off from the body in twenty four bours under ordinary sedentary conditions. It is described, when collected, as a slightly turbid, almost colour less fluid, salt in taste, and having a more or less rancid smell. Investigators have found that perspiration consists of water, inorganic salts, ammonia, urea, uric acid, amino-acids, lactic acid and sugar. An examination of the literature reveals a striking divergence in the observations on the constituents of perspiration. Many investigators have apparently failed to recognize the great variation which exists among individuals and even in the same individual at different times.

5. Change in the composition of perspiration.-

Vass and Mc Swiney (1930) found that if freshly shed perspiration was allowed to stand at room temperature or at 370 C. the ammonia nitrogen increased considerably and the reaction became definitely alkaline. The glucose content, however, did not disappear, as might have been expected. A typical observation is recorded in Table 2.

Table -2:

Date	pH	NH3.N mgm./100 c.c.	Gluicose mgm./100 c.c.	Amino-acid-N mgm./100 c.c.
17.10.29	6.64	6.78	26.4	9.2
Incubated at 370 C. for 72 hours, 31.10.29	8.08	39.0	16.1	3.2

The change in reaction of the fluid and increase in ammonia nitrogen occur gradually, as is shown in Table 3.

Table -3:

	Time (hours)	NH3-N mgm./100 c.c.	pH
Sweat kept in the sterile bottle at 37 C.	0	3.8	5.95
	6	5.0	6.29
	17	12.19	7.0
	24	18.72	7.28
	41	29.96	7.62
	66	37.58	7.7

That the decomposition was mainly accomplished by the bacteria normally present on the skin, which attack the urea and then the epithelial debris, to form ammonia, was demonstrated in the following experiment: The sweat, which had been collected in a sterile bottle (was divided into four portions: (a) non-filtered; (b) filtered through a filter candle to remove bacteria and also d6bris; (c) non-filtered; (d) 'filtered. The portions (a) and (b) were kept at 370 0 (c) and (d) at room temperature. The initial concentration of the urea nitrogen was 18-1 mgm. per 100 c.c. The figures represent the content of ammonia nitrogen per 100 c.c.

Table -4:

Time in hours.	Non-filtered at 37 C	Filt-red at 37 C.	Non-filtered at lab. temp.	Filtered at lab. temp.
0	-	-	5.94	-
16	16.5	-	-	-
21	-	5.34	-	5.32
72.5	33.7	-	8.6	-
75`5	-	5.38	-	5.3
117	39	-	14.4	-
147	-	6.76	-	5.86
223	-	7.4	-	16.14

The divergence of opinion recorded in the literature as to hydrogen-ion concentration of perspiration, and ammonia nitrogen, and glucose content of perspiration, can, to some extent at least, be accounted for by the readiness with which perspiration is decomposed even at ordinary temperatures by the bacteria normally present in perspiration. It is clear that unless precautions are taken to prevent decomposition, accurate observations are impossible.

In order to determine the constituents of perspiration, Vass and McSwiney adopted the following method of collection. The subject, who had bathed the previous night, was washed down with distilled water at 980 F., and dried with "sterile" cloths. The rubber suit, which had been carefully washed and dried, was then put on. The suit consisted of four pieces: trousers, jerkin, and two arms fitted with mitts, and perspiration was run off through rubber tubes attached to different parts of the suit.

To promote sweating the subject was placed in a hot room at 1030 F., with, as far as possible, constant humidity. A few experiments were made, using a Berthe steam cabinet, a light bath and a radiant heat bath. The length of the experiment. Varied from fifteen to sixty minutes.

6. Perspiration of normal males.

Fourteen specimens of freshly shed perspiration from normal males whose ages ranged from 18 to 30 have been examined and the minimum and maximum values obtained from each determination are given in Table 5.

Table -5:

	pH	NH3-N mgm./f00 c.c.	Urea-N mgm./f00 c.c.	acid-N mgm./f00 c.c.	Glucose mgm./f00 c.c.	Chlorides g. NaCI/l, 000 c
Minimum values	5.1	2.55	11.1	2.4	9.4	2.65
Maximum values	7.35	7.0	32.92	9.2	26.4	5.01

The fact that considerable variations were observed in the analyses of sweat of different individuals led us to investigate the variations of the concentrations of the constituents of sweat shed by the same individual on different occasions over a long period. In Table 6 are shown the minimum and maximum values observed in the analyses of seven freshly-shed samples from the same subject.

Table -6:

	pH	NH3-N mgm./f00 c.c.	Urea-N mgm./f00 c.c.	acid-N mgm./f00 c.c.	Glucose mgm./f00 c.c.	Chlorides g. NaCI /l,000 cc
Minimum values	5.1	3.8	15.64	4.5	7.3	2.34
Maximum values	6.2	7.0	33.95	9.9	20.7	4.63

The values observed for each determination have been averaged and are compared in Table 7 with the average values calculated from the results obtained for the fourteen male specimens. There is good agreement between the averages of the individual's perspiration and those deduced from sweat collected from fourteen. Male subjects.

Table -7:

	pH	NH3-N mgm. /f00 c.c.	Urea-N mgm. /f00 c.c.	acid-N mgm. /f00 c.c.	Glucose mgm. /f00 c.c.	Chlorides g. NaC I/l,000 cc
Average from individual's sweat	5.71	4.8	23.57	7.2	12.7	3.39
Average value for normal males	6.14	4.7	21.44	5.0	12.6	3.7

In Table 8 the average values calculated for the sweat of ten normal females are compared with those obtained for normal males. There is, it will be observed, good agreement between these averages, except in the glucose content.

Table -8:

	pH	NH3-N mgm. /f00 c.c.	Urea-N mgm. /f00 c.c.	acid-N mgm ./f00 c.c.	Glucose mgm./ f00 c.c.	Chlorides g. NaCI /l,000 cc
Average from 10 normal female subjects	6.57	6.0	19.23	6.5	20.0	3.0
Average from 14 normal male subjects	6.14	4.7	21.44	5.0	12.6	3.7

Sweat collected from stout healthy subjects was found to have a considerably higher glucose content than that from normal subjects: 45, 44 and 43 mgm. per 100 c.c. were obtained from three subjects respectively as compared with 20 mgm.

7. Lactic acid

Pemberton (1929) gives the following summary of the range of lactic acid found in the sweat of arthritic patients and normal persons:-

Normal persons.-Blood frcom 14 to 25 mgm. per 100 c.c. Urine 5 to 13 mgm. per 100 c.c. Sweat from 120 to 425 mgm. per 100 c.c.

Arthritic patients-Blood from 11 to 30 mgm. per 100 c.c. Urine from 3 to 21 mgm. per hour from 8 to 31 mgm. per 100 c.c. Sweat from 90 to 458 mgm. per 100 c.c.

Pemberton concludes: (1) That lactic acid is not present in abnormal amounts in the arthritic patient. (2) That as lactic acid is present in sweat in considerable amounts, its presence may be referable to the chemical changes occurring in the sweat-glands during activity. (3) That the benefit accruing to arthritic patients from sweating measures cannot, in the light of these results, be ascribed to the elimination of lactic acid in the sweat.

Vass has attempted to isolate hydroxy acids from sweat collected from seven normal individuals, but his attempts have proved unsuccessful. Lactic acid, according to his determinations, was not present in amounts greater than 120 mgm. per 100 c,c. of sweat.

These are given in reference (1).

8. Durability of textiles

In March 2022 the European Commission published its proposal for the Eco design for Sustainable Products Regulation. Its objective is to set binding requirements on how products are designed, through a specific act for textile products, covering aspects such as “durability, reparability, fibre-to-fibre recyclability, and mandatory recycled content, minimise and track presence of substances of concern, reduce adverse impacts on climate and environment, micro plastic shedding”. At the same time, the European Commission launched the EU strategy for sustainable and circular textiles, which highlights the same characteristics and adds that “failures in quality such as colour fastness, tear strength or the quality of zippers and seams are among the main reasons for consumers to discard textiles”. This report identifies the existing standards and methodologies used for measuring some of those characteristics, assessing whether those are robust and fit for purpose to support minimum requirements. It also highlights shortcomings and challenges.

Binding minimum requirements coupled with a clear target on reducing resources use have the potential to transform the industry towards the vision set up in the EU initiatives. It is important to get them right.

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In March 2022, the Commission unveiled the EU strategy for sustainable and circular textiles and the Eco design for Sustainable Products Regulation (ESPR1). With these two pieces of legislation, the textile sector will be expected to transition towards a climate-neutral, circular economy where products are designed to be more durable, reusable, repairable, recyclable and energy-efficient. It is urgent to turn this vision into action since the climate, social and environmental impacts of the textile sector continue to grow within the current linear system. This approach should start, first and foremost, with reducing the volume of textile products that are put on the market, bringing production and consumption within planetary boundaries. The EU strategy for sustainable and circular textiles2 aims to significantly improve textile products placed on the European market. This includes setting binding eco design requirements targeting the "durability of textile products (covered in this brief); reparability, fibre-to-fibre recyclability, and mandatory recycled content, minimise and track the presence of substances of concern, reduce adverse impacts on climate and environment, micro plastic shedding"

ECOS believes design must ensure clothes are toxic free and long lasting, prioritizing life extending measures such as durability (both functional and emotional), ease of reuse, repair and remanufacturing. Stretching the approach: alongside the positive list of characteristics that the Commission mentioned in the documents published in March 2022, minimum requirements should also consider the most damaging hotspots, such as chemical use and content, water, energy, etc. For truly sustainable products, the EU framework should allow questions about whether the product is necessary in the first place and if we really need a particular finish, coating or dye.

How to look into textile durability, and where standards play a role.

The ESPR framework will allow for setting a range of requirements for textile products, including product durability. It is important to target relevant requirements that can generate the most environmental gains. This means setting up horizontal requirements for textile products overall, and, when needed, considering different conditions for different product groups, as well as setting minimum levels that expose low-quality goods. Moreover, further investigations on which property is relevant for which product groups is essential. For the classification of textile products for which to set minimum requirements, we suggest a selection from broad product groups that have already been the focus of standardisation activities for a long time and where specific standards that account for key characteristics already exist: clothing, footwear, curtains, bath/bed and kitchen textiles, upholstery, mattresses, floor coverings, workwear, and PPE. Targetingclothes and footwear would be key when looking for impact and environmental gains. On the different properties, we suggest keeping in mind the EU Eco label requirement for textiles, Nordic Swan, and Blue Angel, with many insights on different horizontal related requirements (see more on this in the Annex).

In order to include relevant requirements in the Eco design for Sustainable Products Regulation (ESPR), it is important to understand the factors influencing the durability properties of textile products: whether the fabric is woven, non-woven, knitted, the impact of fibre choice and test methods available to assess these characteristics

The goal of this paper is to investigate which standards and methodologies are used for assessing textile durability and failures in quality; how different fabrics behave during tests, and which properties may be relevant to include in the ESPR for assessing durability. This needs to be coupled with a clear target on reducing resources used to transform the industry, towards the vision set up in the EU initiatives.

This brief looks into functional durability, which is anchored in many characteristics (tear/tensile/seams/bursting strengths, yarns and seam slippage, abrasion resistance, pilling, dimension stability, colour fastness, quality of trimming etc.) Functional durability has specific standards and methods available to assess those characteristics. However, this paper does not cover emotional durability.

The textile industry imperatively needs to address the low level of "emotional durability" of textile products, which significantly contributes to the decision to discard clothes after a short period. Design for durability, thus, needs to account for "emotional durability", considering a product's ability to be desirable long-term, in addition to the "functional" one covered in this brief.

The functional durability of textiles can be described as the ability to maintain their original shape, strength, and appearance after being exposed to wear, washing and other stresses. Durability depends on a variety of factors. Some properties can be attributed to fibre composition, but the length of fibres, yarn twist, construction (binding, fabric density, etc.), dyes, chemical treatments and finishes also play an important role. Textile testing indicates if the quality of a product is sufficient and exposes low-quality fabrics and faulty goods. Durability testing often includes the following aspects:

- Strength and abrasion resistance (fabric, seams, accessories);
- Loss of appearance from use (pilling, colour fading, etc.), and
- Effects of laundering (dimension stability, colour loss, water resistance loss, etc.).

Other properties that could be connected to the quality of new products are absorbency, water vapor resistance, electricity build-up, thermal resistance, or air permeability. These are often not considered when assessing durability since they are measures of the initial quality and not the possible loss of quality from wear and washing. Lack of comfort or function may, however, also lead to shorter use time.

The relevant scope of properties to determine the durability of a product differs based on the intended use and type of material tested. Our briefing describes the most common test methods used for assessing durability; what each method aims to assess; which fabrics are relevant to analyze with the respective test method, and what materials can be assumed to perform better or worse. The Annex investigates and compares the use of those test methods in a selection of ISO Type 1 labeling (EU Eco label requirement for textiles, Nordic Swan and Blue Angel) to identify the methods they use, the categorization, and thresholds already available.

9. Test methods for assessing durability

Tensile strength

Tensile strength indicates the maximum stress fabrics can manage without breaking, the elongation (i.e., the ability to extend during the applied stress) and the elastic recovery.

Procedure and fabrics tested

• The force needed to stretch a fabric until rupture (where many threads break at the same time).

• Elongation at break (expressed in %).

• Yield point: stress the fabric can withstand before irreversible deformation occurs from original shape (0.2% change or more when stress is removed).

The test is used for woven, felted, and nonwoven fabrics. Knitted and highly elastic woven fabrics are tested for bursting strength.

It can either be tested with strip or grab method:

• Strip method:

- Full width of specimen is gripped by jaws in the equipment and pulled until breakage.

- Two procedures: 5 o

Cut strip test applied to fabrics which cannot be ravelled such as nonwoven and coated fabrics. o Ravelled strip test used for regular woven fabrics.

• Grab method: the larger samples, centre part of the specimen is gripped by jaws in the equipment (edge effects removed)

The results differ between the methods, lower forces are reached for the strip test (due to the lower width of samples) compared to grab.

According to OVAM report , strip test is the most used method, but this has not been confirmed as the grab test is equally used. If tensile strength is included in the ecodesign criteria for textiles, it is important to decide which method should be used.

The test gives an overall evaluation of the strength of fabrics and expose fragile or low-quality goods, but it does not demonstrate a typical situation that textiles are exposed to during everyday wear (unless extreme cases). It also does not reveal weak spots in the fabric since many threads are exposed at the same time.

Performance of different fabrics

The fibre type, regularity in diameter, weave pattern and pre-treatment influence the fabric strength. The longer the fibres, the denser the fabric and the finer the fibres, the higher tensile strength is achieved. Elastic fabrics extend and prevent tearing and breakage.

Low tensile strength can occur after mechanical and chemical processing, such as dyeing and mechanical surface treatments. Other aspects such as weaving faults, exposure to UV, washing and other degrading processes will also lead to losses in strength.

Fabrics consisting of synthetic fibres will normally have higher tensile strength compared to textiles with natural fibres, especially when using filament yarn.

• Synthetic fibres have very good strength properties, high extensibility, and high elasticity.11 Polyamide is among the strongest fibres.

• Wool fibres have low strength, but high extensibility and elasticity.

• Cotton fibres have high strength but low extensibility and elasticity (high for weft knits). Cotton generally fulfils requirements for garments used under normal conditions but cannot achieve higher stresses needed for specialty garments such as for military use.

Strip method standards

The most common standards are:

• EN ISO 13934-1 Textiles: Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method.

• ASTM D5035-11 Standard test method for breaking force and elongation of textile fabrics (strip method).

Equipment, sample sizes, conditioning time etc. differs between the standards. No information has been found that the relative difference between natural and synthetic fibres change when testing according to ASTM compared to EN ISO.

EN ISO 13934-1 is more commonly used in Europe, therefore, preferred for the ESPR.

Grab method, standards

The most common standards are:

• EN ISO 13934-2 Textiles: Tensile properties of fabrics — Part 2: Determination of maximum force using the grab method.

• ASTM D5034-21 Standard test method for breaking force and elongation of textile fabrics (grab test).

No information was found regarding differences between test methods.

EN ISO 13934-2 is more commonly used in Europe and preferred for the ESPR.

Tear strength

The tear strength indicates the force needed to propagate a previously started tear in a fabric.

Procedure and fabrics tested

A specimen is prepared with a pre-cut/a tear and mounted between two jaws moving from each other forcing the tear to continue. The measured tear strength is the fabric's resistance to continue tearing when the force is applied.

The test is applicable to woven fabrics but may be used for some nonwovens. It is not applicable for knitted or elastic woven fabrics.

The test is relevant for jeans, jackets, high-performance textiles, etc., but may also be used for other conventional woven products. Tearing can occur when a fabric has been punctured and is then exposed to stress. A single tear may lead to an entire textile product being discarded, either due to failure in functionality or loss of appearance. Hence textile tearing strength is an important measure of textile durability and will demonstrate how warp and weft in a fabric will resist tearing.

Performance of different fabrics

High tear strength is achieved when fabrics are constructed so that yarns can move in the construction and share the load when exposed to tear force. The longer floats in a weave, generally the higher tear strength can be achieved (since floats allow yarns to move). This means that satin usually is stronger than twill, and twill is stronger than plain weave.

The higher density of the fabric, the lower the tear strength (opposite relation to tensile strength). Dense fabrics lead to immobile yarns, and higher friction creates lower tear strength. The more slippery the yarns/smooth surface of fibres and the longer fibres, the higher the tear strength. This means that the highest tear strength is most likely achieved by using synthetic filament fibres.

High tear strength can also be achieved using a rip stop. Rip stop fabrics are plain weaves but constructed with stronger reinforcing yarns in intervals, both in weft and warp creating a checked appearance. If a puncture appears, further tearing is prevented in the rip stop by the reinforcement yarn.

Tear strength standards

• EN ISO 13937-1 (2000) Textiles: Tear properties of fabrics – Part 1: Determination of tear force using ballistic pendulum method (Elmendorf).

• ASTM D1424.

• EN ISO 13937-2 (2000) Textiles: Tear properties of fabrics — Part 2: Determination of tear force of trouser-shaped test specimens (Single tear method).

• EN ISO 13937-3 (2000) Textiles: Tear properties of fabrics — Part 3: Determination of tear force of wing-shaped test specimens (Single tear method).

• ASTM D5587.

• EN ISO 13937-4 (2000) Textiles: Tear properties of fabrics — Part 4: Determination of tear force of tongue-shaped test specimens (Double tear test)

. • ASTM D2261

. Several methods exist, but EN ISO 13937-1 seems to be the most used one. The differences in methodology should be discussed with a textile testing laboratory.

These are given in reference (2).

10. Experiments

Presentation and analysis of data

The fabrics used for tests are plain woven cloth and single jersey knitted fabric. The quality particulars are given in table. The perspiration chemicals used are NH3N, Urea, Amino acid, Glucose and NaCl. The conduction of chemical test is given below.

The chemicals used are NH3N, Urea, Amino acid, Glucose, NaCl. Woven fabric plain weave and knitted fabric single jersey were taken for test. The width was measured. Material to liquor ratio is 1:20. The amount of chemicals used for test is given in table. The width of the fabrics were measured after drying the every treated fabrics.

The fabric is subjected to perspiration chemicals for 4 hours duration for 3 multiple treatments. The shrinkage measurements are done for woven and knitted fabrics.Width measurement is given in table 9. Shrinkage values are given in table 10 and 11. The tear test, (table 12 and 13),thickness of fabric (table 14), bending length (table 15)and crease recovery tests (table 16)are done and given in table. The use of perspiration chemicals are given in table 17. Quality particulars of fabrics are given in table 18. The breakage of yarn crosswise are given in table 19. Sitra norms for single yarn strength is given in table 20.

Table -9: Width Measurement

S.NO	PERSPIRATION TREATMENT	WIDTH OF FABRIC WOVEN	WIDTH OF FABRIC KNITTED
1	0	123CM	81CM
2	1	117CM	82CM
3	2	118CM	82.5CM
4	3	117CM	80CM

Table -10: Shrinkage of Woven Fabric

S NO	PERSPIRATION TREATMENT	SHRINKAGE (CM)
1	0	
2	1	6
3	2	-1
4	3	1
5	AVERAGE	6

Table -11: Shrinkage of Knitted Fabric

S NO	PERSPIRATION TREATMENT	SHRINKAGE (CM)
1	0	
2	1	-1
3	2	-0.5
4	3	2.5
5	AVERAGE	2.5

Table -12: Tearing Strength of Woven Fabrics

S NO	PERSPIRATION TREATMENT	WARP TEARING VALUE	TEARING STRENGTH (GMS)	DIFFERENCE (GMS)	WEFT TEARING VALUE	TEARING STRENGTH (GMS)	DIFFERENCE (GMS)
1	0	18	1152		15	960	
2	1	17	1088	64	15	960	0
3	2	16	1024	64	14	896	64
4	3	17	1088	-64	15	760	-64
5	AVERAGE			21			0

Table -13: Tearing Strength of Knitted Fabrics

SNO	PERSPIRATION TREATMENT	WALES TEARING VALUE	TEARING STRENGTH (GMS)	DIFFERENCE (GMS)	COURSE TEARING VALUE	TEARING STRENGTH (GMS)	DIFFERENCE (GMS)
1	0	33	2112		30	1920	
2	1	28	1792	320	31	1984	-64
3	2	18	1152	640	33	2112	-128
4	3	25	1600	-448	28	1792	320
5	AVERAGE			171			43

Table -14: Thickness of Woven and Knitted Fabrics

SNO	PERSPIRATION TREATMENT	WOVEN WARP (MM)	WOVEN WEFT (MM)	KNITTED WALE (MM)	KNITTED COURSE (MM)
1	0	2.6	2.6	3.6	3.8
2	1	3.0	3.0	3.9	3.9
3	2	2.9	2.9	3.8	3.5
4	3	3.0	3.0	3.8	3.9

Table -15: Bending Length of Woven and Knitted Fabrics

		TABLE 15	BENDING LENGTH OF WOVEN AND KNITTED FABRICS		
SNO	PERSPIRATION TREATMENT	WOVEN WARP (CM)	WOVEN WEFT (CM)	KNITTED WALE (CM)	KNITTED COURSE (CM)
1	0	1.9	1.9	1.9	1.0
2	1	2.1	3.0	2.9	2.5
3	2	3.1	3.8	2.4	2.0
4	3	3.1	3.3	2.3	1.6

Table -16: Crease Recovery of Woven and Knitted Fabrics

SNO	PERSPIRATION TREATMENT	WOVEN WARP ANGLE	WOVEN WEFT ANGLE	KNITTED WALE ANGLE	KNITTED COURSE ANGLE
1	0	69	80	100	130
2	1	90	90	125	150
3	2	97	98	100	150
4	3	101	100	100	125

Table -17: Perspiration Chemicals Used

SNO	MATERIAL	NH3N	UREA	AMINO ACID	GLUCOSE	NaCl
1	WOVEN=148.8GMS	60mgm	200 mgm	60mgm	150mgm	12mgm
2	KNITTED=56.7GMS					
3	M:L=1:20	One spoon =5gm				
4	205.5X20=4110ML					

Table -18: Quality Particulars of Woven and Knitted Fabrics

S NO	WOVEN	KNITTED
1	EPI=66	CPI=45
2	PPI=50	WPI=29
3	WARP COUNT=22	CRIMP%=135%
4	WEFT COUNT=25	STITCH LENGTH=0.244CM
5	GSM=128.34	COUNT=30s
6	ENDS/43MM=111.7	GSM=97
7	PICKS/43MM=84.6	COURSES/43MM=76.2
8		WALES/43MM=49.1

Table -19: Breaking of Yarn Crosswise

SNO	PERSPIRATION TREATMENT	WOVEN WARP (GMS)	DIFFERENCE (GMS)	WOVEN WEFT (GMS)	DIFFERENCE (GMS)	KNITTED WALES (GMS)	DIFFERENCE (GMS)	KNITTED COURSE (GMS)	DIFFERENCE (GMS)
1	0	10.31		11.35		43		25.2	
2	1	9.74	0.57	11.35	0	36.5	6.5	26.0	-0.8
3	2	9.16	0.58	10.59	0.76	23.5	13	27.7	-1.7
4	3	9.74	-0.58	11.35	-0.76	32.6	-9.1	23.5	4.2
5	AVERAGE		0.19		0		3.5		0.57

Table -20: SITRA Norms Single Yarn Strength

SNO	WOVEN WARP	WOVEN WEFT	KNITTED
1	COUNT 22-206GMS	COUNT-25-232GMS	COUNT-30-276GMS

Graph is drawn on the woven and knitted fabrics. Graph 1, shows the shrinkage of woven and knitted fabric Vs perspiration treatment. (0,1,2,3).Graph 2 shows the thickness of woven and knitted fabrics.

Graph 3&4 shows the bending length of woven and knitted fabrics.

Graph 5&6 shows crease recovery of woven and knitted fabrics.

Graph 7&8 the tearing strength of woven and knitted fabrics.

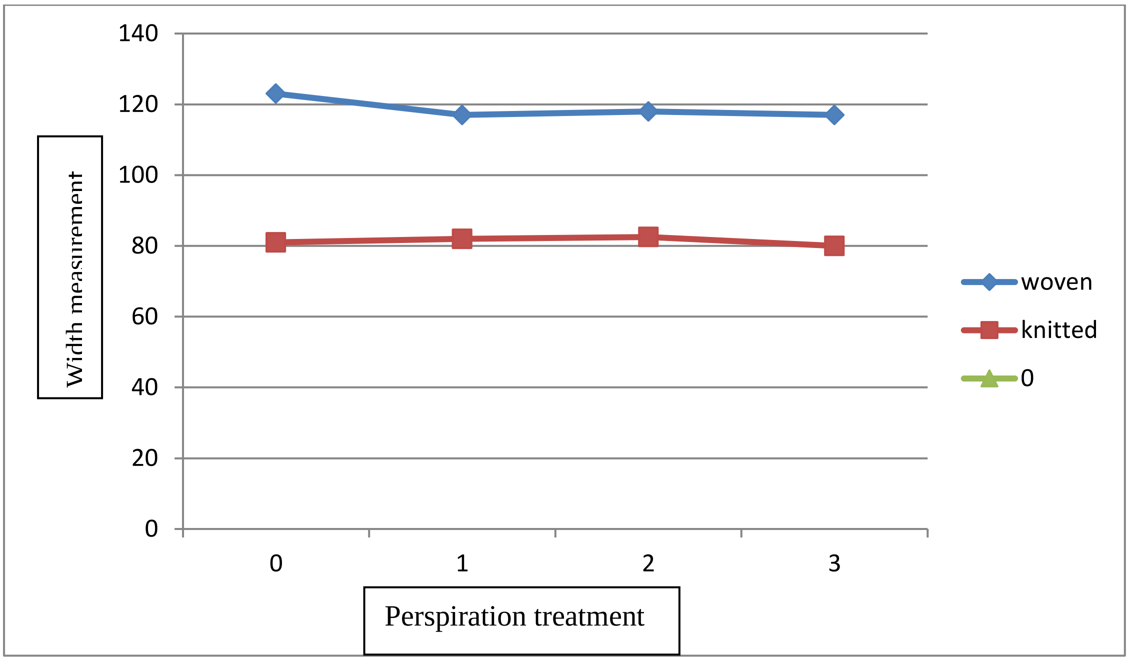

Fig -1: Shrinkage value of woven and knitted fabrics

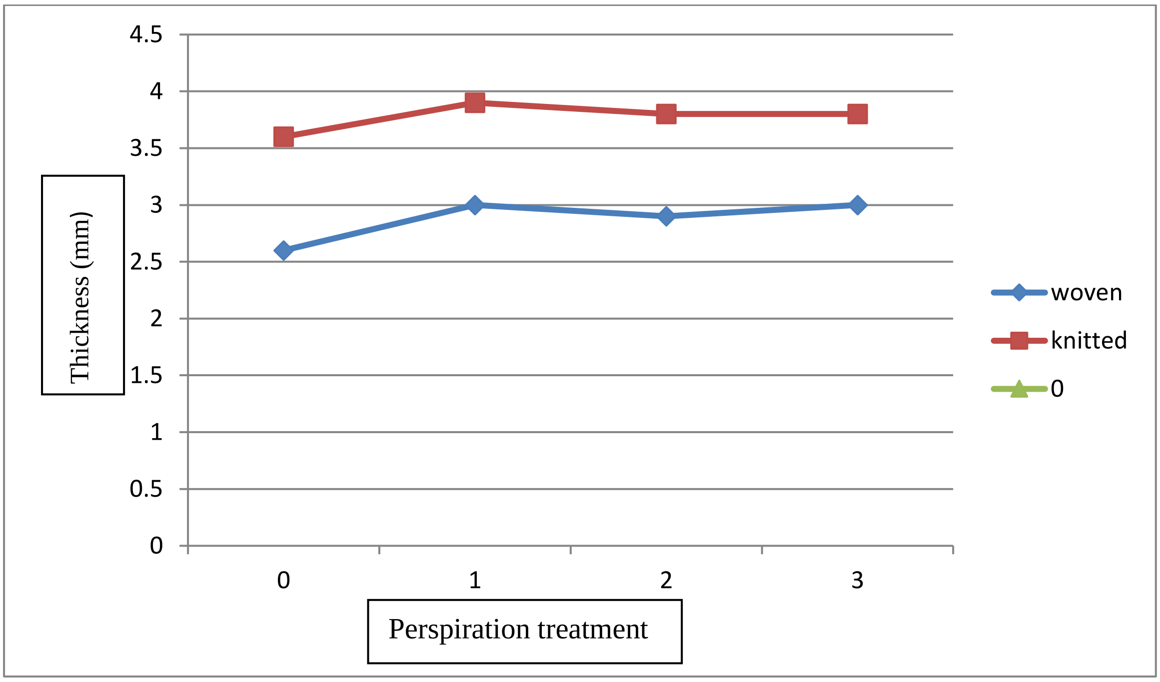

Fig - 1: Thickness of woven and knitted fabrics

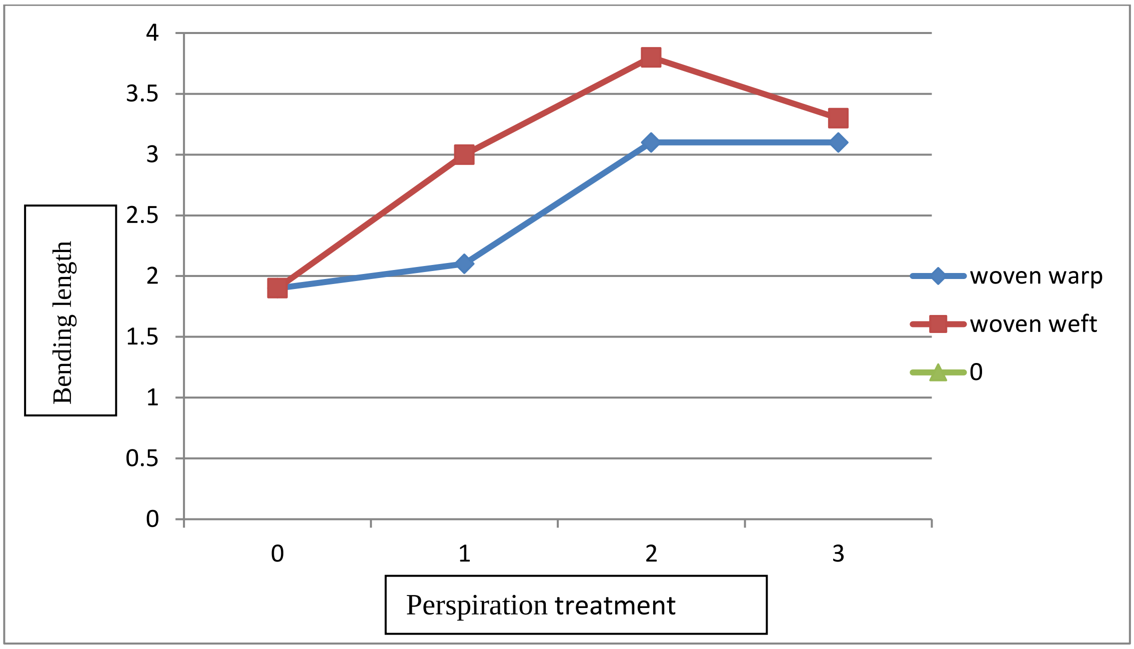

Fig - 2: Bending length of woven fabrics

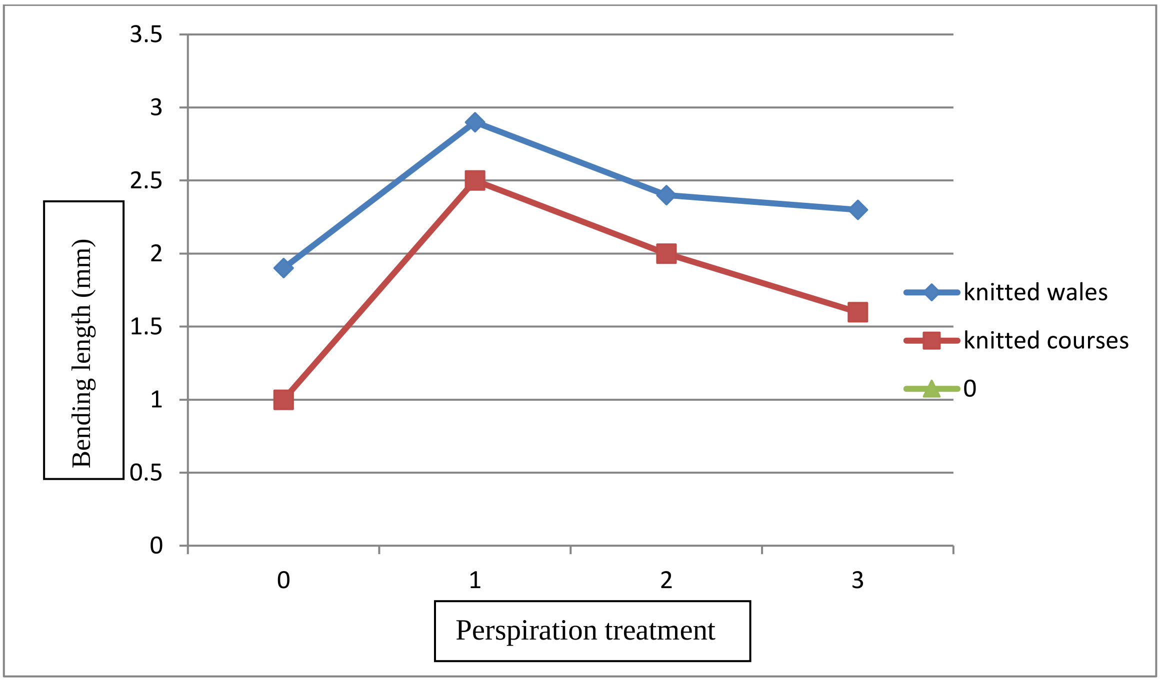

Fig - 3: Bending length of knitted fabrics

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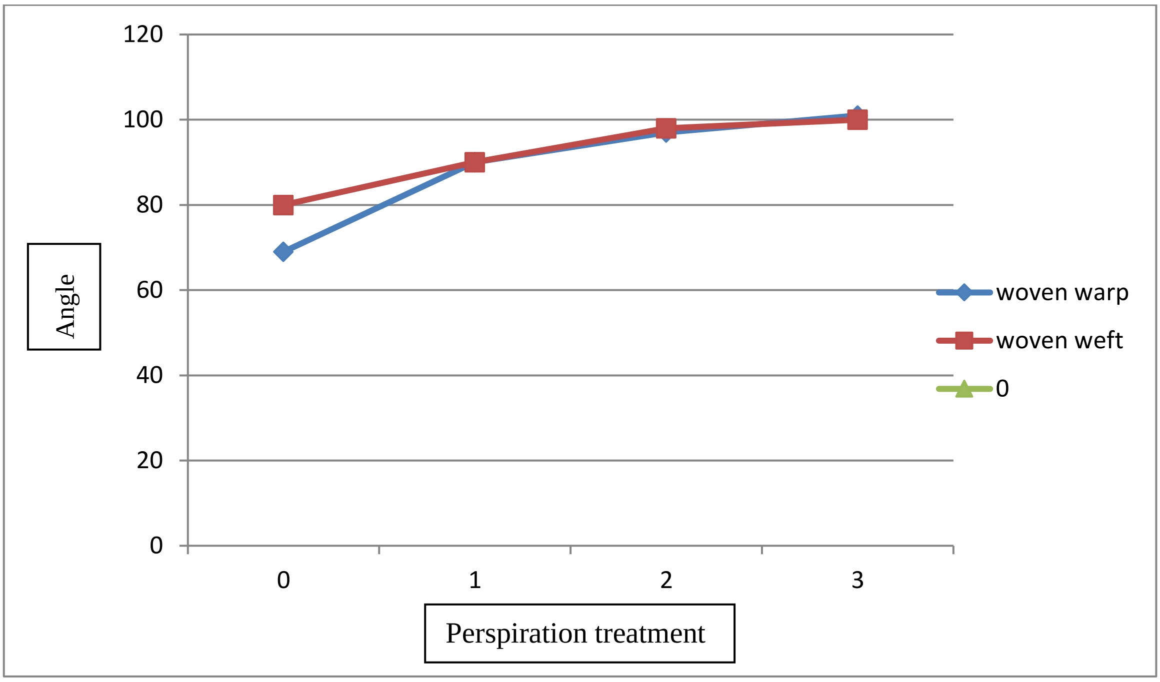

Fig - 4: Crease recovery angle of woven fabrics

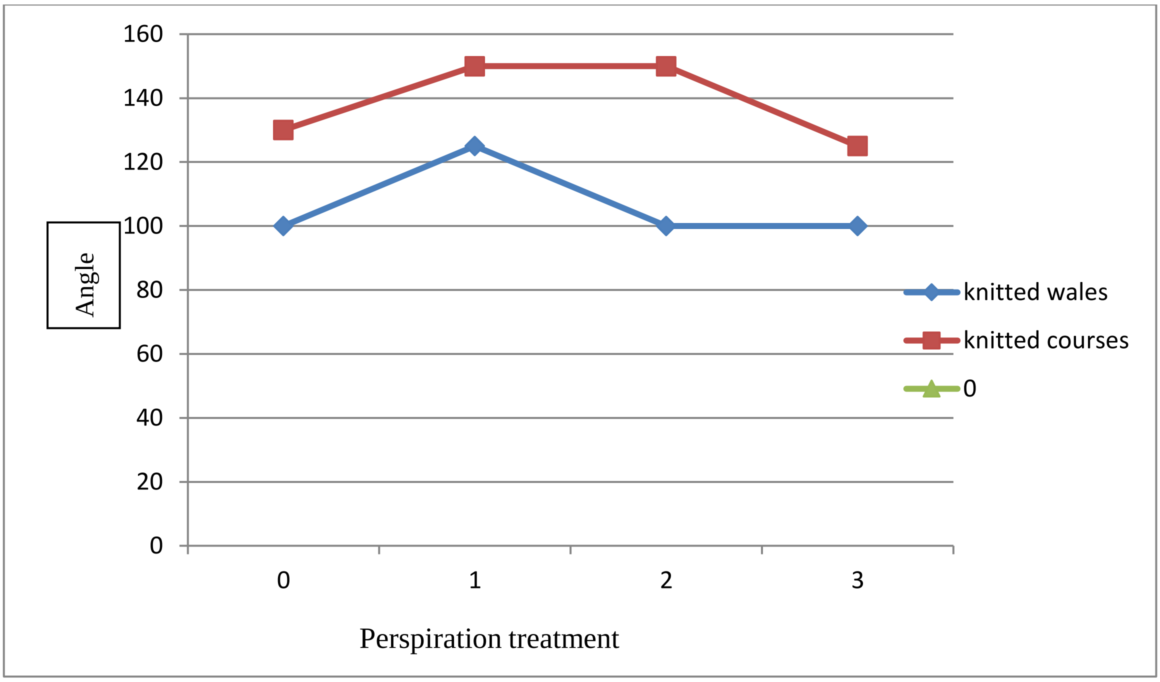

Fig - 5:Crease recovery angle of knitted fabrics

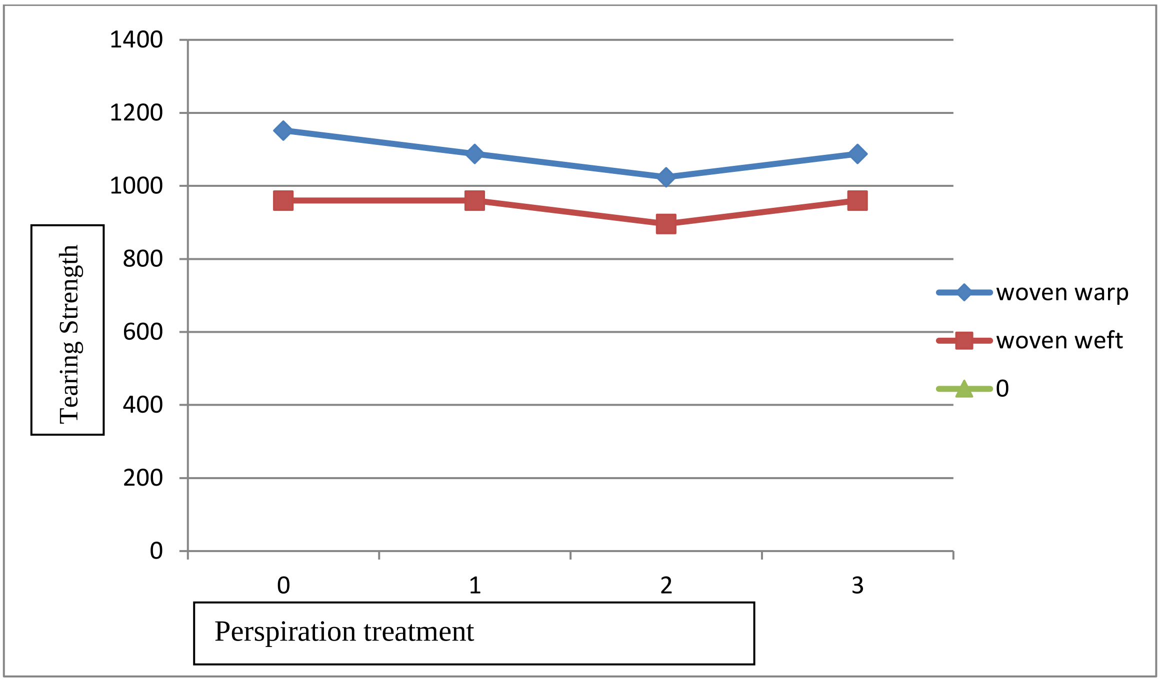

Fig - 6: Tearing strength of woven fabrics

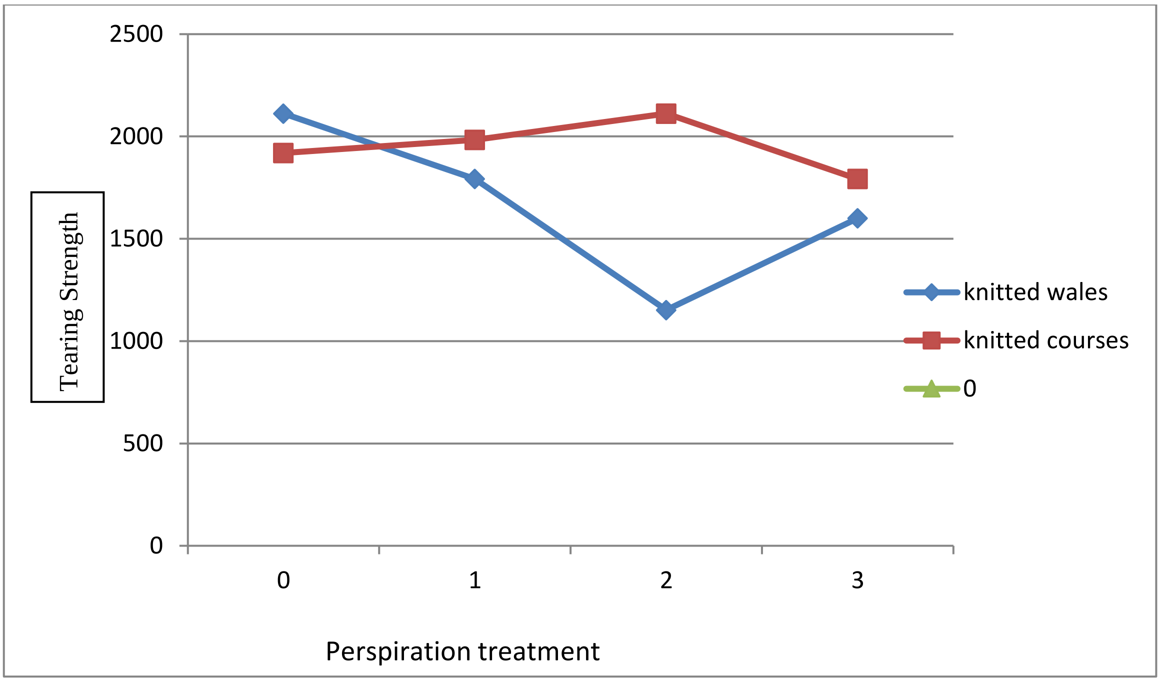

Fig - 8: Tearing strength of knitted fabrics

11. RESULTS AND DISCUSSIONS

The width measurements of woven and knitted fabrics shows there is no appreciable change in the width after perspiration treatment. For woven fabrics width reduces due to shrinkage. It is seen from graph 1. The thickness of the fabric increases for woven and knitted fabrics due to perspiration treatment. It is shown in graph 2.

The bending length of woven and knitted fabrics increase with perspiration treatment. It is shown in graph 3&4.

The crease recovery angle increases for woven fabric due to perspiration treatment. But for knitted fabrics crease recovery angle stays somewhat constant. It is shown in graph 5&6.

The tearing strength is reduced for warp and weft direction in woven fabrics. The tearing strength is constant for course direction in weft knitted single jersey fabrics. But in wale direction tearing strength tends to reduce with perspiration treatment. It is shown in graph 7&8.

The quality particulars are given in table. The ends/43mm, picks /43mm, courses /43mm and wales/43mm are calculated. This portion of fabric is subjected to tearing strength.

The single yarn strength of warp, weft, wales &courses for different perspiration treatments are calculated. The difference of loss in strength for every perspiration is calculated and its average is found out. For woven fabrics for every perspiration treatment 0.19gms of strength is lost. Totally 1152 gms is the tearing strength. To get the tear 1152/0.19=6063 washes are required i.e 16.6 years. Other factors such as light, abrasion, tensile, shear strength should be considered for tear of fabric. There is no appreciable loss in tear strength on weft side. So actual life will be average of warp and weft. i.e 8.3 years. Beyond which the fabric tears.

For knitted fabrics the average of difference is 3.5gms for wales direction for loss in tear strength. In course direction the loss in tear strength for every perspiration treatment is 0.57gms. The number of washes required to tear fabric in wale direction is 2112/3.5=603 washes. i.e 1.65 years.

The number of washes required to tear the fabric in course direction is 1920/0.57=3368 washes =9.2years.

The average of two is(1.65+9.2)/2=5.425yearsm Beyond which the fabric tears.

The shrinkage of fabric also decides the durability. The woven fabric is initially stretched in loom and in processing machine. So the shrinkage value is considered between 2nd and 3rd wash of perspiration chemicals. The shrinkage is 1cm for 118cm width. Assuming 1cm shrinkage for 118 washes carried out the calculations are made. For 10cm shrinkage 1180washes which is 3.2 years. This is for woven fabrics.

The knitted fabric is coming in relaxed state from the knitting machine. So the average shrinkage reading is taken. This comes to around 1cm for 81 washes. So to have 10cm shrinkage 810 washes should be carried out which is 2.2years time.

12. CONCLUSIONS

From the experimental work it has been found out that the tearing of woven fabric occurs around 8.3 years and knitted fabrics is around 5.4years. The shrinkage of woven fabrics occurs at 3.2 years and shrinkage of knitted fabrics occurs at 2.2 years time. The durability of woven and knitted fabrics are determined by shrinkage and tear. The perspiration from body erodes the fibre and shrinkage and tear occurs. The woven fabric because of its tight construction withstand for longer life compared to knitted fabrics. The loose structure of yarn in knitted fabrics holds more perspiration chemicals and which results in lesser life.

13. REFERENCES

1.https://journals.sagepub.com/doi/pdf/10.1177/003591573402700710

2. https://ecostandard.org/wp-content/uploads/2023/01/ECOS-Report_Standards-to-measure-textile-durability_December-2023.pdf

3.https://sdlatlas.com/test-materials/other/perspiration-test-set-of-chemicals-ISO

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