STUDIES ON FABRIC HANDLE USING THE WITHDRAWAL TECHNIQUE ON WOVEN AND KNITTED FABRICS TREATED WITH NaOH

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report " **STUDIES ON FABRIC HANDLE USING THE WITHDRAWAL TECHNIQUE ON WOVEN AND KNITTED FABRICS TREATED WITH NaOH**" is the bonafide work of " **M.ARUNPRAGASH, V.A.R.SREEKANTH, R.ANANDRAJ, S.PRASANTH** " who carried out the project work under my supervision.

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ABSTRACT

In today world of fashion textile material occupies primary importance and thinking from standpoint of human needs textile materials are preferably called as second skin to human. In such case textile material should be comfortable and compatible for day today activities of mankind. Fabric handle is a generic term for the tactile sensations associated with fabrics, and it markedly influences consumer preferences of textile products. Although fabric handle is till being judged subjectively to a large extent, the need of objective methods to measure fabric handle has always existed. An objective screening technique for fabric handle is presented. This method is based on the use of simple device fitted to the INSTRON, and it measures the force generated while passing a fabric specimen through a ring. The method proved capable of detecting differences in fabric handle between comparable fabrics, as illustrated by studies on woven fabrics (different GSM) and knitted fabrics (different P/C blend ratios) treated with NaOH in different concentrations. The relationship of the mean handle force for each specimen and its drape co-efficient is studied and the correlation between these values is being analyzed.

LIST OF FIGURES

LIST OF GRAPHS

1. INTRODUCTION

1.1FABRIC HANDLE

The mechanical parameters which influence the handle of the woven fabrics can be determined with the use of KES-F (Kawabata Evaluation System for Fabric) and INSTRON Tension-tester. The Kawabata proposed that a given fabric can be estimated on the basis on two factors calculated from mechanical parameters determined by the KES-F system. The total hand value which expresses the general handle and the total appearance value which determined the fabric appearance. The fabric's formability co-efficient, which is defined as the ratio of bending rigidity to the initial modulus, can be calculated on the basis of results obtained by the FAST system. The fabric's handle is based on objectified instrumental research, with the use of an instron tension tester, has not been developed. Only a graphic multi-axial system for presenting the data which characterize a flat textile product has been elaborated. In this system, every quality measured by the instron tension-tester is presented on an individual axis. The present aims at approaching the elaboration of a general woven-fabric handle factor on the basis of the mechanical parameters obtained by an instron tension-tester.

1.2 PROBLEM WITH P/C BLENDS

Comfort Characteristics of Polyester/Cotton Blends

Modern day living conditions require clothing that is light weight, comfortable, safe, elegant, easy care and hard wearing. No single textile fiber has all the desirable attributes. Synthetic fibers have better wear and easy care properties but they lack many comfort related properties. Natural and regenerated cellulosic fibers have better feel and higher moisture absorbency leading to good comfort in wear and low static charges but have poor strength and abrasion resistance. The blended yarns composed of two or more fiber components of different types such as wool/polyester, wool/acrylic, polyester/cotton; polyester/viscose in intimate blend can produce yarns with desirable properties. For instance, blending of polyester fiber with cotton viscose has become popular because of the complementary nature of the properties. The blend of polyester with cotton viscose results in reduction of the most of the negative features of polyester, while negative features of cotton viscose are overcome by the presence of polyester in the blend.

In general, main motives behind blending are:

1. Combination of merits of constituent fibers,
2. Opportunity to produce colored effects, and
3. Reduction of cost by use of cheaper fiber.

Mehta and Narrasimham have summarized the some comfort related properties and positive as well as negative attributes of these properties for natural and man -made fibers. Comfort attributes of fibers like cotton, wool and viscose can be combined with hard wearing and heat settable attributes of synthetic fibers to produce fabrics with right balance of properties. Desirable or undesirable attributes of fibers can be affected by the actual textile construction. Yarn and fabric parameters, together with finishing treatments and garment design can considerably change the comfort level produced by a garment.

1.3 ALKALI HYDROLYSYS

Alkali treatment is nothing but treating fabrics with chemicals such as sodium Hydroxide, potassium hydroxide, etc. The main thing behind the use of sodium Hydroxide is that weight loss will be less compared to other alkali's. Hydrolysis of Polyester with Sodium Hydroxide is a saponification reaction through elimination of - OH groups, as a result of which polyester losses its weight. From an x -ray analysis of alkali treated polyester, it was established that caustic hydrolysis initially proceeds over the whole fiber surface and then continues through enlarged surface cavitations causing higher weight loss, but no evidence was found of core cavitations in fibers to prove the weakening in the fiber interior. Sodium hydroxide can probably react only at the surface of polyester and it cannot penetrate the fiber surface. During the alkali treatment, the

CHAPTER-2

2. LITERATURE REVIEW

2.1 POLYESTER COTTON BLEND

Modern day living conditions require clothing that is light weight, comfortable, safe, elegant, easy care and hard wearing. No single textile fiber has all the desirable attributes. Synthetic fibres have better wear and easy care properties but they lack many comfort related properties. Natural and regenerated cellulosic fibre have better feel and higher moisture absorbency leading to good comfort in wear and low static charges but have poor strength and abrasion resistance. The blended yarns composed of two or more fibre components of different types such as wool polyester, wool/acrylic, polyester/cotton, polyester/viscose in intimate blend can produce yarns with desirable properties. For instance, blending of polyester fibre with cotton/viscose has become popular because of the complementary nature of the properties.

2.2 FIBRE PROPERTIES

2.2.1. COTTON

Cotton is the oldest fiber used for textile purposes. In the tropical countries, well as variety of fine fabrics till 1600 A.D. the date of origin of cotton is unknown.

2.2.1.1. CHEMICAL PROPERTIES

The cotton fiber is elongated cell, constructed from millions of cellulose molecules. Small amount of moisture, fatty materials, minerals are other constituents of cotton. So the chemical properties of cotton are mostly influence d by the chemical characteristics of cellulose.

ACTION OF HEAT

Cotton fiber ignites easily and it burns with a bright flame, which continues even after the fiber is removed from fire. Cotton can be heated in a dry state to 150°C without any decomposition. But if heating continues, a brown color on cotton develops gradually. A slight brown discoloration can occur at temperatures lower than 150°C, which does not deteriorate the fiber. However, it is sufficient to spoil the effects of bleaching.

ACTION OF LIGHT

Exposure to air in presence of sunlight for a long period will have an effect on cotton like that of heat. Oxycellulose is gradually formed accompanied by tendering because of atmospheric oxygen. The tendering effect by light and air is accelerated by traces of metals like copper.

ACTION OF WATER

Rate cotton is very hard to wet because the wax is present on the surface of the fiber. Cold water swells cotton without any chemical damage. Swelling is accompanied by the disappearance of the natural twist i.e., deconvolution. The irregular cross section becomes more circular, which reappears on drying. Structurally, swelling is due to the intercrystalline areas, which means only amorphous regions are affected by swelling. ACTION OF ACIDS Cold dilute solutions of mineral acids at boil have no effect on cotton cellulose, provided the acid are neutralized or washed out completely before drying. Cold concentrated sulphuric acid dissolves cellulose and forms cellulose hydrate. Hydrochloric acid affects cotton much more severely than sulphuric acid.

ACTION OF ALKALI

One of the main advantages of cotton is its resistance to alkali solutions. Mild alkalies like sodium carbonate have no action on cotton in the absence of air either at low temperature or at high temperature. However, in presence o f oxygen or air, oxycellulose is formed with gradual tendering of cotton. Dilute solution of strong alkalies like sodium hydroxide with concentration of 2% - 7% can be boiled without least tendering in absence of air. Generally, dilute solution of sodium hydroxide is used for scouring. Strong alkalies with higher concentration induce structural and physical changes in cotton fiber. Sodium concentration of the alkali used. As the concentration of alkali increases, the number of water molecules per molecule of alkali decreases for the formation of smaller hydrates. Thus the diameter of the hydrated form of alkali decreases.

2.2.1.2. PHYSICAL PROPERTIES

FIBER FINENESS

The wall thickness of different types of cotton ranges from 3.5 micron to 10 micron. Ribbon width is said to range from 12 micron to 25 micron. The thickness part of a fiber is not at the base but it is at the middle. The tip end is usually gently tapered. The base end is slightly finer than the middle portion.

FIBER UNIFORMITY

It has been observed that the longer cotton tends to become uniform in length than the shorter ones. The varying percentage of immature fiber also indicates non than the shorter uniformity of wall thickness for the same variety of fibers. Also there are considerably differences between cotton grown from the same seed in the same location from time to time. Unless like other fibers will not possess same fiber properties because the cotton properties will change periodically according to the monsoon changes.

POROSITY

Cotton fibers is porous and exhibits capillary effects to a higher degree. The

70% or more of the fiber. LUSTRE the natural luster of cotton fiber is determined by two factors i.e., fiber shape and fiber polish. The luster does not depend upon weight, length, diameter, fineness or convolutions. It depends upon the ratio of semi - major and semi-minor axes of the elliptical fiber cross section. If the ratio is below, the luster will be high. The highest luster is noticed in the fiber with circular cross section. So the dominating influence in luster is the external fiber surface and the exact geometric shape is of secondary importance.

DENSITY

Cotton fiber has a density of 1.54 gm\cc, which corresponds to a specific volume of 0.64 cc/gm.

STRENGTH

The load required tom break i.e., tensile strength of single cotton fiber varies widely. It depends upon the thickness of the wall, prior damage to the fiber and cellulose degradation. Matured fibers with coarse and heavy wall are the strongest fibers. Their strength ranges from 9 gm to 13 gm per fiber. The strength of fiber 8 increases at higher humidity or at higher moisture. In general, the tensile strength increases up to a relative humidity of 60% and then remains mostly constant.

ELONGATION

When load is applied, the length

Average fiber elongation at break is about 5% to 10%, exactly around 6% to 8%. In the structure of cotton fibers, the fibrils spiral round at an angle of about 20^0 to 30° to the fiber axis. In general, increasing the helix angle reduces the resistance for ex tension.

MODULUS

Modulus is generally related to the resistance to deformation. Up to certain limit of deformation, the stress and strain follow Hooke's law i.e., strains is proportional to stress. The stress -strain relation for a single fiber is roughly a straight line when the fiber contains little moisture and in this case, Hooke's law is valid up to the breaking point.

TORSIONAL RIGIDITY

The mean rigidity of cotton fiber is about 7.9 x 10"-4 g.wt/sq.cm/sq.tex. Rigidity varies with the shape, conditions of growth and wall thickness of the fiber. The high rigidity of thick walled fibers suggests why coarse cottons must be more highly twisted than fine cottons to produce yarns of the same size.

2.2.1.3 MODIFICATIONS OF COTTON WITH ALKALI

The cotton fabric immersed in aqueous solutions of caustic soda (NaOH) treatment of cellulosic fibers with aqueous solutions of sodium hydroxide at various temperatures produces a polymeric change in the cellulose.The hydrodynamic diameter of various hydrates of NaOH decreases with increasing concentration of the alkali in water. Formation of cellulosate anion and the different sizes of NaOH x H 20 have been offered as explanations why certain concentrations of alkali metal hydroxides are effective in penetrating between cellulose chains to cause maxim um swelling, cleavage of hydrogen bonds, and a change in the conformation of native celluloseto cellulose II. Historical development of these observations and the composition and identification of five different soda celluloses (Na -Cell I through Na-cell V) that are consistent with x -ray diffraction data have been reviewed. A phase diagram of the different soda celluloses shows the relationship between NaOH concentration and temperature for each of the phases. Sarko and co - authors have proposed elaborate pathways by which native cellulose is converted to each of the soda celluloses that ultimately lead to the thermodynamically stable and irreversible cellulose II structure. However, these pathways are based on the premise that cellulose II exists in antiparallel chain conformations. The most popular view that has been held for the past fifty years is that Cellulose exists in a parallel chain conformation while cellulose II exists in an antiparallel chain conformation. A more recent and simpler explanation of how cellulose I is converted into cellulose II and what the arrangements of the cellulose chains are in the unit cell is given chain conformation that can be achieved by initially breaking intramolecular hydrogen bonds between 6 -OH and 2-OH **on** the adjacent glucose residue. The formation of new and stronger intermolecular hydrogen bonds occurs on conversion to cellulose II. Moreover, the computer -generated models indicate that substantial amounts of energy would be required to convert the parallel -up chains in native cellulose into the antiparallel chain conformations of cellulose II. Although these investigators have not specifically discussed " soda cellulose intermediates", their cellulose II structural models consistent with the presence of different degrees of salvation hydration of sodium hydroxide between cellulose chains at various degrees of chain separation, swelling and deswelling as well as equilibrium in the conversion of cellulose to cellulosate ions.

2.2.2. **POLYESTER**

The work of W. H.Carothers, on linear fiber forming polymers put this initial foots on polyesters by polycondensation method. The polyester were aliphatic polyesters, made from dibasic acids like adipic acids and glycols. The melting point of the polyester were below 100°C having molecular weights in the range of 2500-5000. It is only a short step onward from him to J.R.Whinfield and J.T.Dickson, who prepared the first high molecular weight, high melting polyester in 1940. This polymer is poly(ethylene terephthalate) or poly(oxyethylene oxy terephthaloyl) or simply PET. Polyester fiber is defined as, " a manufactured composed of at least 85 % weight of an ester of dihydric alcohol and terephthalic acid. So this may include pure polyester or polyester tether fiber. Generally polyester fibers are produced from spinnerets. Polyester polymer is produced commercially in a two step polymerization process, i.e., monomer formation by ester interchange of dimethyl terephthalate with glycol or esterification of terephthalic acid with glycol followed by polycondensation by removing excess glycol. Monomer formation [step 1] by the catalyzed ester interchange reaction between molten dimethyl terephthalate and glycol takes place at about 200 °C. The product is a mixture of monomer, very low molecular weight polymer, and as a methanol by product, which distills at 150°C. Ester interchange catalysts are divalent salts of manganese, cobalt, magnesium, zinc, or calcium. An alternative monomer formation system involves terephthalicphthalate and a catalyzed direct etherification rather than ester interchange. T he monomer which is the same from both methods expect for some end groups, usually is polymerized in the presence of antimony catalyst. Chain extension is promoted by removal of excess glycol from the various viscous melt at about 280°C, with carefully controlled agitation and a progressive reduction of pressure to about 200 Pa. heating is continued about 280°C until the desired degree of condensation is obtained.

2.2.2.1. STRUCTURE OF POLYESTER

The length of the repeated unit in poly (ethylene terephthalate) along the chain is the trans configuration to each other (10.9 °A). The chains are therefore nearly planar. The unit cell is triclinic; the atomic positions in the crystalline indicate that no special forces of attraction exist between the molecules. The spacing's between atoms of neighboring molecules is of order expect if Vander Waals forces operate. Drawn polyester fibers may be considered to be composed of crystalline and non crystalline regions. The theoretical density of pure crystalline material can be determined mathematically from the dimensions of the unit cell. Percentage crystallinity and molecular orientation relate to tensile strength and shrinkage; however the various methods of measurement are problematic.

Polyester fibers have many favorable properties, such as high strength and resilience, resistance to many chemicals and resistance to abrasion, stretching, shrinking and wrinkling. It has certain disadvantages, such as tendency to pill, static charges, and high luster, as well as being unbreathable difficult to dye and resistant to oily stain removal, due to its hydrophobic nature and inactive surface. improving the undesirable properties of polyester fibers is done under harsh conditions, since the fibers are resistant to most chemicals. In order to modify the surface of the polyester enzymes are used. The enzyme, polyesterase, is a serine esterase that acts by cleaving the polymer chain through hydrolysis of ester bonds of the polyester fibers.

2.2.2.2 PHYSICAL PROPERTIES

MOISTURE REGAIN

The moisture regain of polyester is low, ranges between 0.2 to 0.8 percent Although polyesters are non absorbent, they do not have wicking ability. In wicking, moisture can be carried on the surface of the fiber without absorption.

SPECIFIC GRAVITY:

The specific gravity 1.38 or 1.22 depending on the type of polyester fibers is moderate. Polyester fibers have a density greater than polyamide fibers and lower than rayon. Fabrics made from polyester fibers are medium in weight.

HEAT EFFECT:

The melting point of polyester is close to polyamide, ranging from 250 **to** 300°C. Polyester fibers shrink from flame and melt, leaving a hard black residue. The fabric burns with strong, pungent odour. Heat setting of polyester fibers, not only stabilizes size and shape, but also enhances wrinkle resistance of the fibers.

2.2.2.3 CHEMICAL PROPERTIES

EFFECT OF ALKALIES

Polyester fibers have g moderate resistance to strong alkalies at room temperature and degraded at elevated temperature.

EFFECT OF ACIDS

strong acids at room temperature. Prolonged exposure to boiling hydrochloric acid destroys the fibers, and 96% sulphuric acid and causes disintegration of the fibers.

EFFECT OF SOLVENTS:

Polyester fibers are generally resistant to organic solvents. Chemical used in cleaning and stain removal do not damage it, but hot m-cresol destroys the fibers, and certain mixtures of phenol with trichloromethane dissolve polyester fibers. Oxidizing agents and bl eachers do not damage polyester fibers.

MISCELLANEOUS PROPERTIES

Polyester fibers exhibit good resistance to sunlight, and it also resists abrasion very well. Soaps, synthetic detergents, and other laundry aids do not damage it. One of the most serious faults with polyester is its oleophilic quality. It absorbs oily materials easily and holds the oil tenaciously.

2.2.2.4 MECHANICAL PROPERTIES

A wide of polyester fibers properties is possible depending on the method of manufacture. Generally, as the degree of stretch is increased, which yields higher crystallinity and greater molecular orientation, so are the properties, e.g., tensile strength and initial young's modulus. At the same time, elongation normally decreases. An increase in molecular weight further increase tensile strength, decreases but t he initial modulus may be also reduced. Yams maintained at a fixed length and constant tension during heat setting are less affected with respect to changes in modulus , and reduced shrinkage values are still obtained. Poly (ethylene-terephthalate) shows non linear and time — dependent elastic behavior. Creep occurs under the load with subsequent delay in recovery on removal of the load, but compared to that of other melt -spun fibers, creep is small.

2.2.2.5 MODIFICATIONS OF POLYESTER WITH ALKALI

Polyester fibers have taken the major position I textiles all over the world although they have many drawbacks e.g., (a) low moisture regain (0.4%), (b) the fibers has a tendency to accumulate static electricity, (c) the cloth made up of polyester fibers pickup more soil during wear and it also difficult to clean during washing, (d) the polyester garments from pills and thus, the appearance of a garment is spoiled, (e) the polyester fiber is flammable. Thus, it has been suggested that surface modifications can have an effect on hand, thermal properties, permeability, and hydrophilicity.

Numerous research papers and patents are available and considerable amount of research works is in progress on the hydrolysis and aminolysis of polyester fibers to overcome their disadvantages.

Namboodri and Haith carried out a comparative study by treating the polyester fibers with alkalies and various alkoxides (e.g. sodium hydroxide with water, sodium methoxide in methanol, sodium ethoxide in ethanol, sodium the polyester fiber was in the order sodium hydroxide < tertiary butoxide < secondary propoxide < methoxide and ethoxide. It was suggested that the observed order followed the nucleophilicity of the bases and the relatively lower reactivity of the secondary propoxide and tertiarybutoxide was assumed to be due to the streric retardation during the equilibrium reactions. The hydrolysis of the polyester fiber was assumed to be taking place on the surface of the fiber. It was assumed that a random attack of the base on the carboxyl groups of the surface polymer molecules took place with removal of the shorter chains from the surface, which was further hydrolyzed by the base present in the solution.

Kosohk Wonetal. have reported that the treatment of a polyester fabric with aqueous sodium hydroxide solution caused a decrease of weight and breaking strength and improved handle with increasing sodium hydroxide concentration, treatment time and temperature. It has been reported that these effects were further enhanced in the presence of a carrier, such as palanil carrier A. the molecular weight of the fiber was also decreased, but crystallinity was not affected by the alkali treatment.

Hydrolysis improved the smoothness of the fabric and decreased the electrostatic charge for friction. Elisson etal. observed that untreated polyester fibers have relatively smooth surface, while NaOH treatment causes pitting of the fiber surface. The pits increase in number and depth as the time of hydrolysis was lengthened.

increased with increasing alkali concentration and treated temperature and time. With increasing weight loss, drape and flex stiffness and tear strength decreased, and tear strength retention at weight loss 17% was >70%. At the same weight loss, handle was affected by the treatment conditions. Zhang and co -workers observed that the addition of dodecyl - dimethybenzeneammonium bromide cationic surfactant reduced the concentration of NaOH and thus lowered the degree of degradation of poly(ethylene terephthalate) fibers.

The hydroxyl ions in the solution of sodium Hydroxide attack the carboxyl group in the polymer which result in the formation of disodium terephthalate and ethylene glycol. Disodium terephthalate is soluble in alkaline solution (pH above 8) up to 13 -14%. Free terephthalic acid is on the surface of the fabric which is to be washed out with alkaline water before neutralizing the fabric.

2.3 POLYESTER / COTTON BLENDS ON ALKALI

According to R.T.SHET, S.H.ZERONIAN, H.L .NEEDLES and S.A.SIDDIQUI, Alkali treatment of polyester by a continuous techniques pad - heat technique for a given length of time results in a much higher degree of hydrolysis, as indicated by weight loss, than a batch process employing a large liquor :sol id ratio. The moisture related properties of polyester are essentially unaffected by the alkali treatment, and the tensile

wail) direction as indicated by yarn tests , are also not affected when the weight polyester and brings about mercerization of the cotton. The presence of cotton improves moisture related properties while the polyester imparts dimensional stability to alkali treated blend fabrics.

The treatment of cotton with aqueous sodium hydroxide of mercerization strength is a well known process for enhancing its physical properties. It has recently been concluded that although low temperature is required to swell the cotton for mercerization, the treatment has been attributed to the limitation of the reaction mainly to the fiber surface. Cold industrial mercerization is therefore a topochemical reaction resulting in a more condensed skin around the unswollen core of the fiber. Warm sodium hydroxide on the other hand, penetrates cotton fibers rapidly, resulting in more uniform swelling of the fiber when the temperature is lowered. Hot alkali treatment of polyester/cotton blends could achieve the dual purpose of imparting a soft silky hand to the polyester fiber and improving the hydrophilicity and dye ability of the cotton fiber. The objective of this study was to examine the effect of hot alkali treatments on the physical properties of polyester and polyester/cotton blend fabrics.

According to Dr J.Hayavadhana Two groups of 67/33 blended dress materials were subjected to alkaline oxidation process. following copper sulphate padding H202 bleaching and alkaline hydrolysis the fabric was imparted high silky feeling .finished fabric were characterized by higher WT(tensile strength), greatly reduced G,2 HG (shear properties), extensively improved H,2HB oxidation .Bhattacharya stated that at high concentration of NaOH, the strength loss was to high because some polyester fiber get dissolved resulting in weakening the fiber. Reichstadter pointed out that for the improvement of the polyester fabric, mild sodium hydroxide may be used .this treatment may reduce some strength loss, but improves the pilling and abrasion resistance and also the fabric handle

2.4 Action of Alkali on Polyester

The action of caustic on polyester fibres leading to loss in weight and thus imparting silky feel has been discussed in detail in the literature survey at the start of the thesis. Hence, it can be said that by treating the Jute / PET fabric with caustic, the handle properties can be improve. Although a considerable amount of work on the surface modification of PET fabric, and a method to improve the absorbency of jute fabric has been carried our separately, less emphasis placed on the study of low stress mechanical properties of alkaline hydrolysed jute warp and texturised (crimped) polyester weft union fabrics. The thrust of the work detailed in the present chapter is to explore the above said possibility.

CHAPTER 3

3. AIM OF THE PROJECT:

Fabrications of test module for the INSTRON for the measurement of fabric handle using the withdrawal technique. Different 100% woven cotton fabric samples were tested for the withdrawal force before and after the treatment with different concentration of NaOH at 70 C for 45 minutes. Three different knitted fabric of the following composition (35/65, 50/50, 65/35) were tested for the withdrawal force before and after the treatment with different concentration of NaOH at 70 C for 45 minutes.

All the finished samples both treated and untreated were tested for fabric handle and was related to the drape co-efficient of the samples.

CHAPTER 4

4.1 MATERIAL SPECIFICATION

4.1.1 SAMPLE SPECIFICATION

Sample: 1 (woven)

Reed = 68
Pick = 68
Warp count = 30
Weft count = 30
Fabric width =50”

Sample: 2 (woven)

Reed = 60
Pick = 60
Warp count = 20
Weft count = 20
Fabric width =50”

Sample: 3 (woven)

Reed = 92
Pick = 88
Warp count = 60
Weft count = 60
Fabric width =54”

Sample: 4 (woven)

Reed = 92
Pick = 88
Warp count = 40
Weft count = 40
Fabric width =54”

Sample: 5 (woven)

Reed = 92
Pick = 88
Warp count = 60
Weft count = 60
Fabric width =63”

Sample: 6 (woven)

Reed = 64
Pick = 54
Warp count = 30
Weft count = 40
Fabric width =50”

Sample: 7 (woven)

Reed = 66

Fabric width =50”

Sample: 8 (woven)

Reed = 84
Pick = 72
Warp count = 40
Weft count = 40
Fabric width =50”

Sample: 9

Knitted fabric (p/c) blended= 35/65

Sample: 10

Knitted fabric (p/c) blended= 65/35

Sample: 11

Knitted fabric (p/c) blended= 50/50

4.1.2 CHEMICAL SPECIFICATION

- **AGENT: NAOH (SODIUM HYDROXIDE)**
- **FORM: PELLETS.**
- **TYPE: PRO ANALYSIS.**
- **MAKE: MERCK.**
- **MOLECULAR WEIGHT: 40.00**

Also called caustic soda, dye, Sodium hydroxide, chemical compound, NaOH, a white crystalline substance that readily absorbs carbon dioxide and moisture from the air. It is very soluble in water, alcohol, and glycerin. It is a dissociation of sodium chloride; chlorine gas is a co -product. Small amounts of sodium hydroxide are produced by the soda -lime process in which a concentrated solution of sodium carbonate (soda) is reacted with calcium hydroxide (slaked lime), calcium carbonate precipitates, leaving a sodium hydroxide solution. Sodium hydroxide (NaOH), also known as lye or caustic soda, is a caustic metallic base. It is widely used in industry, mostly as a strong chemical base in the manufacture of vinyl chloride (for PVC), paper, textiles, and detergents. Sodium hydroxide is also the most common base used in chemical laboratories

4.1.3. MACHINE SPECIFICATION

CONSTRUCTION

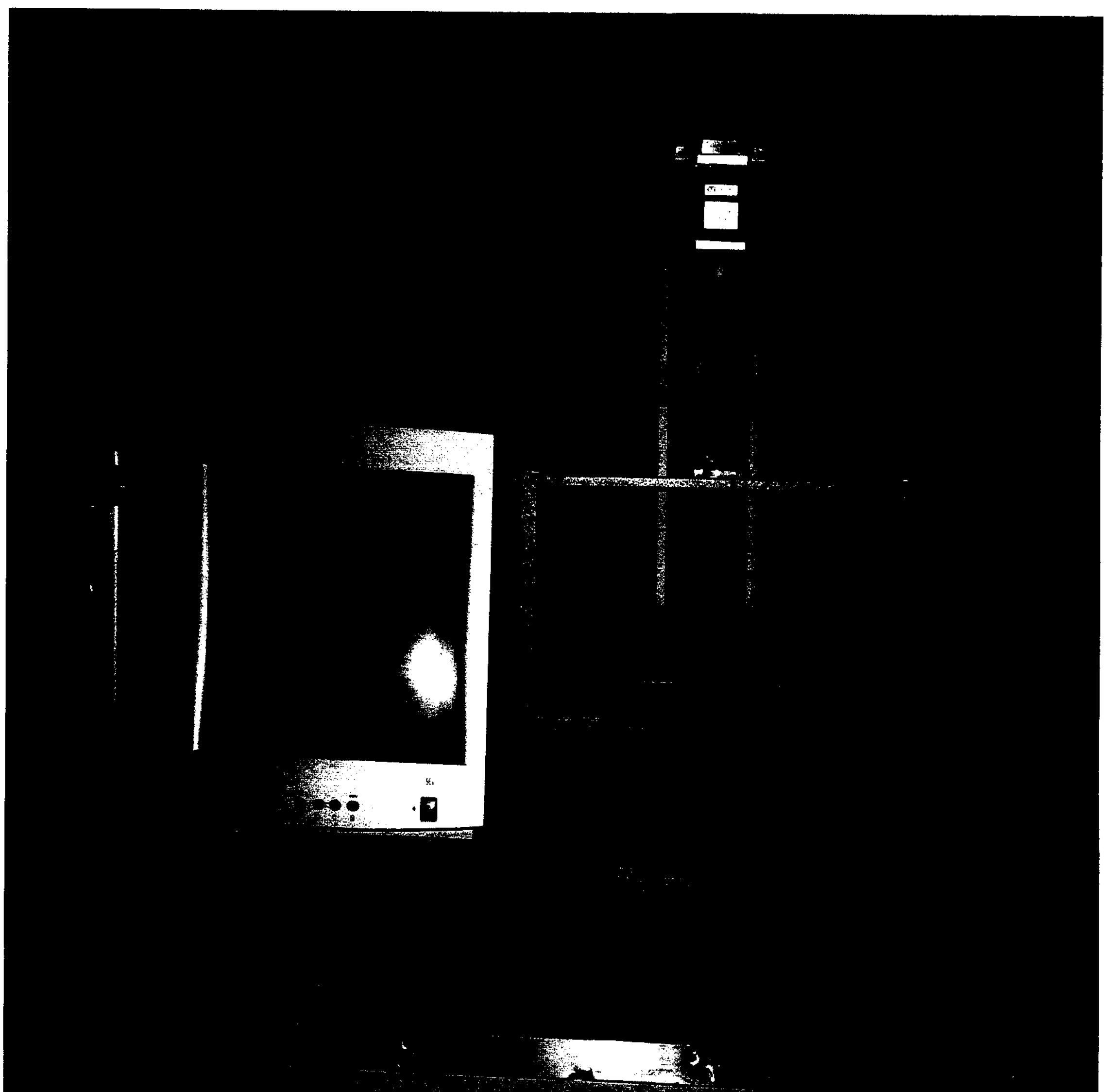
The hand value of the fabric is calculated in INSTRON tension-tester by replacing the design of the machine by fixing a platform at the bottom and we have a circular template above the platform in which the fabric passes. On the top of the machine therein a hook in which the fabric is hanged for the testing process and the reading in given by the computer.

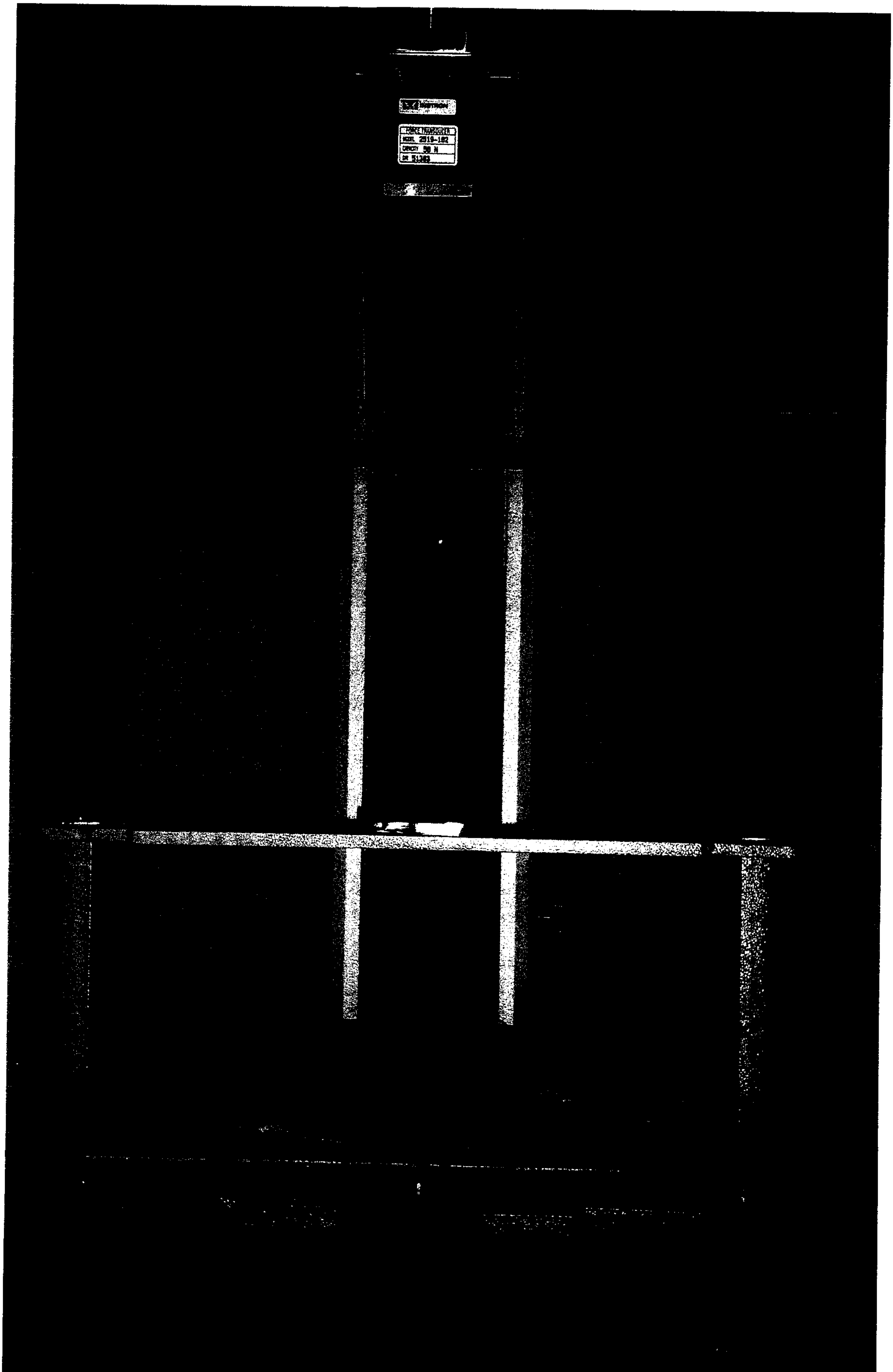
- **Material for construction** : stainless steel
- **Platform Diameter** : 45cm x 45cm
- **Sample size** : 30cm diameter
- **Ring Diameter** : 3cm

OPERATION

The sample is placed on the platform and the hook which is at on the top is connected to load cell will come down and sample is hanged on the hook and it will moves upward through the template (3cm dia) and the load cell connected to a computer will give the amount of load required to pull the fabric through the ring is collected for each sample

MACHINE

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4.2 PROCESS SPECIFICATION

4.2.1 TIME

Weight loss was found to be directly proportional to the Time of hydrolysis as the time of hydrolysis increased, weight loss also increased. Generally the time taken for the alkaline hydrolysis is 15, 30, 45 minutes. But here the time is kept constant as 45 minutes. The percentage loss in weight of samples is calculated.

4.2.2 TEMPERATURE

When a fabric saturated with aqueous alkali is heated at constant external temperature there will be an increase in the concentration of scoured alkali due to the evaporation of water from the fabric phase. The temperature of scoured alkali in the fabric phase, after an initial increase with time will attain an equilibrium value once the loosely bound water is evaporated. For the improvement of luster property and comfort property of cotton hot alkali treatment is necessary for the 70°C is preferred.

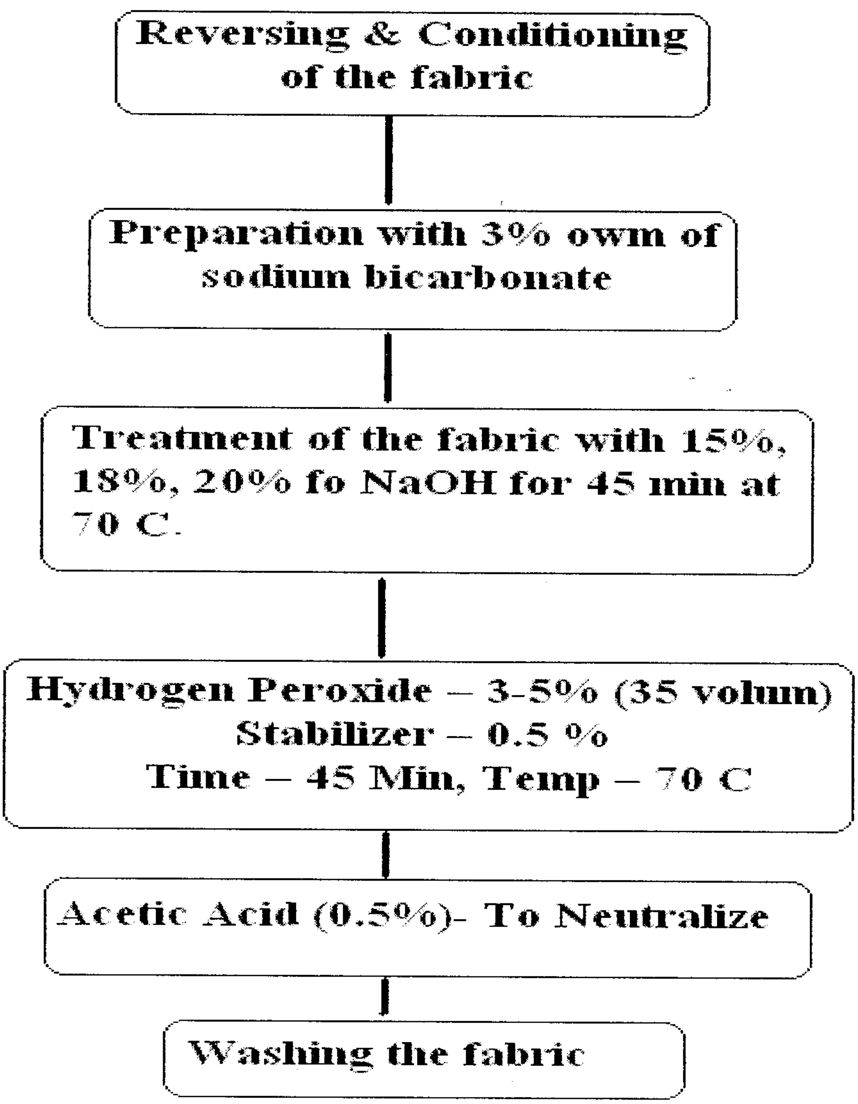
4.2.3 CONCENTRATION

At the higher concentration, the surface of the fiber gets ruptured and the weight loss of the fabric is increased by 25%. At lower concentration the rate of hydrolysis taken more time to attain its equilibrium so that the concentration that are selected are 15%,18%, 20%.

4.2.4 LIQUOR RATIO

the potential of low liquor dyeing principles. The effect depends on several factors and the bath ratio is one among them influencing the mechanical properties of the fabric to a greater extent lower bath ratio will exhibit the properties favorable to a soft fabric so finally the liquor ratio of 1:20 is selected.

4.3 TREATMENT PROCEDURE



4.4 TESTING PROCEDURE

4.4.1 GSM of the Fabric

Testing procedure:

1. Make all the tests in the standard Atmosphere.

2. GSM of a fabric is the grams of the fabric present in one square meter.

3. The cloth sample is cut using GSM cutter.

4. Then the fabric weight is measured using electronic weight measuring device.

5. GSM of a fabric is measured in grams per square inch.

6. Take 10 readings

4.4.2 Fabric Thickness

Testing procedure:

1. Conduct the test in a standard atmosphere.

2. Fabric thickness is the density of the fabric.

3. Clean the presser-foot and the reference plate. Check that the presser foot shaft moves freely. With the presser -foot so loaded as to exert the appropriate specified pressure on the reference plate, set the thickness gauge

4. To read zero.

5. Raise the presser-foot and position the sample, without tension, on the refere nceplate so that no part of the area to be measured lies nearer to a selvedge than

6. Lower the presser-foot gently on to the sample and not the gauge reading after 30 seconds.

7. Similarly determine the thickness at 10 places on the sample so chosen that each such place contains different warp and weft threads as relevant.

8. Fabric thickness is measured in millimeters.

4.4.3 Weight Loss %

Testing Procedure

1. Make all the tests in the standard atmosphere.

2. Weight loss is the Amount weight lost by the fabric after the fabric is treated with the alkali treatment.

3. Initial weight of the fabric is noted.

4. Fabric is treated with a alkali solution

5. Final weight of the fabric is noted

6. Weight Loss is calculated in percentage.

7. Weight loss% is calculated.

4.4.4 DRAPE

Testing Procedure

1. A circular specimen of diameter 10 inch is supported on a circular disc of diameter 5 inch. When doing so, the unsupported area of the fabric drapes over the edge of the supporting disc.
2. If the specimen is a solid object say a card board, drapping would occur such that the area of projection from the periphery would equal to
3. When the fabric is supported, it will assume the folded configuration due to gravity and the shape of the projected area will not be circular.
4. Cut the figures drawn in the paper.
5. Then he cut portions are weighed and drape co efficient is calculated.

Measurement through weight method

$$\text{Drape Co-efficient} = {}^{Ws - Wd}/_{WD - Wd}$$

Where,

W_D – Weight of the paper whose area is equal to the area of the specimen.

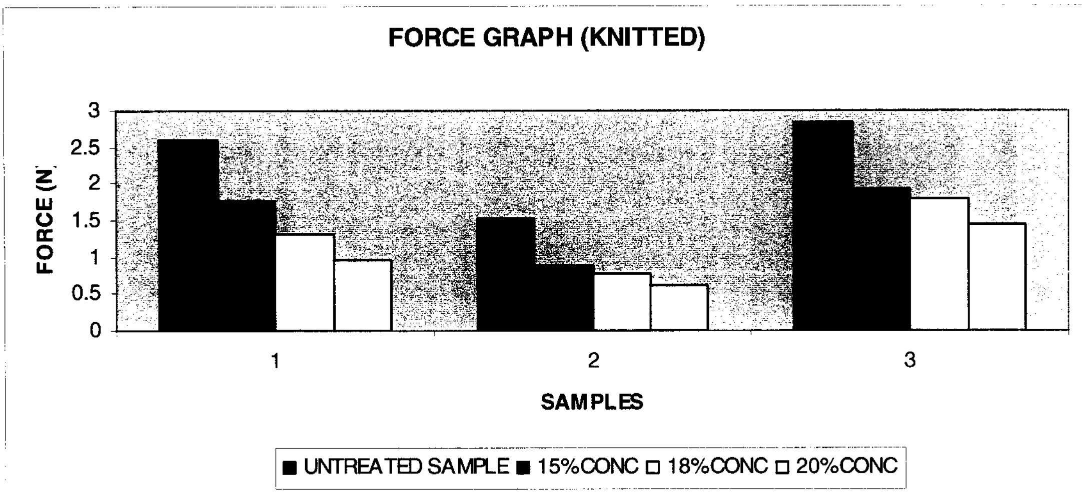
Wd – Weight of the paper whose area is equal to the area of the supporting disc.

Ws - Weight of the paper whose area is equal to the projected area of the specimen.

5. RESULT AND DISCUSSION

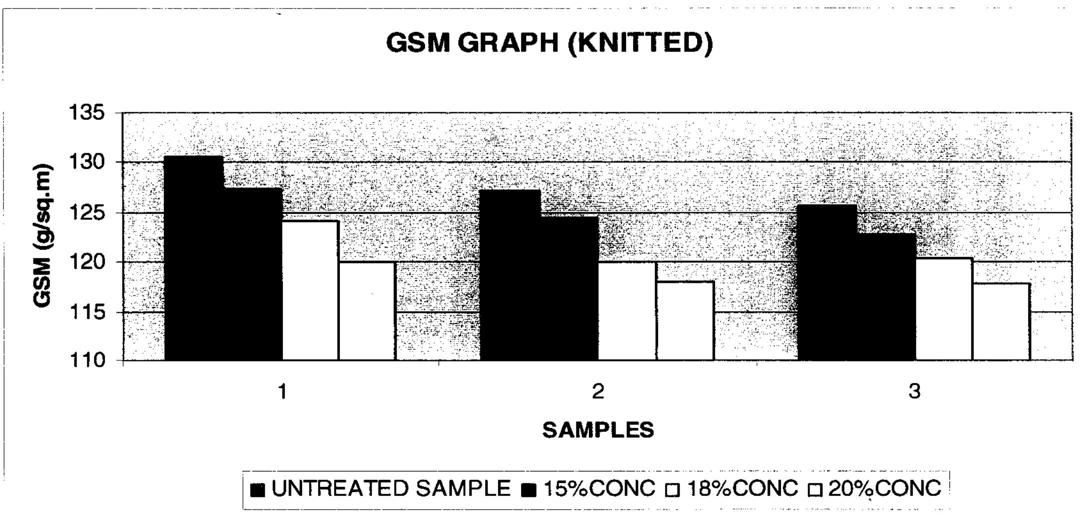
5.1 KNITTED RESULTS

5.1.1 FORCE CHART



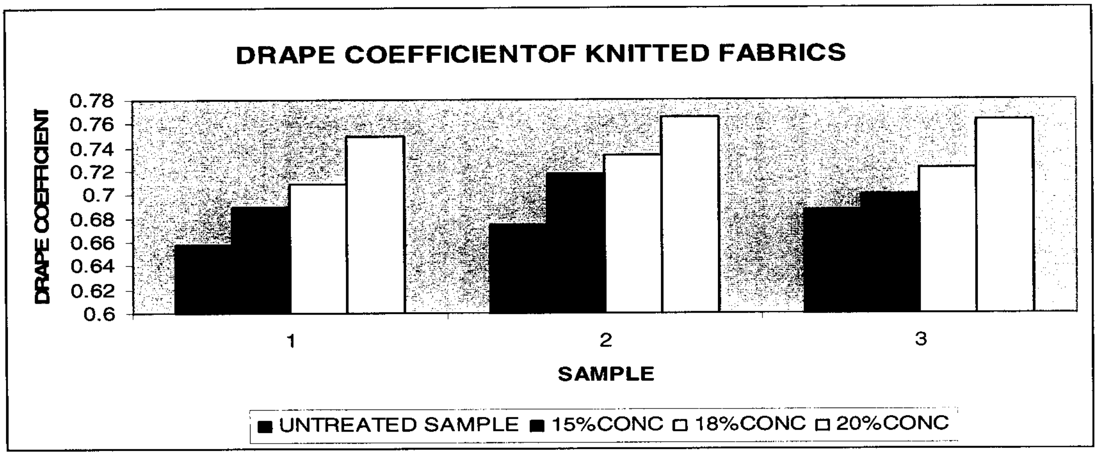
	SAMPLE1	SAMPLE2	SAMPLE3
UNTREATED	2.60607	1.53272	2.83022
15%CONC	1.76847	0.87716	1.94034
18%CONC	1.32007	0.77591	1.7917
20%CONC	0.97691	0.61581	1.45711

5.1.2 GSM CHART



	SAMPLE1	SAMPLE2	SAMPLE3
UNTREATED	130.6	127.1	125.7

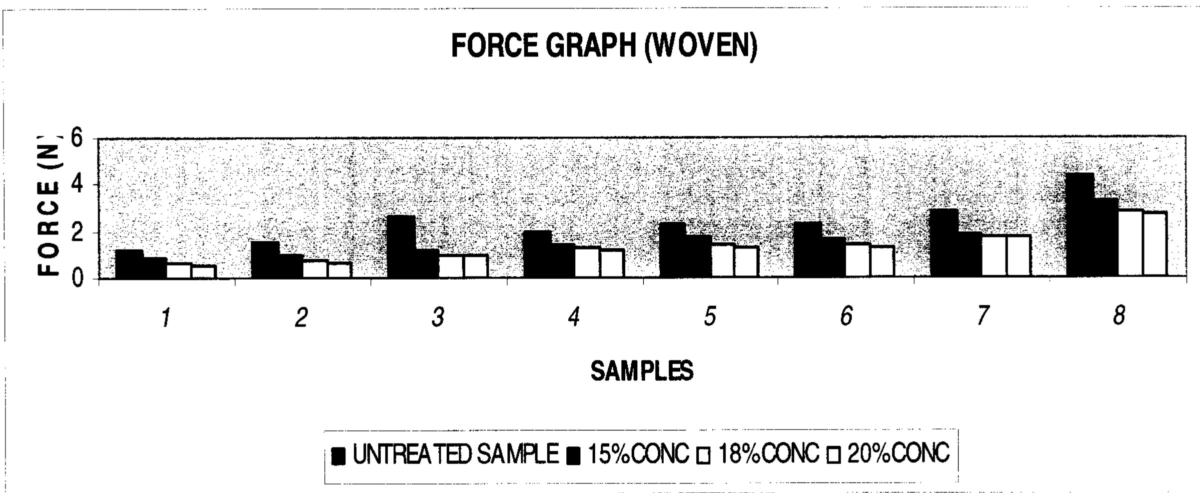
5.1.3DRAPE CHART



	SAMPLE1	SAMPLE2	SAMPLE3
UNTREATED	0.6576	0.6752	0.6869
15%CONC	0.6893	0.7177	0.7002
18%CONC	0.7093	0.7339	0.7222
20%CONC	0.7493	0.7653	0.7627

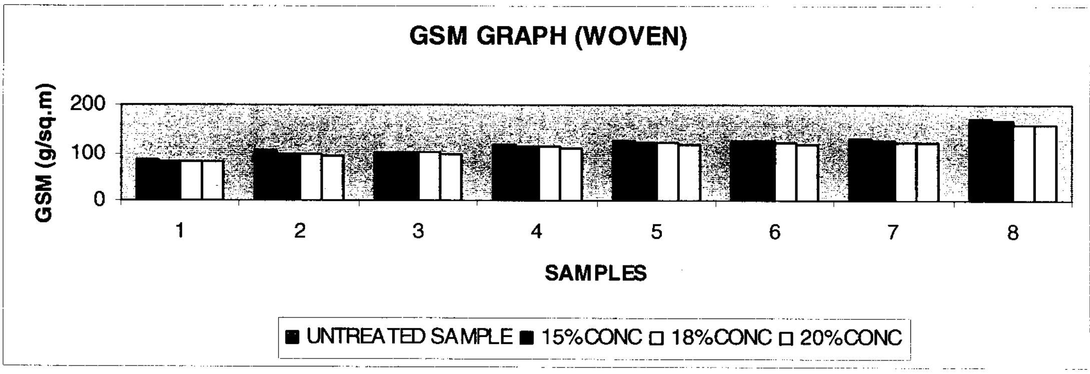
5.2 WOVEN RESULTS

5.2.1 FORCE CHART



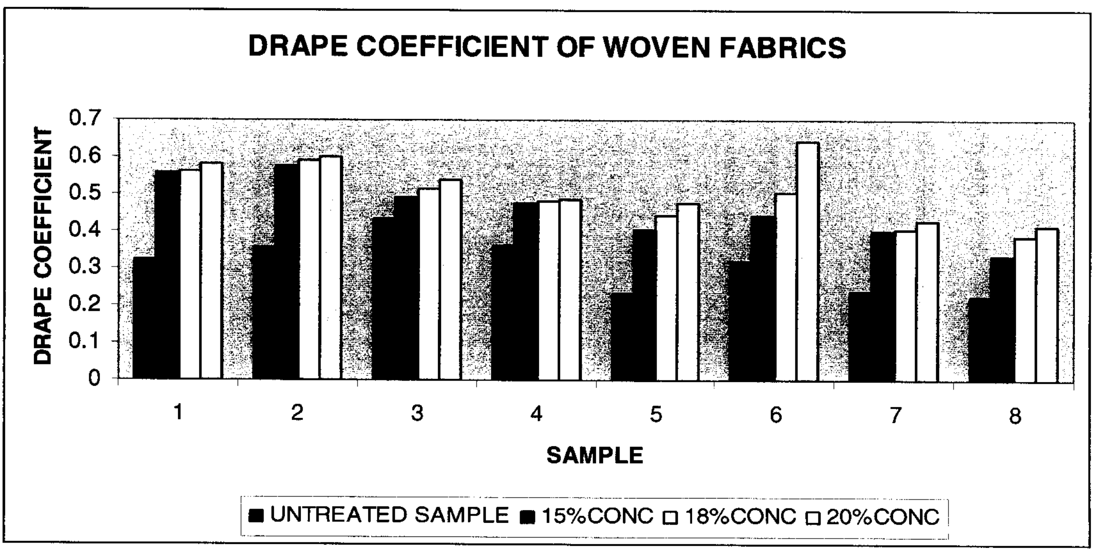
	SAMPLE1	SAMPLE2	SAMPLE3	SAMPLE4	SAMPLE5	SAMPLE6	SAMPLE7	SAMPLE8
UNTREATED	1.22912	1.55478	2.66048	1.99166	2.30808	2.28717	2.83186	4.34442
15% CONC	0.89943	0.93585	1.15287	1.45313	1.75104	1.68497	1.82914	3.26241
18%CONC	0.70771	0.74396	1.02121	1.32281	1.47075	1.40613	1.70779	2.88277
20%CONC	0.52712	0.60636	0.9456	1.25227	1.30153	1.31505	1.69356	2.68496

5.2.2 GSM CHART



	SAMPLE1	SAMPLE2	SAMPLE3	SAMPLE4	SAMPLE5	SAMPLE6	SAMPLE7	SAMPLE8
UNTREATED	85	105	103	118.3	126.1	127.8	130.4	169.4
15% CONC	82	100	101.6	116	123.6	125.8	128	165.6
18%CONC	81	96	100.2	114	121.8	122.5	124.4	160.8
20%CONC	80	92	99.6	112	119	120	122.4	158.6

5.2.3 DRAPE CHART



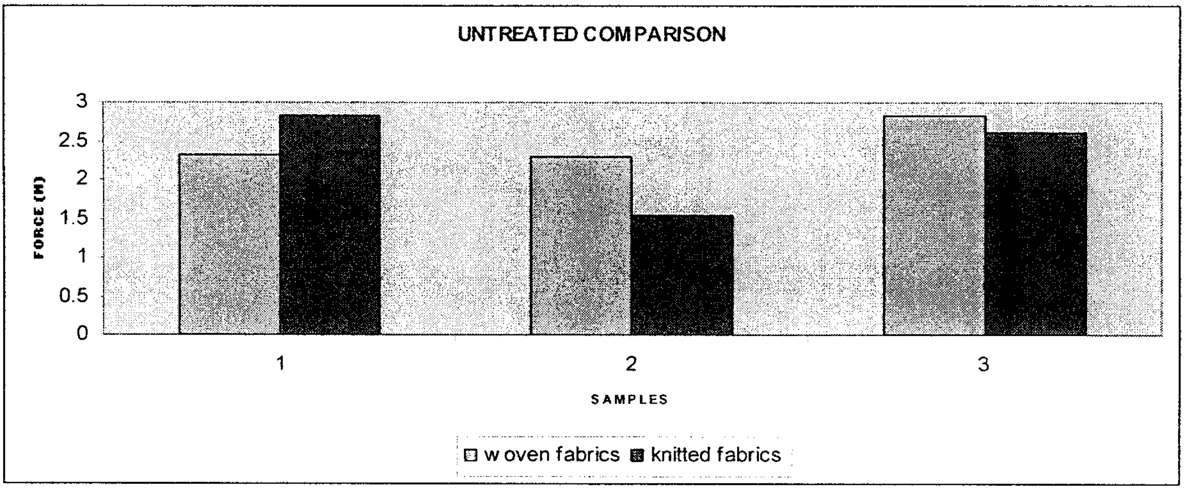
	SAMPLE1	SAMPLE2	SAMPLE3	SAMPLE4	SAMPLE5	SAMPLE6	SAMPLE7	SAMPLE8
TREATED	0.3255	0.3565	0.4341	0.3608	0.2316	0.3191	0.236	0.223
CONC	0.5587	0.5745	0.4896	0.4767	0.4051	0.4423	0.3986	0.3341
CONC	0.5603	0.5925	0.512	0.4831	0.4446	0.506	0.4049	0.3854
CONC	0.5829	0.6008	0.5366	0.4875	0.4756	0.6427	0.4291	0.4152

5.3 COMPARISON BETWEEN WOVEN AND KNITTED FABRICS

5.3.1 FORCE COMPARISION

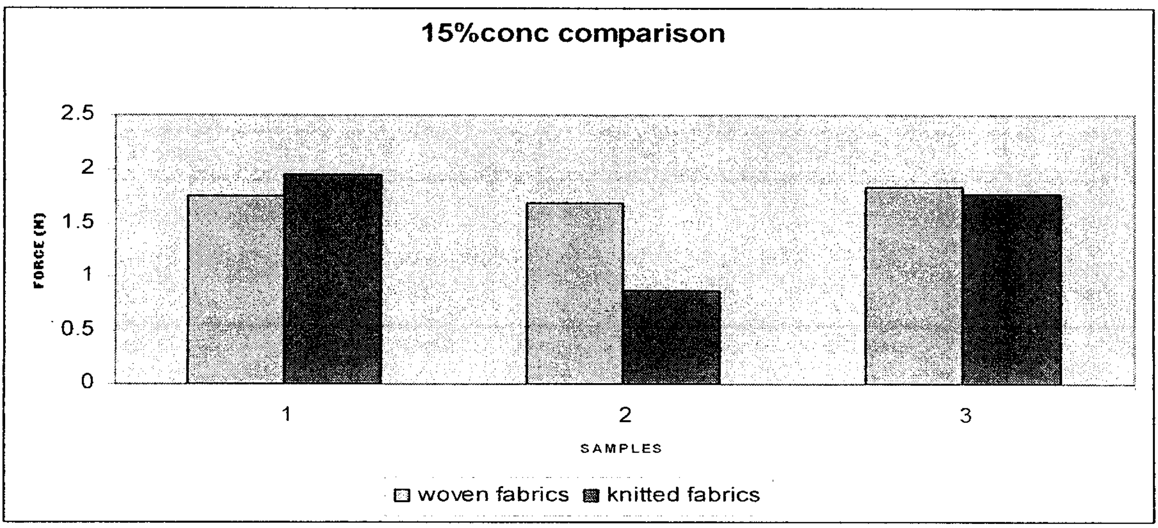
(SAMPLE 5,6,7 VS SAMPLE 11,10,9)

5.3.1.1 Untreated samples



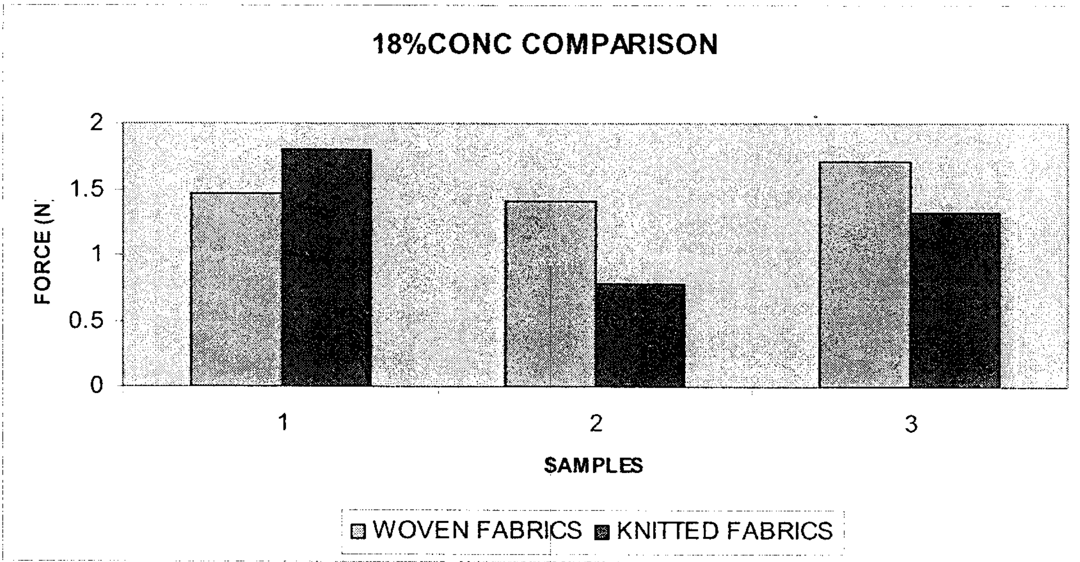
	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	2.30808	2.28717	2.83186
KNITTED	2.83022	1.53272	2.60607

5.3.1.2 15% concentrated samples



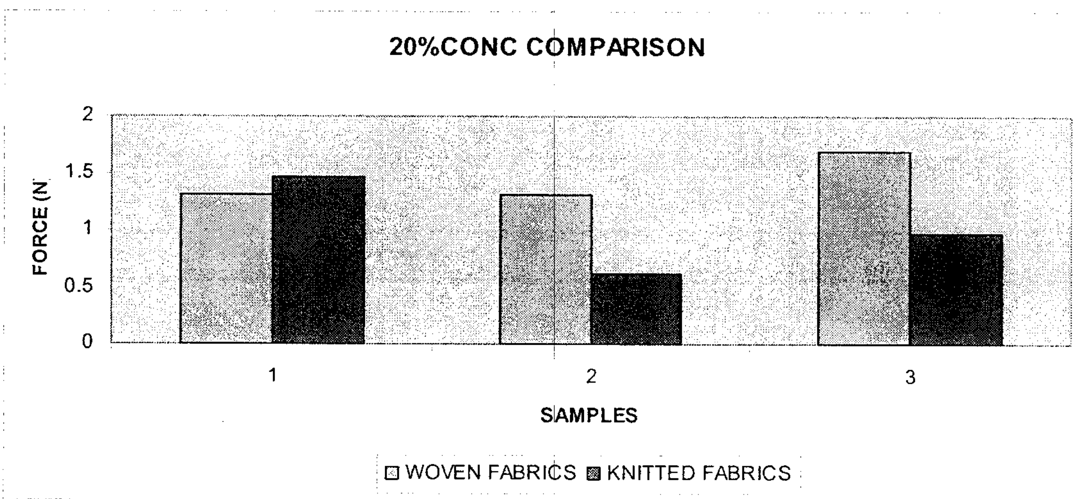
	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	1.75104	1.68497	1.82914

5.3.1.3 18% concentrated samples



	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	1.47075	1.40613	1.70779
KNITTED	1.7917	0.77591	1.32007

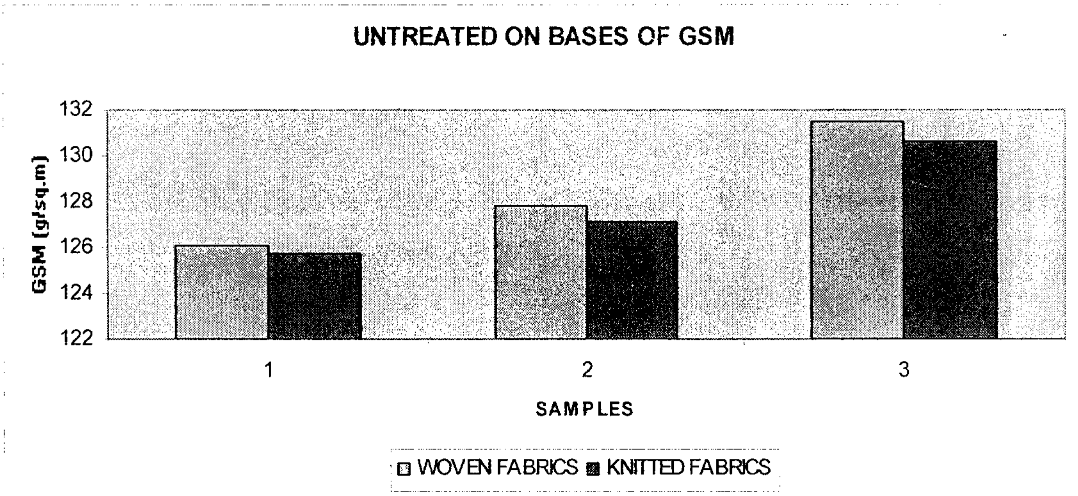
5.3.1.4 20% concentrated samples



	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	1.30153	1.31505	1.69356
KNITTED	1.45711	0.61581	0.97691

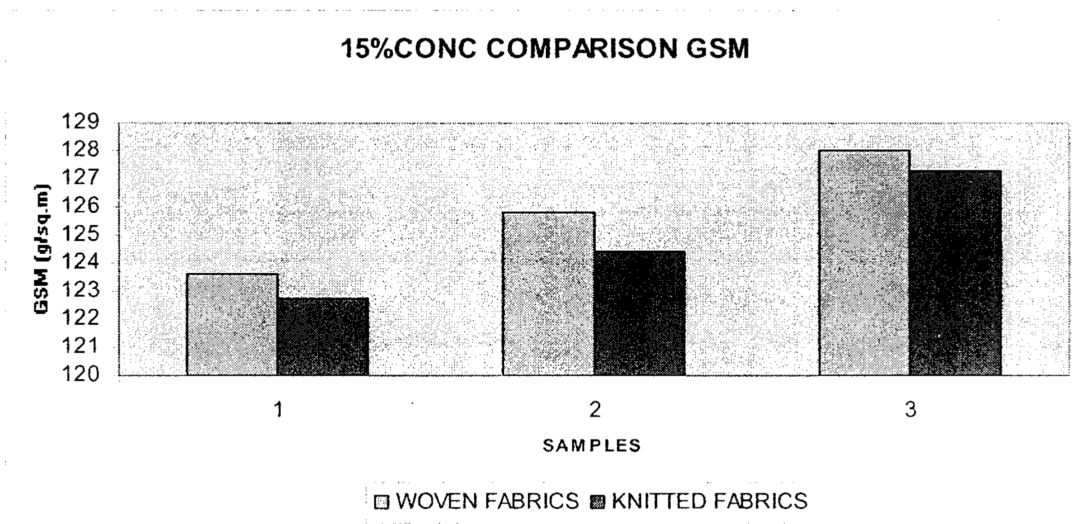
5.3.2 GSM COMPARISON

5.3.2.1 Untreated samples



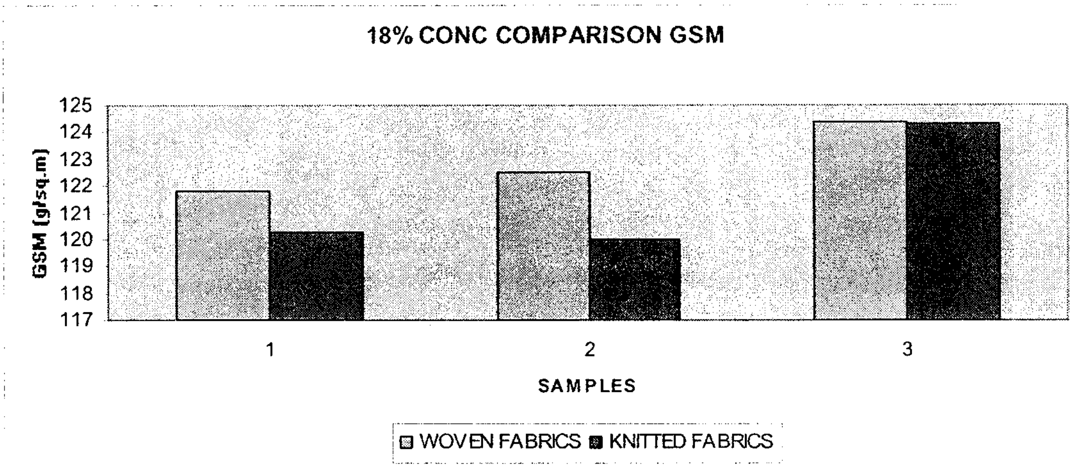
	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	126.1	127.8	131.5
KNITTED	125.7	127.1	130.6

5.3.2.2 15% concentration samples



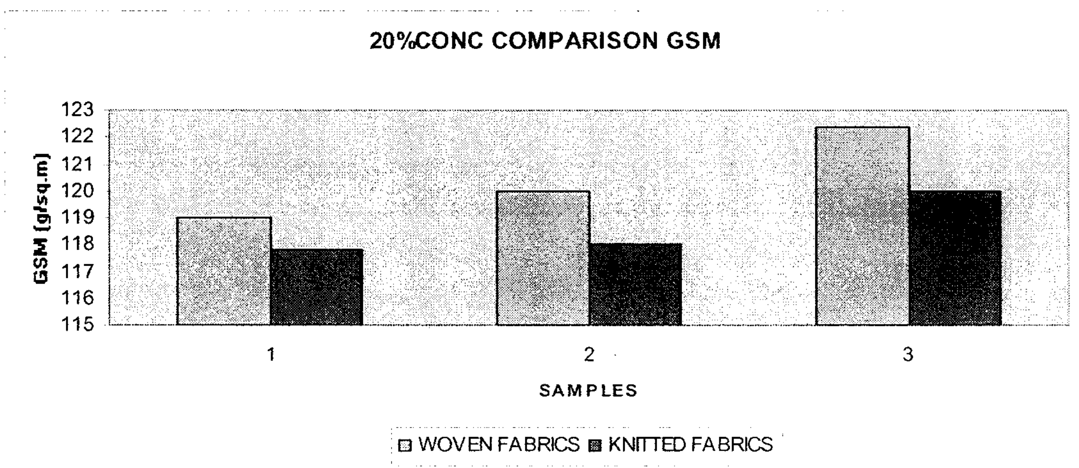
	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	123.6	125.8	128
KNITTED	122.7	124.4	127.3

5.3.2.3 18% concentration samples



	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	121.8	122.5	124.4
KNITTED	120.3	120	124.3

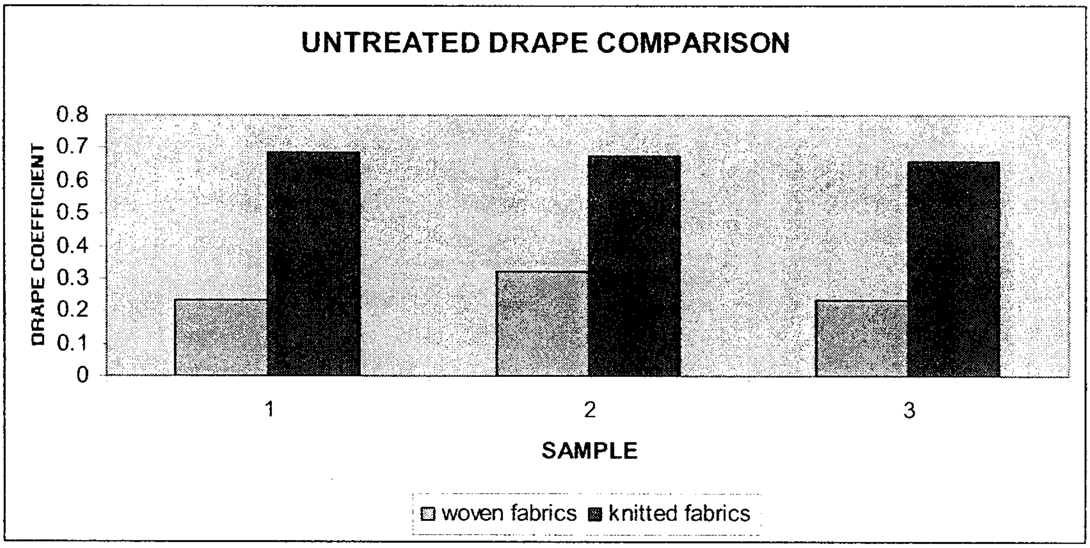
5.3.2.4 20% concentration samples



	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	119	120	122.4
KNITTED	117.8	118	120

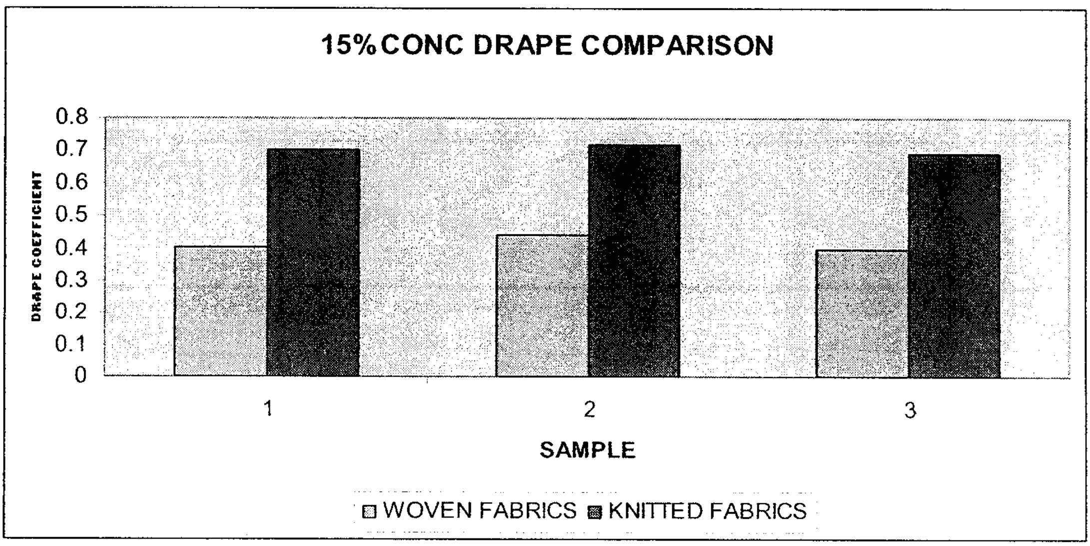
5.3.3 Drape coefficient comparison

5.3.3.1 Untreated samples



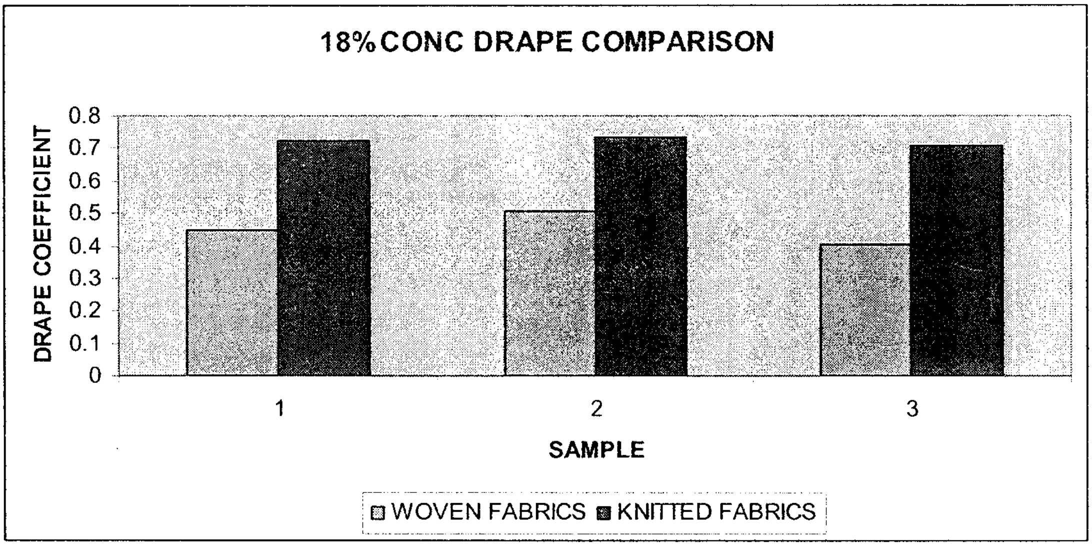
	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	0.2316	0.3191	0.236
KNITTED	0.6869	0.6752	0.6576

5.3.3.2 15% concentration samples



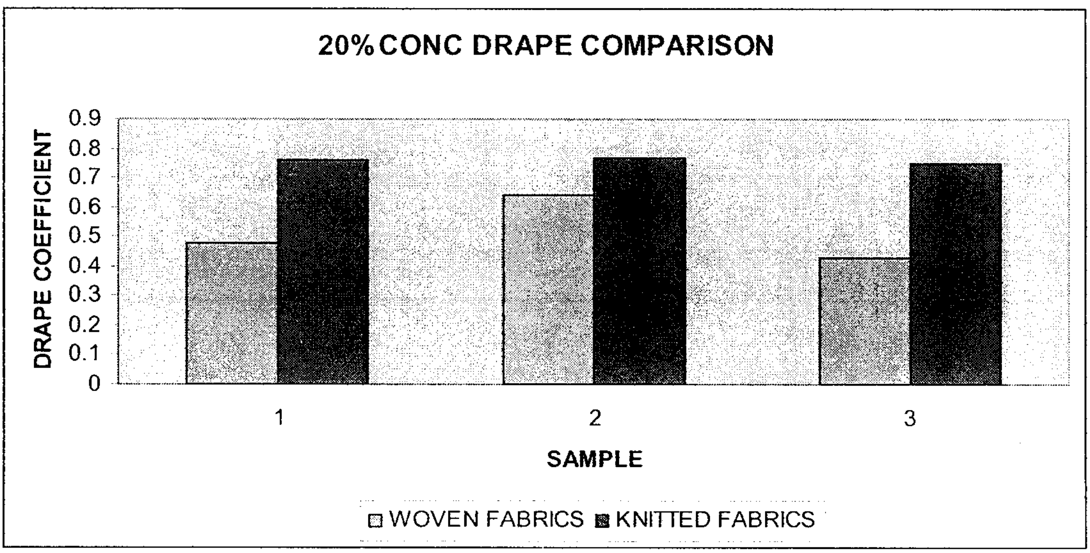
SAMPLE1	SAMPLE2	SAMPLE3

5.3.3.3 18% concentration samples



	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	0.4446	0.506	0.4049
KNITTED	0.7222	0.7339	0.7093

5.3.3.4 20% concentration samples



	SAMPLE1	SAMPLE2	SAMPLE3
WOVEN	0.4756	0.6427	0.4291
KNITTED	0.7627	0.7653	0.7493

6. CONCLUSION

The withdrawal force of the woven and knitted samples are compared with the drape co-efficient and the trends of variations are been studied. It is seen that as the drape co-efficient increases the withdrawal force reduces. It is also seen that as the GSM decreases the handle force also decreases. The effect of alkali treatment reduces the withdrawal force of the samples. As there is an increase in the concentration of the alkali treatment the withdrawal force of the fabric decreases. The withdrawal force of the samples treated with 15% concentration is more than the samples treated with 18% and 20%concentration.

From these results, we can conclude that the drape co-efficient, withdrawal force are heavily influenced by the concentration of the alkali with which the fabrics are treated.

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