POLYESTER COTTON BLEND WOVEN FABRICS

A PROJECT REPORT

Submitted by

K.ARUN KARTHICK 71205212003

C.GOWTHAM 71205212015

P.P.PRAKASH 71205212024

N.VIJAYANAND 71205212312

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BONAFIDE CERTIFICATE

Certified that this project report "**EFFECT OF ALKALINE HYDROLYSIS ON POLYESTER COTTON BLEND WOVEN FABRICS**" is the bonafide work of "**K.ARUN KARTHICK, C.GOWTHAM, P.P.PRAKASH & N.VIJAYANAND**" who Carried out the project work under supervision.

SIGNATURE	**SIGNATURE**
DR. LOUIS D'SOUZA	**MR.S.SUNDARESAN**
PROFESSOR AND HEAD	**SUPERVISOR**
DEPARTMENT OF TECHNOLOGY	LECTURER
KUMARAGURU COLLEGE OF TECHNOLOGY	DEPARTMENT OF TEXTILE TECHNOLOGY
COIMBATORE - 641 006	KUMARAGURU COLLEGE OF TECHNOLOGY
	COIMBATORE – 641 006

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ABSTRACT

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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. Natural fibers such as cotton exhibit good next to skin properties and synthetic fibers such as polyester are known for their easy care and functional properties. In such a case textile technologist engineered clothing's that holds the combined advantage of both natural and synthetic means by blending them. Among many common blends, clothing's produced from PET/COTTON blend holds major consumption in garment market next to cotton. There are many patented technologies to improve the comfort properties of polyester fiber and making it more Comfortable like cotton.

Polyester fibers have excellent mechanical properties and resistance to chemicals, and therefore they are widely employed for woven fabrics. Here Polyester Cotton blend woven fabrics were treated with alkali solution of different parameters, varying concentration 15%, 18% and 20%, varying time by 30mins, 45mins & 60mins and varying temperature by 50°C, 60°C & 70°C. The physical and performance test for different concentrations are conducted to study their comfort properties.

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INTRODUCTION

INTRODUCTION

POLYESTER COTTON BLEND

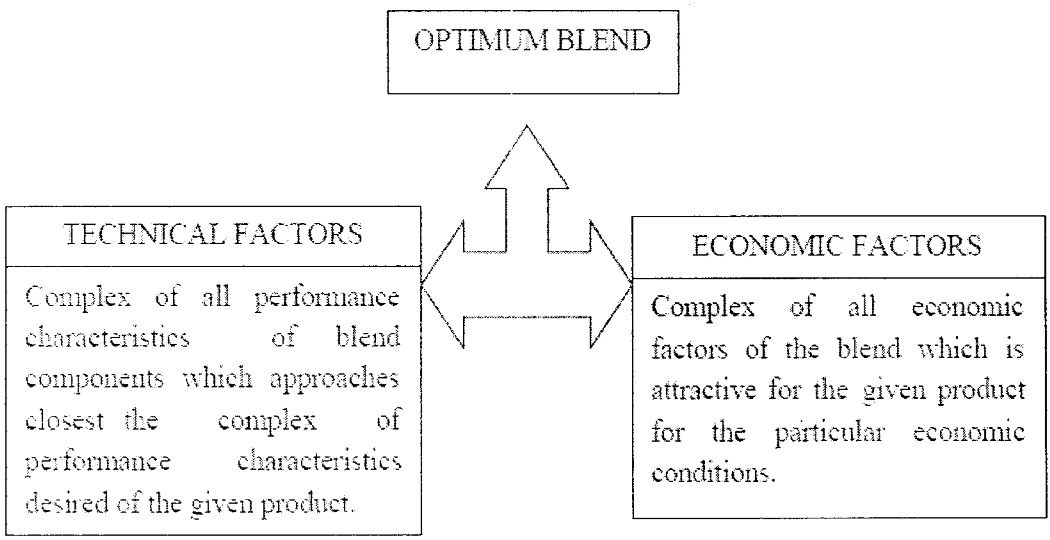
Modern day living conditions require clothing that is light weight, comfortable, safe, elegant, easy care and hard wearing. No single textile fiber has all the desirable attributes. Synthetic fibres have better wear and easy care properties but they lack many comfort related properties. Natural and regenerated cellulosic fibres 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.

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 alkalies. 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 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 molecular chains in the cotton fiber get broken down due to this the fiber get swelled and mercerization takes place. So the luster and fineness of the fiber gets improved.

OPTIMUM BLEND OF YARNS

An optimum blending ratio can be determined from statistically significant laboratory and practical wear trials of yarns and products made of them, as suggested in the diagram below. The optimum blend has to meet both technical and economical requirements.



COMPARISON:

POLYESTER	COTTON
+ Good Crease Retention + Good Wrinkle Recovery + Good Tenacity + Better Abrasion Resistance + Lower Staining Tendency + Ease of Washing + Higher Colour Fastness	- Poor Crease Retention - Poor Wrinkle Recovery - Poor Tenacity - Lower Abrasion Resistance - Higher Staining Tendency - Difficulty of Washing - Lower Colour Fastness
- Poor Moisture Absorption - Poor Static Dissipation - Poor Moisture Vapour Transmission - Poor Feel - Warm, Crisp Hand - Lower Comfort - Non Bio-degradable	+ Good Moisture Absorption + Good Static Dissipation + Good Moisture Vapour Transmission + Good Feel + Cool, Silky Hand + Higher Comfort + Bio-degradable
BLEND WITH POSITIVE ATTRIBUTES OF BOTH FIBRES	

LITERATURE REVIEW

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 li quor :sol id ratio. The moisture related properties of polyester are essentially unaffected by the alkali treatment , and the tensile warp direction ,as indicated by yarn tests , are also not affected when the weight loss is kept below 14%. Hot alkali treatment o f polyester/cotton blend fabrics serves a dual purposes subjectively, it imparts a silk like soft hand to the 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 theref ore 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 lower ed. 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 H2O2 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 (bending properties)and acceptable values of koshi, shari, fukurami, hari, and total handle value (THV),confirming the silky handle imparted by alkaline 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.

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 c loth 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 hydroly sis 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 isopropoxide in isoproponal, and potassium tertiary butoxide in tertiary butanol) at 60 °C and at different concentrations. It was found that the loss in weight of 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 s econdary propoxide and tertiarybutoxide was assumed to be due to the streric retardation during the equilibrium reactions. 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 th e 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.

Song and Kim found that the weight loss of poly(ethylene terephthalate) fibers by alkali treatment decreased in the order of KOH > NaOH > Na2CO3 and increased with increasing alkali concentration and tr eated 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 results 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.

FIBRE PROPERTIES

1) COTTON

Cotton is the oldest fiber used for textile purposes. In the tropical countries, it is the most important fiber. India was the centre for world's cotton industry as well as variety of fine fabrics till 1600 A.D. the date of origin of cotton is unknown.

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 heat ed in a dry state to 150°C without any decomposition. But if heating continues, a brown color on cotton develops gradually. As **EFFECT OF ALKALINE HYDROLYSIS ON P/C BLEND WOVEN FABRIC** 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 ligh t and air is accelerated by traces of metals like copper.

- **ACTION OF WATER**

Raw 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 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 cellul ose 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 hydroxide as well as potassium hydroxide form different hydrated forms in association with water. The diameter of these hydrated forms depends on the concentration of the alkali used. As the concentration of alkali increases, the number of water molecul es per molecule of alkali decreases for the formation of smaller hydrates. Thus the diameter of the hydrated form of alkali decreases.

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.

length than the shorter ones. The varying percentage of immature fiber also indicates non uniformity of wall thickness for the same variety of fibers. Also, there are considerable 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 are porous and exhibits capillary effects to a higher degree. The fibrils themselves are dense as a result of the higher packing density of the molecules and so non porous. This part of the structure constitutes approximately 70% or more of the fiber. LUSTRE the natural luster of cotton fiber is determined by two factor s i.e., fiber shape and fiber polish. The luster does not depend upon hair 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

- **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

the tensile strength increases up to a relative humidity of 60% and then remains mostly constant.

- **ELONGATION**

When load is applied, the length increases, the change in length with respect to the original length is defined as extension or elongation or strain. Average fiber elongation at break is about 5% to 10%, exactly around 6% to 8%. In the stru cture of cotton fibers, the fibrils spiral round at an angle of about 20^0 to 30^0 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.

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 100^0C having molecular weights in the range of 2500-5000. This polymer is poly(ethylene terephthalate) or poly(oxyethylene oxy terephthaloyl) or simply PET. Polyester fiber is defined as "a manufactured fiber in which the fiber forming substance is any long chain synthetic polymer composed of at least 85 % weight of an ester of dihydric other fiber. Generally polyester fibers are produced from spinnerets. Polyester polymer is produced commercially in a two st ep 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 ^{o}C. The product is a mixture of monomer, very low molecular weight polymer, and as a methanol by prod uct, which distills at 150^{o}C. Ester interchange catalysts are divalent salts of manganese, cobalt, magnesium, zinc, or calcium. An alternative monomer formation system involves terephthalicphthalate and an 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^{o}C, with carefully controlled agitation and a progressive reduction of pressure to about 200 Pa. heating is continued about 280^{o}C until the desired degree of condensation is obtained.

STRUCTURE OF POLYESTER

The length of the repeated unit in poly (ethylene terephthalate) along the chain is 10.75^{o}A, a value only slightly less the expected for a fully extended chain with one chemical unit to the geometric repeating u nit, and successive ester groups in the trans configuration to each other (10.9^{o}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 at oms of neighboring molecules is of order expected if Vander Waals forces operate. Drawn polyester fibers may be 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 re sistant to most chemicals. In order to modify the surface of the polyester enzymes are used. The enzyme, polyesterase, is a serine sterase that acts by cleaving the polymer chain through hydrolysis of ester bonds of the polyester fibers.

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.

CHEMICAL PROPERTIES

➢ **EFFECT OF ALKALIES**

Polyester fibers have good resistance to weak alkalies at high temperatures. It exhibits only moderate resistance to strong alkalies at room temperature and degraded at elevated temperature.

➢ **EFFECT OF ACIDS**

Weak acids, even at the boiling point, have no effect on the polyester fibers are exposed for several days. Polyester fibers have good resistance to strong acids at room

COMFORT DESCRIPTION

Introduction

Comfort is one of the most important aspects of clothing. It has been defined by very ways:

1. Bekesius defines comfort as "The absence of unpleasantness or discomfort" or a neutral state compared to the more active state of pleasure".
2. "Rees describes comfort as "The temperature regulation of the body in order to define the system in which comfort must be maintained".

wearer".

4. Yaglou suggests that "A satisfactory definition will never be achieved because such a definition is not possible". Over all comfort can be defined as a state of pleasant psychological, physiological and physical harmony between a human being and the environment.

Different aspects of clothing comfort

- Thermo physiological comfort: it concerns the heat and moisture transport properties of clothing, i.e. transmission of heat, temperature, heat of wetting, air permeability, moisture absorption/regain, liquid water transmission, moisture vapor transmission.
- Skin sensational/tactile comfort: it concerns the mechanical contact of the fabric with skin, how a fabric or garment feels when it is worn next to the skin i.e. fabric handle/feel, softness, fullness, feeling of cold/ warmth, static charge generation, pliability, bending, flexing.
- Physiological comfort: it concerns the aesthetic properties of fabric, i.e. drape, luster, color/dye pick up, crease recovery, pilling, soiling and staining.

Moisture transmission

The thermo physiological wearing comfort of a clothing system is determined mainly by the water vapor permeability of the textile materials in the system. A high degree of water vapor permeability of the clothing system supports the moisture transfer from the skin of the wearer through the textile layers into the environment and establishes a comfortable microclimate.

The moisture transported through the fabric in two forms:

i) Water vapor form

ii) Liquid water form

Mechanism of water vapor transmission

The water vapor can pass through the textile layer by following mechanisms:

i) Diffusion of the water vapor through the air spaces between the fibres.

ii) Absorption, transmission and desorption of the water vapor by the fibres.

iii) Adsorption and migration of the water vapor along the fibre surface.

iv) Diffusion of the water vapor through the fibre or yarn capillaries.

The water vapor transmission property of a fabric is essentially the property of inter yarn pores. The vapor diffuses through the air spaces between the fibre materials. An open fabric structure in a given material promotes the diffusion process. From the holographic visualization of vapor diffusion through textiles (Fig. 2) it is observed that the resistance to the water vapor diffusion comes in different layers.

These different layers are

i) Evaporating fluid layer, which remains full of water saturated vapor,
ii) Confined air layer, between the skin and fabric
iii) Boundary air layer, and
iv) Ambient air.

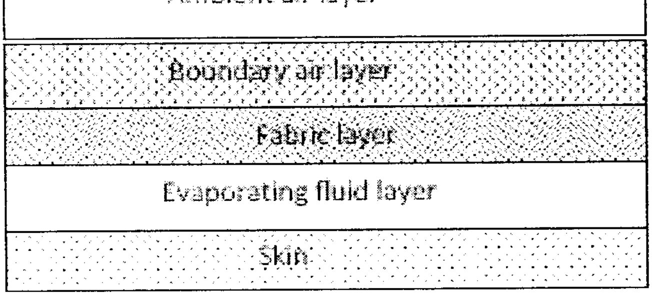


Fig.2: Different layers through which water vapor transport

Water vapor resistance mainly depends on the air permeability of the fabric (Yoon & Buckley, 1984) and represents its ability to transfer perspiration coming out of the skin. From the holographic visualization (Schneider & Roustan, 1990), it is observed that resistance provided by the fabric is lower than that of the external boundary layer, and often much lower than the inner confined air layer between skin and fabric. The diffusion of vapor through the fibrous assembly is a mass tr ansfer which occurs on a molecular basis in low speed flow. The vapor is transported from the higher concentration zone to the lower concentration zone. The equation of the diffusion process is governed by Fick's law. It states that the mass flux of the constituent vapor per unit area is proportional to the concentration gradient. Ambient air layer Boundary air layer Fabric layer Skin Evaporating fluid layer

$$m = - DA * dc/dx$$

Where, m = mass flux (kgs-1)

A = area of transfer (m2)

D = proportionality constant/ diffusion constant (m2s-1)

C = mass concentration of the vapor (kg m-3)

dc = concentration difference between two layers

dx = equivalent air thickness between the layers

The diffusion which follows Fick's law is called Fickian diffusion. In this case the diffusion constant doesn't alter with changes to the water vapor concentration within the polymer or with changes in temperature. In case of air permeable fabrics and micro -porous polymers this type of diffusion takes place.

The transmission rate of the hydrophilic polymers conforms to the following relationship:

$$WVT = DS\,(p1-p2)/l$$

Where,

(p1-p2) = partial pressure gradient between the two surfaces

l = thickness of the polymer

D = diffusion constant

S = solubility coefficient

Gretton and Brook found that in case of hybrid polymers also (consisting of both microporous and hydrophilic components) the diffusion is mainly dependant on the concentration gradient.

Mechanism of liquid water transportation

In this process water is transported through the fabric, due to the capillary action of the fibrous structure. Transport of liquid perspir ation in textiles can occur by fibres, along their surfaces or the capillaries between them. The nature of the fibres and the structure of the assemblies determine the speed and the amount of liquid transport. In fibrous structures liquids can wick into the inter-fibre spaces because of the capillary pressure. The law of hydrodynamic flow through the cylindrical capillaries, in the pressure of gravitational acceleration, leads to the following differential equation dL/dt = (?rcos?/4?L) - (gpr2/8?)

Where

L = the height of liquid rise

T = the time

r = the radius of capillary

? = viscosity

? = surface tension of the liquid

g = gravitational acceleration

? = the contact angle of the liquid -surface

The liquid wicks vertically through the fibres are limited by the gravitational force. Ultimately the equilibrium height wicked by the liquid is expressed as,

L = 2?cos?/rgp

The capillary force which is the cause for the wicking arises from the wetting of the fibre surface. If the liquid does not wet the fibres it will not wick the fibrous assembly. The balance between the forces involved in wetting the fibre surface, drives the wicking process. When contact angle is above 900, liquid in a capillary is depressed below the surface instead of rising above it. A high contact angle for water with the surface means that water will run off it, a low contact angle means that water will wet the material. So the wet ability of the fabric, which is a surface characteristic, has a very important effect on th e wicking process.

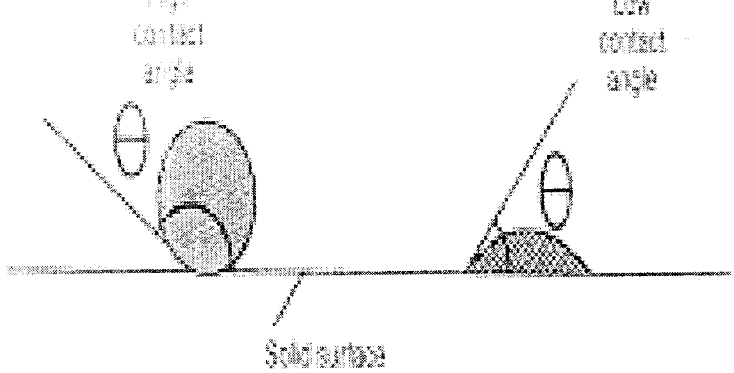


Fig.: Effect of contact angle on wetting

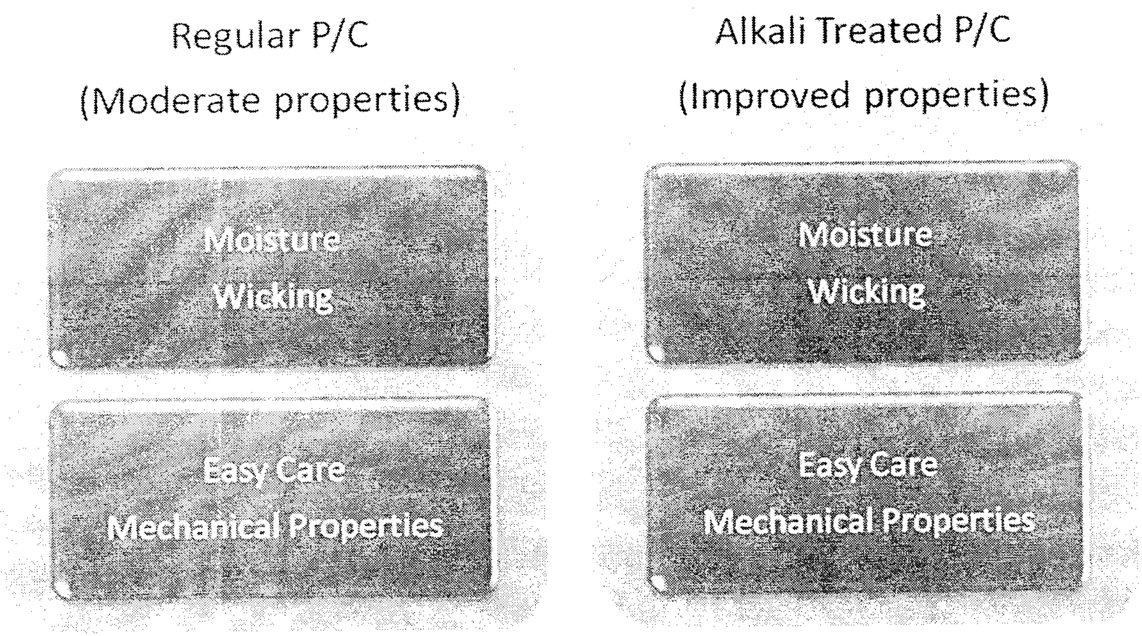
The studies done by Ansari & Haghighat show that yarn characteristics such as fibre fineness, fibre surface smoothness, yarn structure and twist, have considerable effect on the wicking rate of water. The wicking of water decreases with increase in linear density of the yarn and the wicking rise also decreases with the increase in twist factor. Hiracu and Yoichiro suggested that wicking behavior is strongly influenced by the characteristics of the assembly, such that size and continuity of the capillaries formed within the yarn. It is enhanced with increasing surface hydrophobicity and decreasing the capillary diameter. Discontinuities in the capillary structure tend to disrupt liquid flow. This effect is much more prominent for hydrophilic fibres. Due to the anisotropic structure of the fabric material, different liquid transport properties are observed in different directions and as the capillary network of the fabric is dependent on the direction under consideration, the wicking properties through the thickness of that fabric may be different from those in the plane of the fabric.

AIM OF THE PROJECT

Although a very considerable work has been done on the effect of alkaline hydrolysis treatment applied on the cotton / polyester fabric, the investigations were incomplete in the case of polyester/cotton woven fabrics. Scope of this treatment is also improving the hydrophilicity of polyester in polyester/cotton blend. Only little work is done on the effect on polyester / cotton blends fabric, although blends are widely used. Therefore this investigation has been undertaken. The treated samples will be investigated for weight loss, wickability, stiffness, crease recovery and abrasion resistance. Based on the results obtained suitable recommendation will be made.

The main objectives of this project are

- To improve hydrophilicity of polyester in P/C blend fabric.
- To subject the P/C blend woven fabric treated under controlled condition to alkali hydrolysis with a view of improving fabric properties.
- To evaluate the **Improved Mechanical** properties.



METHODOLOGY

MATERAL SPECIFICATION

YARN SPECIFICATION

- MILL – KARTHIKEYAN MILLS – COIMBATORE.
- BLENDS – 35\65, 65\35 & 100% POLYESTER.
- COUNT – $2/80^{S}$ NE COUNT.
- SAME LOT.

FABRIC SPECIFICATION

- TYPE – PLAIN WEAVE
- EPI – 80
- PPI – 72
- GSM – 95 to 100
- THICKNESS – 0.015 TO 0.025

MATERIALS AND METHODS:

The details of material selected for the study and the parameters considered with their levels are chosen such that they are acceptable in the industrial sector. The fabrics were produced on Sample Weaving Machine in TIFAC CORE.

MATERIALS:

Different bend proportion of polyester/cotton fabrics with same count of yarn.

SPECIFICATION	PC 35/65	PC 65/35	100% PET
EPI	80	80	80
PPI	72	72	72
THICKNESS (cm)	0.023	0.020	0.019
GSM	97.0	97.4	96.5
POLYESTER %	65	35	100
COTTON %	35	65	-

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

Also called caustic soda, lye, 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 caustic and a strong base. The principal method for its manufacture is electrolytic 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.

MOLECULAR WEIGHT	**40.00**
BOILING POINT	**1390UC**
MELTING POINT	**318.4UC**
VAPOUR PRESSURE	**1MM AT 739UC**
DENSITY/SPECIFIC GRAVITY	**2.120 AT20/4 UC (WATER=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 30, 45 & 60 minutes. The percentage loss in weight of polyester / cotton blend fabrics for the first five minutes was very small. The loss in weight was highest during the next increment of time. The reaction appears to slow down with further increases in time of heating.

TEMPERATURE

When a fabric saturated with aqueous alkali is heated at constant external temperature there will be an increase in the concentration of s coured alkali due to the evaporation of water from the fabric phase. The temperature of s coured 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 lusture property and comfort property of cotton hot alkali treatment is necessary for the 50°C, 60°C & 70°C.

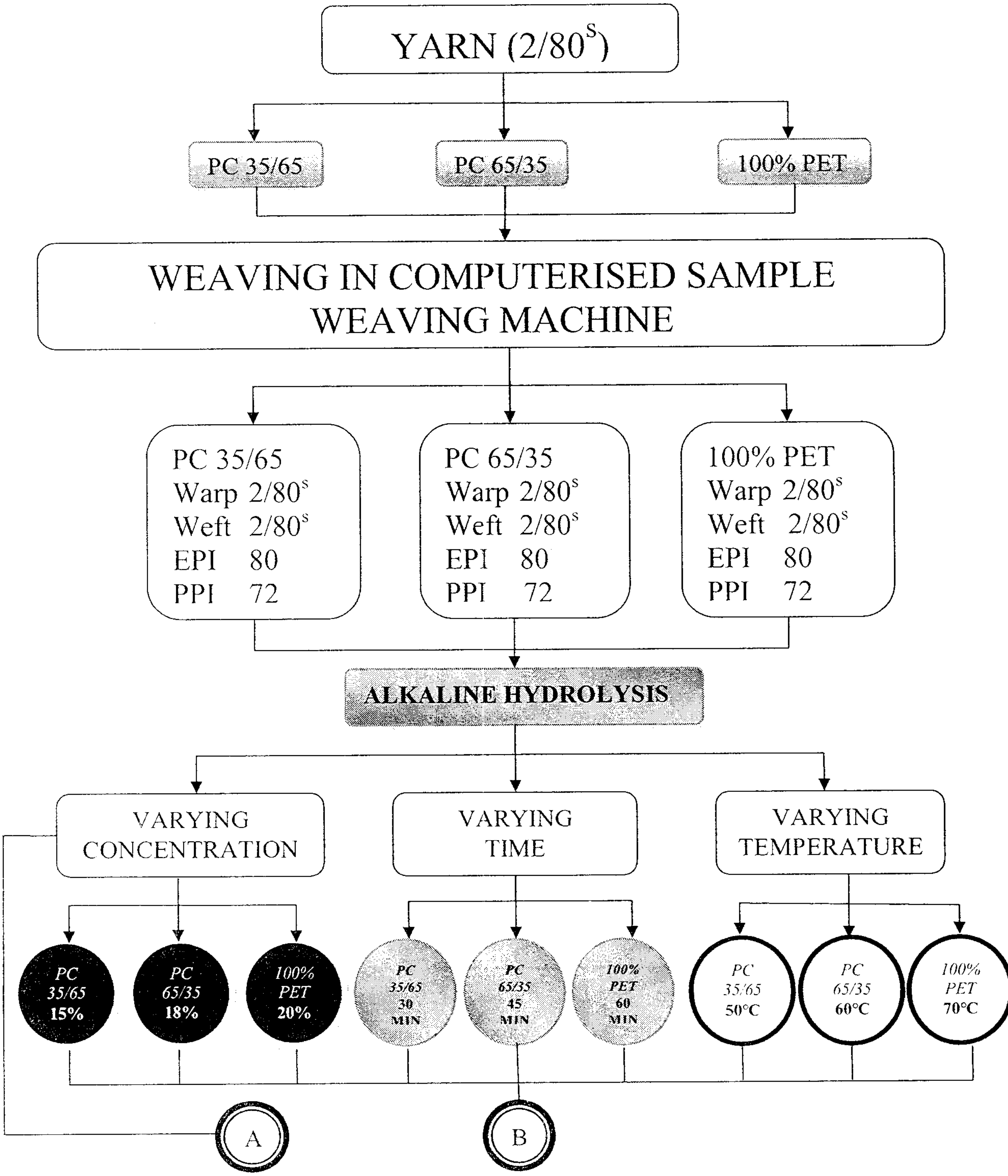
CONCENTRATION

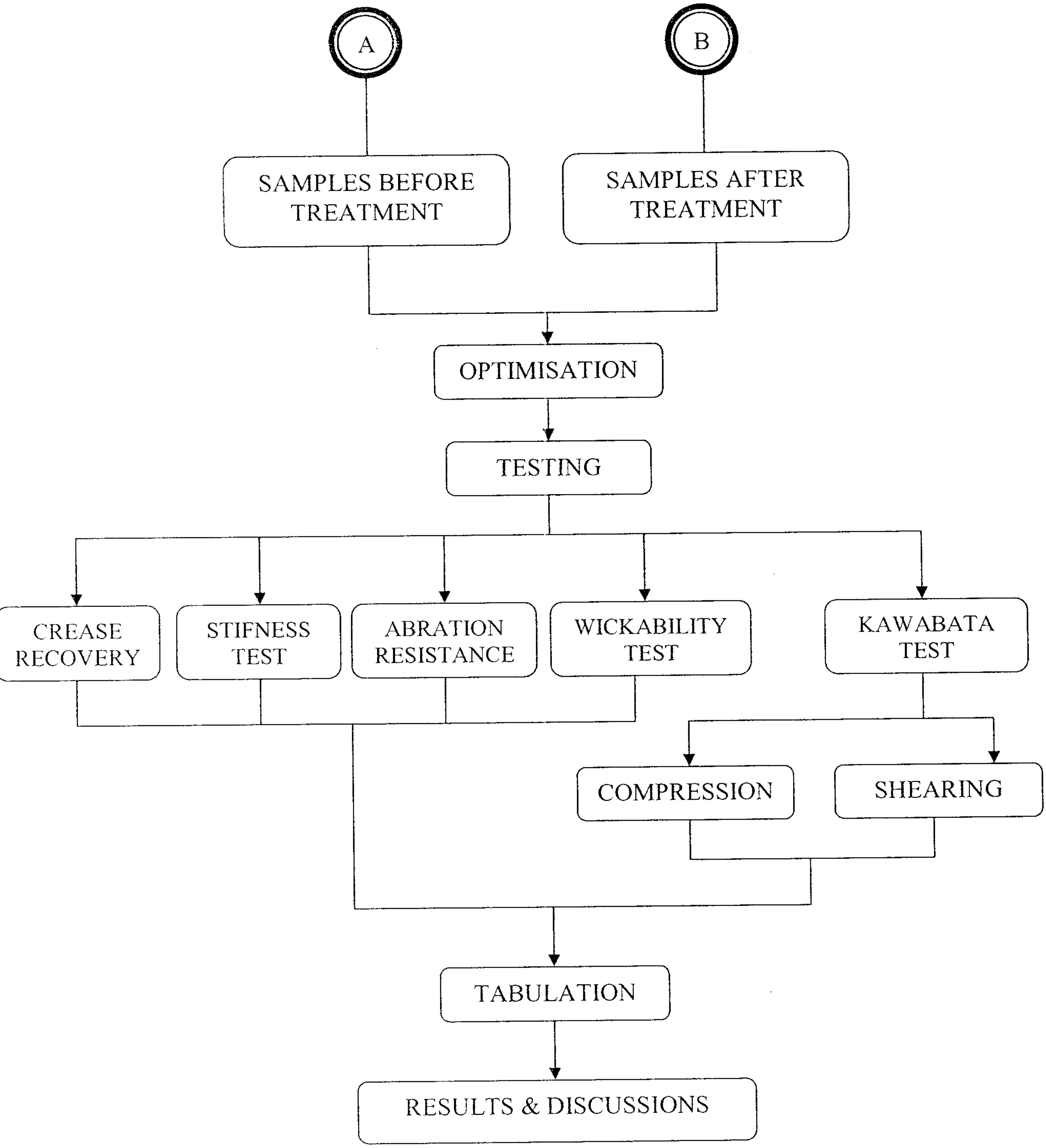
At the higher concentration, the surface of the fiber gets ruptured and the weight loss of the fabric is increased by 25%. At lower concentration the rate of hydrolysis taken more time to attain its equilibrium so that the concentration that are selected are 15%,18%, 20%.

LIQUOR RATIO

It is observed that at lower bath ratio (w/w), the fabric exhibits an excellent handle value as compared at those at higher bath ratio, thus confirming 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.

GENERAL PROCEDURE:




A
B
SAMPLES BEFORE TREATMENT
SAMPLES AFTER TREATMENT
OPTIMISATION
TESTING
CREASE RECOVERY
STIFNESS TEST
ABRATION RESISTANCE
WICKABILITY TEST
KAWABATA TEST
COMPRESSION
SHEARING
TABULATION
RESULTS & DISCUSSIONS

TREATMENT PROCEDURE:

FABRIC SAMPLES

↓

PREPARATION WITH 3% OWM OF SODIUM BICARBONATE (NA_2CO_3)

↓

Treatment of the fabric with
15%, 18%, 20% of NaoH
For 30, 45 & 60 minutes
At $50^{0}C$, $60^{0}C$ & $70^{0}C$

↓

Hydrogen Peroxide – 3-5% (35 volume)
Stabilizer – 0.5 %
Time – 45 Min, Temp – $70^{0}C$

↓

Acetic Acid (0.5%) - To Neutralize

↓

Washing the fabric

TESTING PROCEDURE

TESTING

In order to carried out the test the following testing conditions are required which is 25 ± 1°C (70 ± 2oF) and 75 ± 2 % relative humidity.

BLEND PROPORTION

Testing Procedure:

1. Make all the tests in the standard atmosphere for testing textiles.
2. Take a sample fabric size of 5x5 cm.
3. Weigh the sample.
4. Prepare 70% concentration of sulphuric acid.
5. Immerse the fabric into the solution using the M: L ratio 1:30 at 50°c for 1 hour.
6. Take out the fabric and hot wash it in 50 °c.
7. Wash and neutralize.
8. Dry the fabric and then condition it.
9. Weigh the fabric to calculate the amount of polyester present.

GSM OF THE FABRIC

Testing Method: D 3776 – 96

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 by using Gsm cutter.
4. Then the fabric is hanged in the hook of the quadrant sc ale.

value on the marked scale in which fabric weight (meter 2 and weight per sq.yard) are marked.

6. Gsm of a fabric is measured in grams per square inch.

7. Take 10 readings.

FABRIC THICKNESS

Testing method: IS 7702: 1975

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.

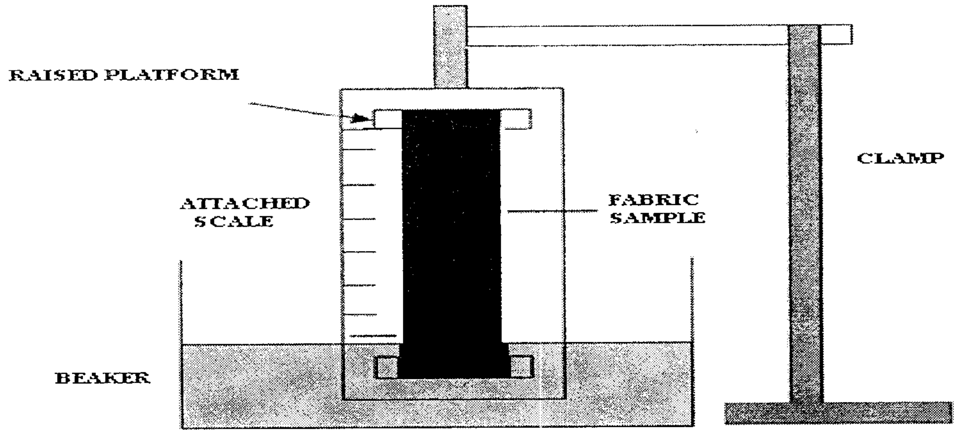
5. Raise the presser-foot and position the sample, without tension, on the reference plate so that no part of the area to be measured lies nearer to a selvedge than 150

mm. Ensure that the area chosen for the test is free from creases. Do not attempt to flatten out any creases; this is likely to affect the result.

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.



TESTING PROCEDURE:

1. A simple set up (Fig 1) was made to study the wicking behavior of Knitted Fabric.

2. A Fabric sample of size 12x2.5cms is wound at constant tension around a frame on which two raised platforms are mounted. The ends on the platform were fixed with a cello tape and the remaining portion of the fabric were cut and removed.

3. The raised portions ensure that there exists a gap between the fabric and the frame so that when the frame is dipped into water, the movement of the water through the fabric is not hindered.

4. A scale was attached next to the yarns on the frame. A single fabric sample was mounted at a time. A beaker containing distilled water with 1% dye solution (Reactive M8b) was prepared.

7. The frame was slowly lowered into the solution so that 2 cm remain submerged in the solution. Simultaneously stop watch was pressed and the rise of dye solution through the yarn was continuously monitored by means of a cathetometer.

9. The distance traveled by the dye solution was noted as a function of time till it become virtually constant.

10. For each fabric 12 fabric samples were studied. The average wicking height of 12 fabric samples at regular interval of time was determined.

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.

STIFFNESS

Test is carried out in the standard testing atmosphere. The tester is set on a table so that the horizontal platform and index line are cut in eye level.

The specimen is placed on the platform with the template loading edges coinciding. Both are pushed forward until the leading edges of specimen & template projects outside with the eye in the position so that the index lines coincides the sliding of specimen is stopped when it cuts both index lines.

Then the reading is noted down from the scale, from which bending length is calculated.

CREASE RECOVERY

The instrument is leveled with the help of a leveling screw & spirit level. The specimen is folded gently to the end with edges in one line, with the help of tweezers. The edges should not be gripped more than 5mm in the tweezers.

The folded specimen is placed on the lower plate of the loading device & the load is applied gently. Before loading a metal foil with thickness not more removed after 5mins.

Half of the numbers of the specimen both warp & weft should be folded face to face and the other half back to back.

As the load is removed, specimen is transferred to the clamp, the specimen is transferred to clamp. As the specimen recovers, the dial is rotated to keep the free edge of the specimen in line with knife edge.

ABRASION RESISTANCE

Four cloth pieces are cut into 38mm diameter specimens. The specimen remains exactly circular since the template is circular in shape. The weight of each sample is noted. 400g weights are put on the top of the holders.

The top plate with the specimen are lowered onto its working position in such a way that

- The plate is supported by the steel caster.
- The pegs of the dims enter into the holes of the plate.
- The cloth touches the energy sheet.
- Counter reads zero.

The motor is started. The machine runs for 50 revolutions. Then the weight of each sample is tabulated against the initial values.

The weight loss is then calculated for each sample.

Kawabata system

Fabric handle or hand has traditionally been assessed by experts who arrive at an overall judgment on quality after manipulating the fabric with their hands. This system requires years of experience and can obviously be influenced by the personal preferences of the assessor. Professor Kawabata of Japan has carried out a great deal of work with the aim of replacing the subjective assessment of fabrics by experts with an objective machine-based system which will give consistent and reproducible results [16-18]. It is generally agreed that the stimuli leading to the psychological response of fabric handle are entirely determined by the physical and mechanical properties of fabrics. In particular the properties of a fabric that affect its handle are dependent on its behavior at low loads and extensions and not at the level of load and extension at which fabric failure occurs. It is this region of fabric behavior that has traditionally been measured and for which specifications have been written.

SUBJECTIVE ASSESSMENT OF FABRIC HANDLE

The first part of Kawabata's work was to find agreement among experts on what aspects of handle were important and how each aspect contributed to the overall rating of the fabric. For each category of fabric four or five properties such as stiffness, smoothness and fullness were identified and given the title of primary hand.

Hand		Definition
Japanese	English	
Koshi	Stiffness	A stiff feeling from bending property. Springy property promotes this feeling. High-density fabrics made by springy and elastic yarn usually possess this feeling strongly.
Numeri	Smoothness	A mixed feeling come from smooth and soft feeling. The fabric woven from cashmere fibre gives this feeling strongly.
Fukurami	Fullness and softness	A bulky, rich and well-formed feeling. Springy property in compression and the thickness accompanied with warm feeling are closely related with this feeling (*fukurami* means 'swelling').
Shari	Crispness	A feeling of a crisp and rough surface of fabric. This feeling is brought by hard and strongly twisted yarn. This gives a cool feeling. This word means crisp, dry and sharp sound made by rubbing the fabric surface with itself).
Hari	Anti-drape stiffness	Anti-drape stiffness, no matter whether the fabric is springy or not. (This word means 'spread').
Kishimi	Scrooping feeling	Scrooping feeling. A kind of silk fabric possesses this feeling strongly.
Shinayakasa	Flexibility with soft feeling	Soft, flexible and smooth feeling.
Sofutosa	Soft touch	Soft feeling. A mixed feeling of bulky, flexible and smooth feeling.

Primary hand values were rated on a ten point scale where ten is a high value of that property and one is its opposite. The properties that are regarded as primary hand and the values of these that are considered satisfactory differ among fabric categories such as men's summer suiting, men's winter suiting and ladies' dress fabrics. Some of the properties considered primary for these categories are shown in Tables 10.2-10.4. The primary hand values are combined to give an overall rating for the fabric in its category. This is known as the total hand value and it is rated on a five point scale where five is the best rating. The primary hand values are converted to a total hand value using a translation equation for a particular fabric category which has been determined empirically.

As a result of this work books of fabric samples for each of the primary hands were produced by the Hand Evaluation and Standardization Committee (HESC) together with standard samples of total hand in each of five categories:

- Men's winter/autumn suiting.
- Men's summer suiting for a tropical climate.
- Ladies' thin dress fabrics.
- Men's dress shirt fabrics.
- Knitted fabrics for undershirts.

The purpose of these standards is to act as a reference to help the experts to produce more uniform assessments of fabric handle.

Objective evaluation of fabric handle

The second stage of Kawabata's work was to produce a set of instruments with which to measure the appropriate fabric properties and then to correlate these measurements with the subjective assessment of handle. The aim was that the system would then enable any operator to measure reproducibly the total hand value of a fabric.

The system which was produced is known as the KESF system and consists of four specialized instruments:

- FBI Tensile and shearing
- FB2 Bending
- FB3 Compression
- FB4 Surface friction and variation

These instruments measure the tensile, compression, shear and bending properties of the fabric together with the surface roughness and friction. A total of 16 parameters are measured, all at low levels of force, which are intended to mimic the actual fabric deformations found in use.

The tensile properties are measured by plotting the force extension curve between zero and a maximum force of 500gf/cm (4.9N/cm), the recovery curve as the sample is allowed to return to its original length is also plotted to give the pair of curves.

PARAMETERS THAT CAN BE MEASURED USING KAWABATA:

Tensile	LT	Linearity of load extension curve
	WT	Tensile energy
	RT	Tensile resilience
Shear	G	Shear rigidity
	2HG	Hysteresis of shear force at 0.5°
	2HG5	Hysteresis of shear force at 5°
Bending	B	Bending rigidity
	2HB	Hysteresis of bending moment
Lateral compression	LC	Linearity of compression thickness curve
	WC	Compressional energy
	RC	Compressional resilience
Surface characteristics	MIU	Coefficient of friction
	MMD	Mean deviation of MIU
	SMD	Geometrical roughness
Fabric construction	W	Fabric weight per unit area
	T_0	Fabric thickness

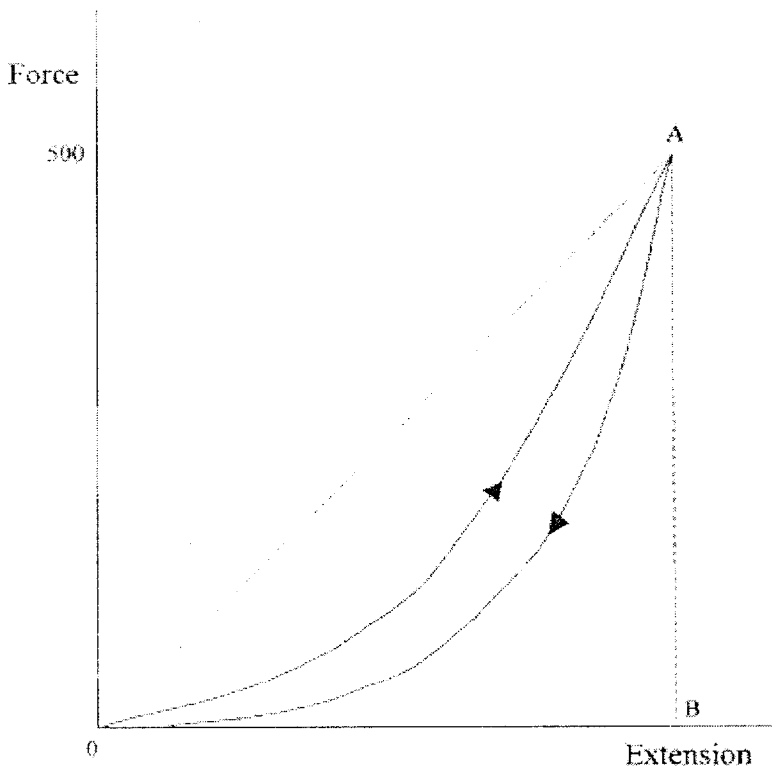
We have measured shear and lateral compression properties using Kawabata modules.

The compression properties are measured by placing the sample between two plates and increasing the pressure while continuously monitoring the sample thickness up to a maximum pressure of 50gf/cm2 (0.49 N/cm2). As in the case of the tensile properties the recovery process is also measured. The quantities LC, WC and RC are then calculated in the same manner as LT, WT and RT above.

In order to measure the shear properties a sample of dimensions 5 cm X 20cm is sheared parallel to its long axis keeping a constant tension of 10g/cm (98.1mN/cm) on the clamp. The following quantities are then measured from the curve as shown

- Shear stiffness G ~ slope of shear force-shear strain curve
- Force hysteresis at shear angle of 0.5° 2HG = hysteresis width of curve at 0.5°
- Force hysteresis at shear angle of 5° 2HG5 = hysteresis width of curve at 5°

In order to measure the bending properties of the fabric the sample is bent between the curvatures -2.5 and 2.5cm"1 the radius of the bend being I/curvature as shown in Fig. 10.25. The bending moment required to give this curvature is continuously monitored to give the curve shown in Fig. 10.26. The following quantities are measured from this curve:



10.23 Load extension curves for KESF.

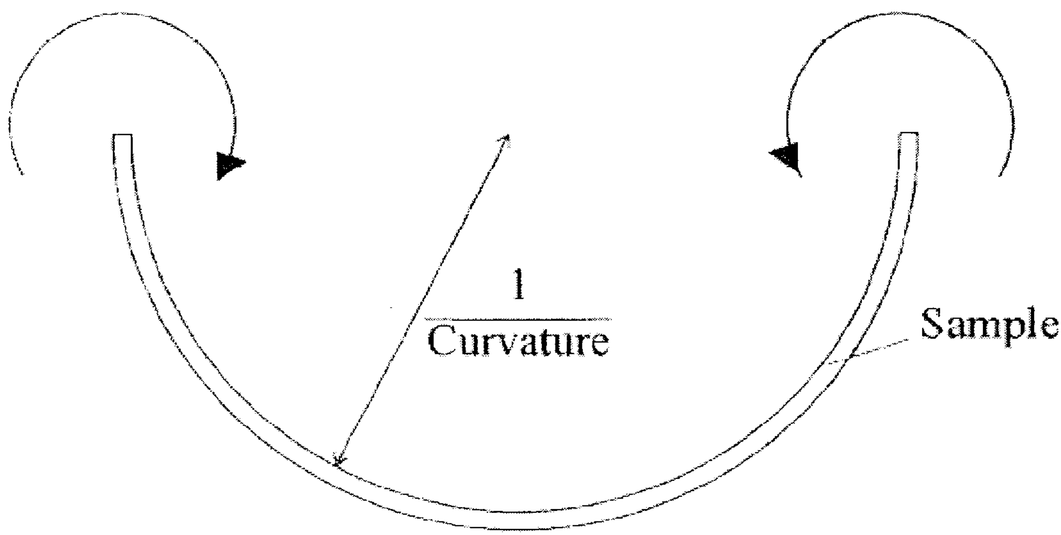
The contact force that the wire makes with the surface is 10gf (98.1mN). A plot of the height variation against distance is shown in Fig. 10.28. The value that is measured is SMD = mean deviation of surface roughness.

The surface friction is measured in a similar way by using a contactor which consists of ten pieces of the same wire as above as is shown in Fig. 10.29. A contact force of 50 gf is used in this case and the force required to pull the fabric past the contactor is measured.

A plot of friction against distance travelled is shown in Fig. 10.30 from which the following values are calculated:

- MIU = mean value of coefficient of friction
- MMD = mean deviation of coefficient of friction

BENDING:

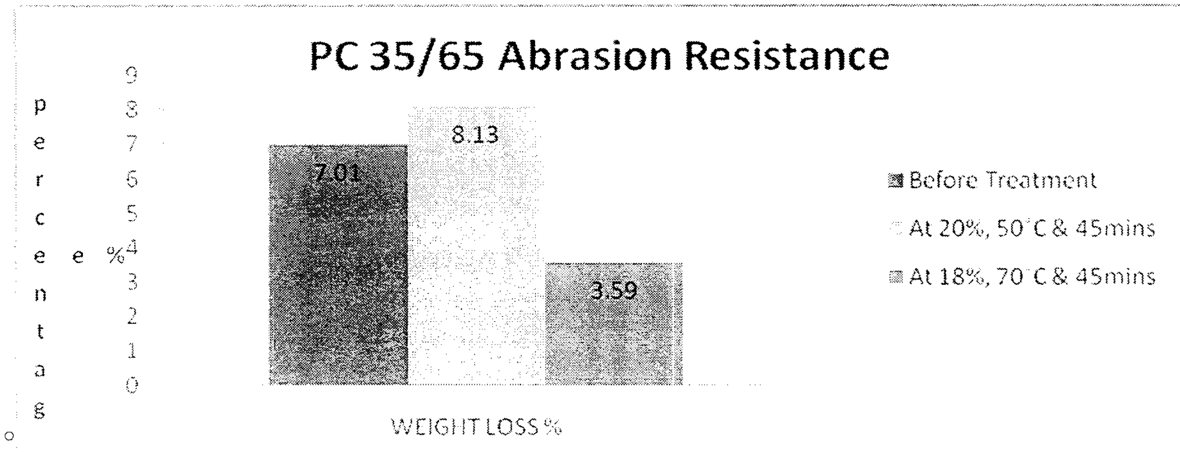


FORCES INVOLVED IN BENDING

RESULTS AND DISCUSSIONS

ABRASION RESISTANCE

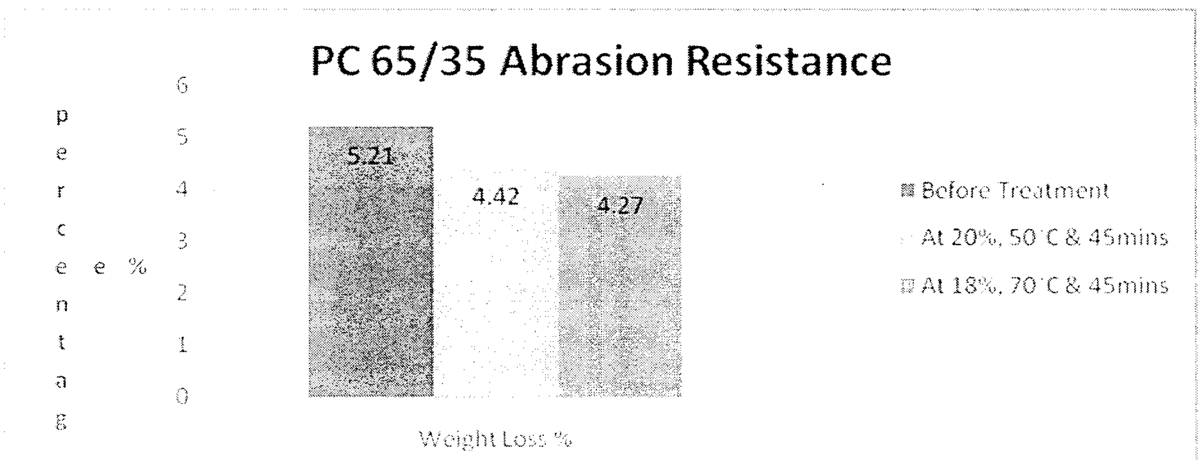
PC 35/65:



INFERENCE:

- ➢ Abrasion Resistance is improved by alkaline hydrolysis treatment at 18% concentration, 70°C Temperature for 45 mins.
- ➢ Abrasion Resistance improved twice than untreated sample.

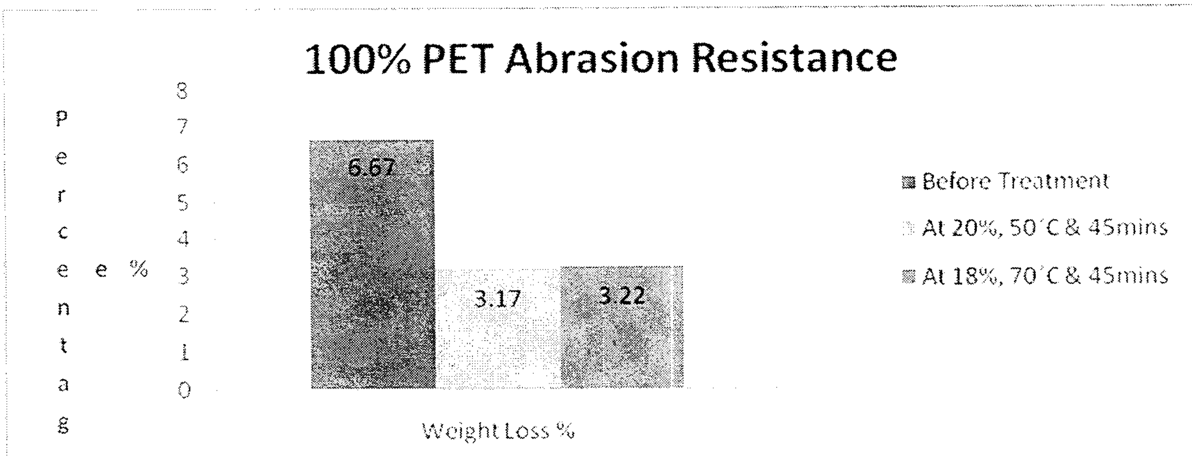
PC 65/35:



INFERENCE:

- ➢ Abrasion Resistance is improved by alkaline hydrolysis treatment at 18% concentration, 70°C Temperature for 45 mins.

100% PET:

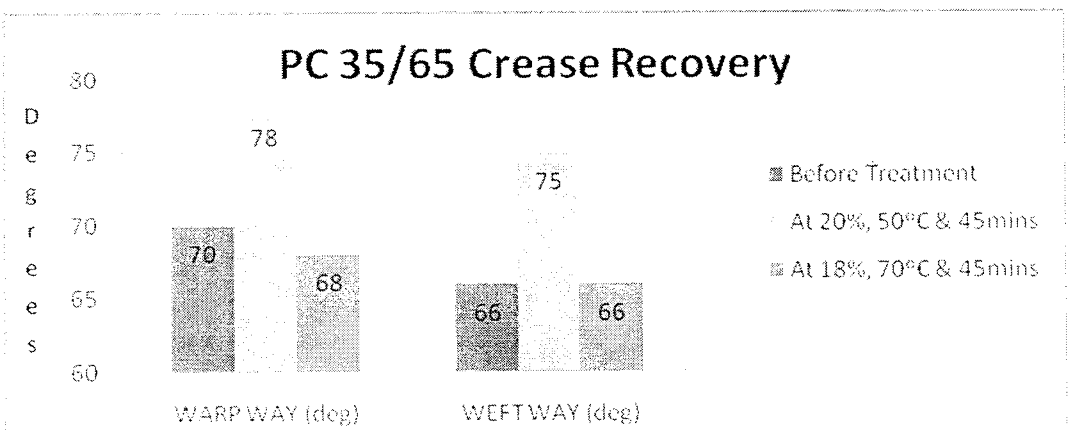


INFERENCE:

- Abrasion Resistance is improved by alkaline hydrolysis treatment at 18% concentration, 70°C Temperature for 45 mins.
- Abrasion Resistance improved twice than that of untreated sample.

CREASE RECOVERY

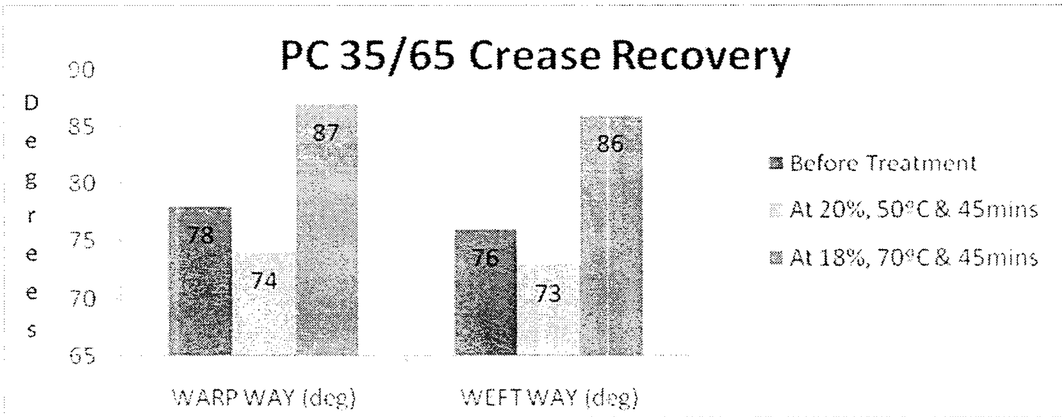
PC 65/35:



INFERENCE:

- Crease recovery is higher for alkaline hydrolysis at 18% concentration with 70°C temperature for 45 mins.

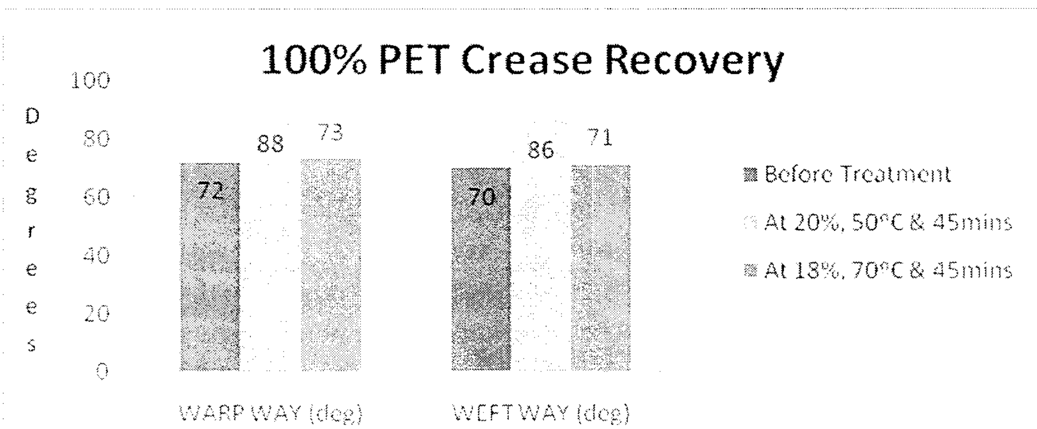
PC 65/35:



INFERENCE:

- Crease recovery is higher for alkaline hydrolysis at 20% concentration with 50°C temperature for 45 mins.
- Crease recovery is reduced for alkaline hydrolysis at 18% concentration with 70°C temperature for 45 mins.

100% PET:

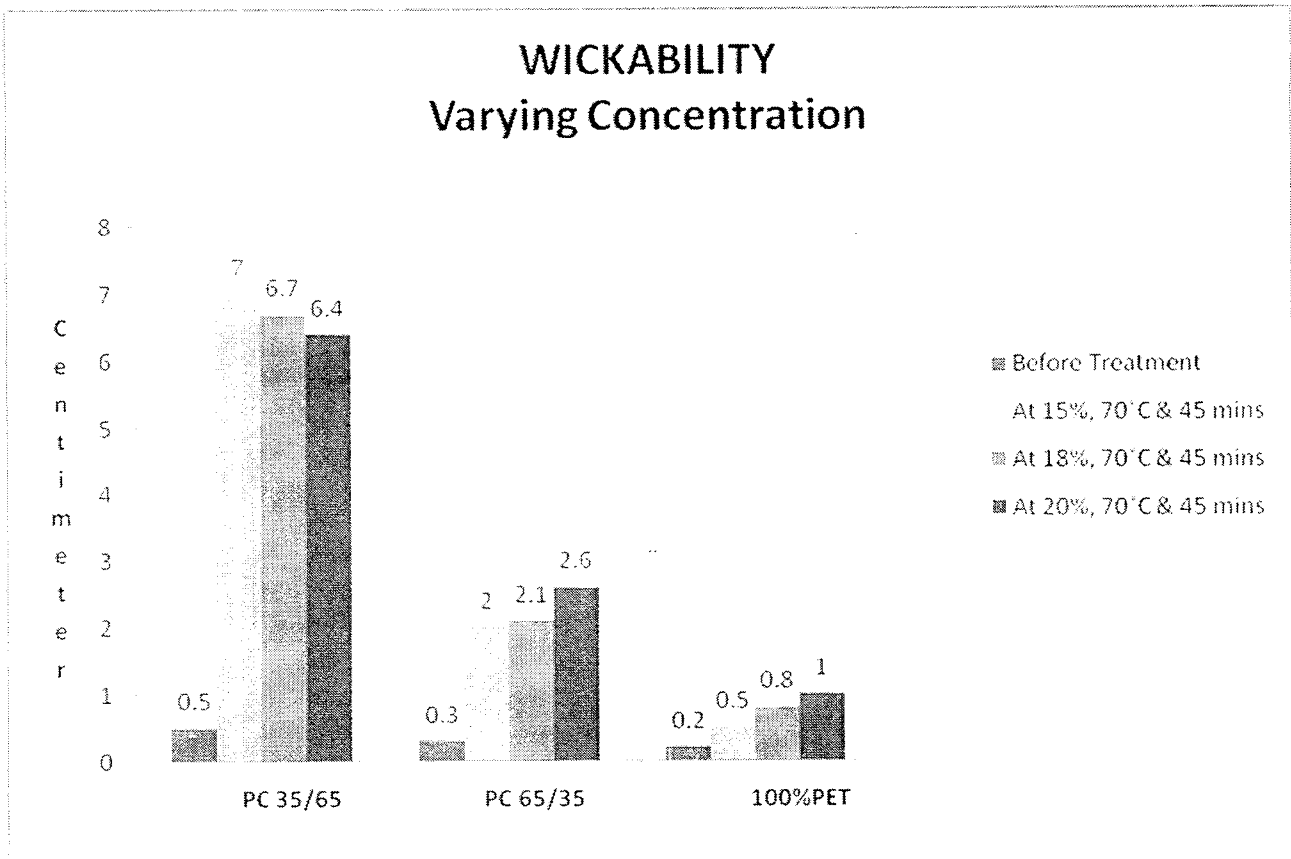


INFERENCE:

- Crease recovery is higher for alkaline hydrolysis at 18% concentration with 70°C temperature for 45 mins.
- Crease recovery is reduced for alkaline hydrolysis at 20% concentration with 50°C temperature for 45 mins.

WICKABILITY

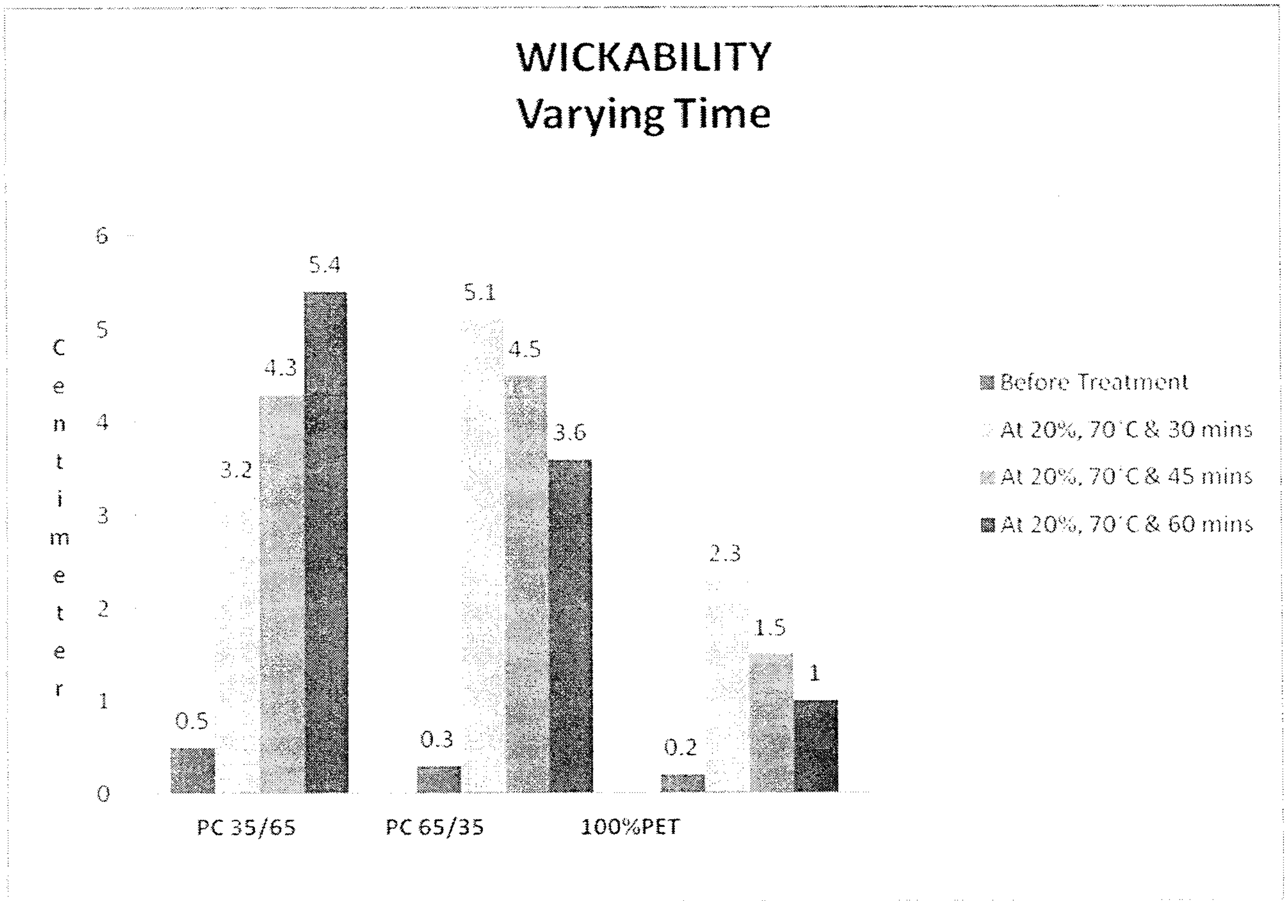
PC 35/65:



INFERENCE:

- Wickability for PC35/65 is more at 15% concentration and was decreasing with increase in concentration.
- Wickability for PC65/35 is more at 20% concentration and was increasing with increase in concentration.
- Wickability for 100% PET is more at 20% concentration and was increasing with increase in concentration.

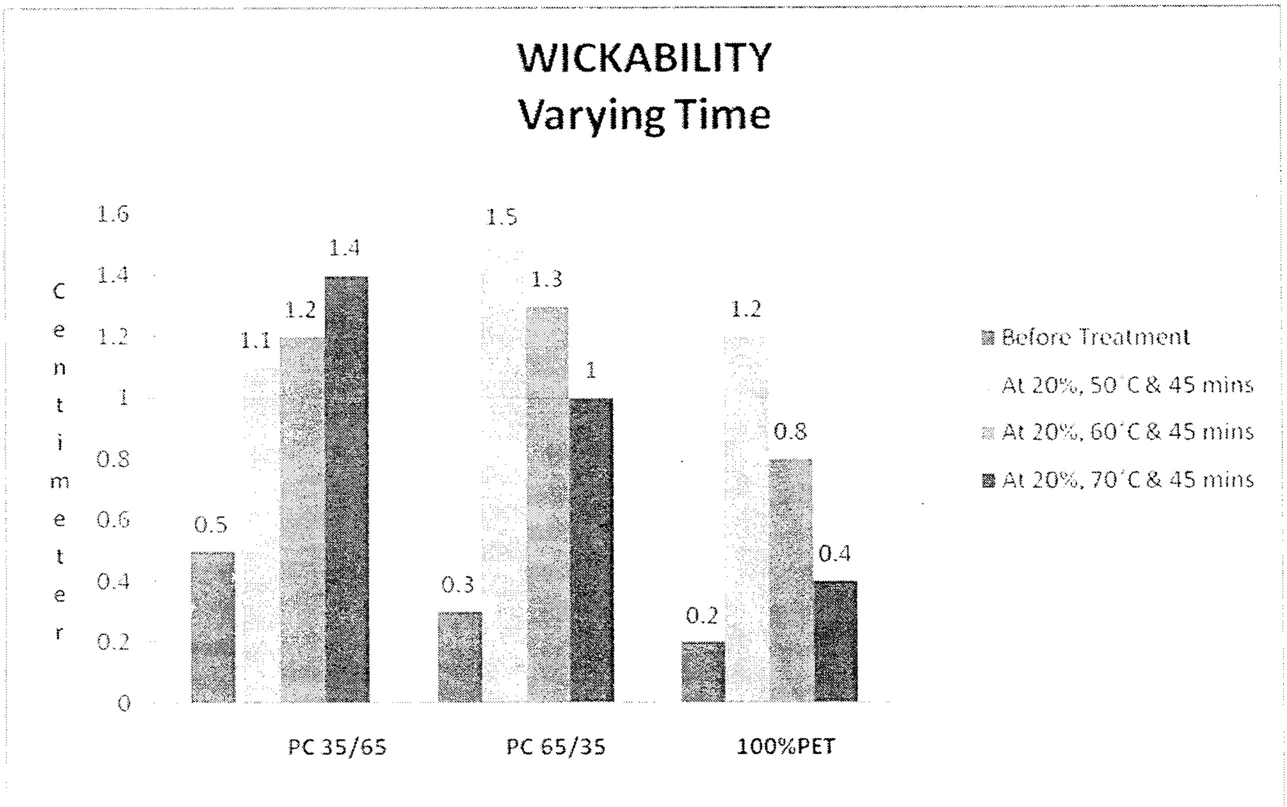
PC 65/35:



INFERENCE:

- Wickability for PC35/65 is more for 60 mins treatment and was increasing with increase in time.
- Wickability for PC65/35 is more for 30 mins treatment and was decreasing with increase in time.
- Wickability for 100% PET is more for 30 mins treatment and was decreasing with increase in time.

100% PET:

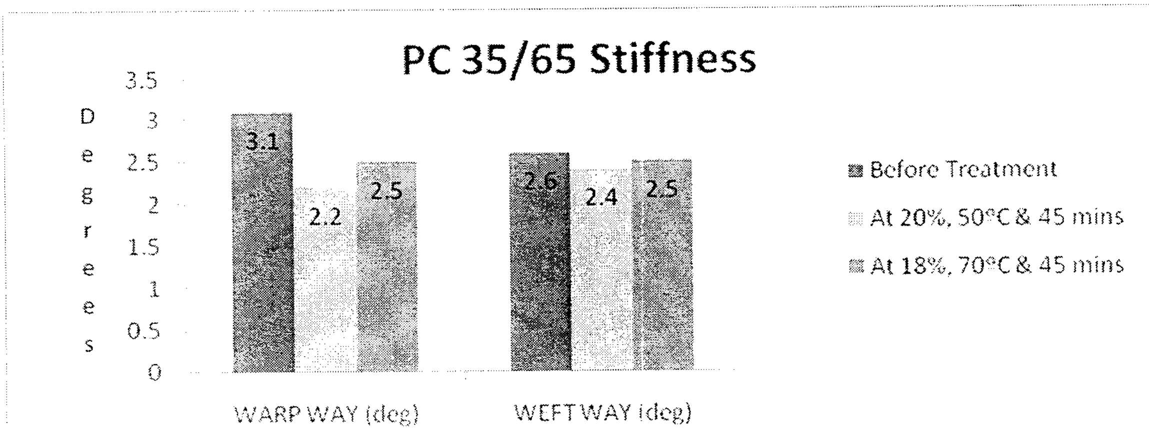


INFERENCE:

- Wickability for PC35/65 is more for 70°C temperature and was increasing with increase in temperature.
- Wickability for PC65/35 is more for 50°C temperature and was decreasing with increase in temperature.
- Wickability for 100% PET is more for 50°C temperature and was decreasing with increase in temperature.

STIFFNESS

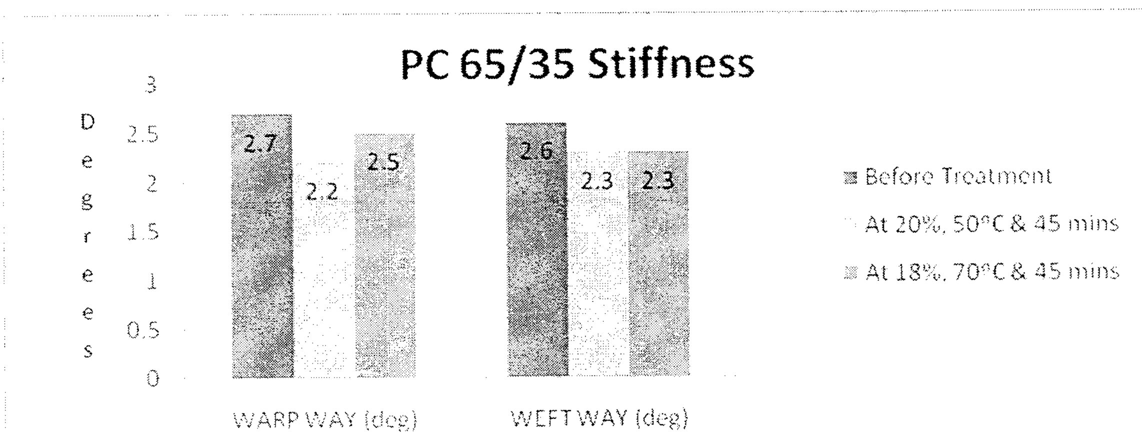
PC 35/65:



INFERENCE:

- Stiffness improves for the alkaline hydrolysis at 20% concentration, 50°C for 45 mins.
- Stiffness improves as concentration increases and when temperature decreases.

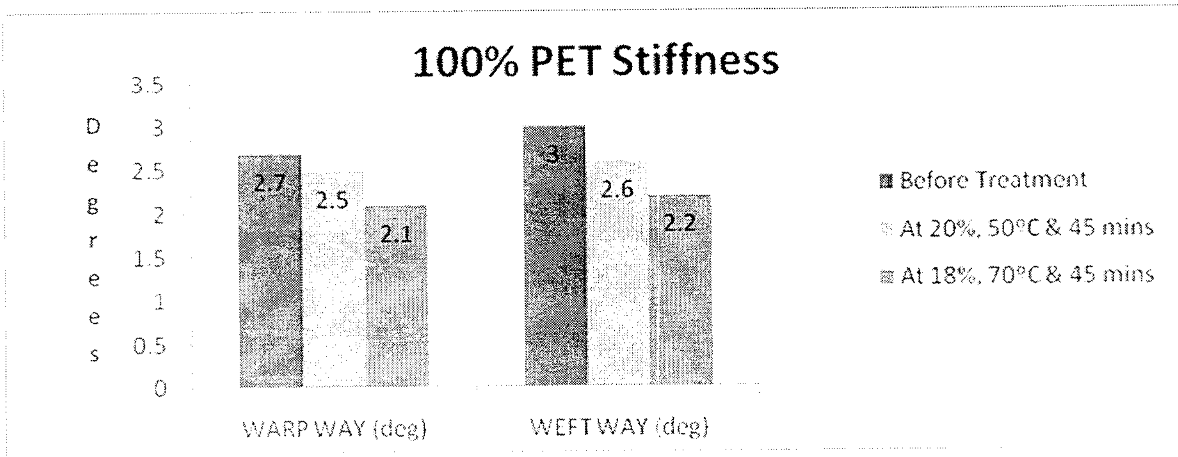
PC 65/35:



INFERENCE:

- Stiffness improves for the alkaline hydrolysis at 20% concentration, 50°C for 45 mins.

100% PET



INFERENCE:

- Stiffness improves for the alkaline hydrolysis at 18% concentration, 70°C for 45 mins.
- Stiffness improves as concentration decreases and when temperature increases.

KAWABATA RESULTS

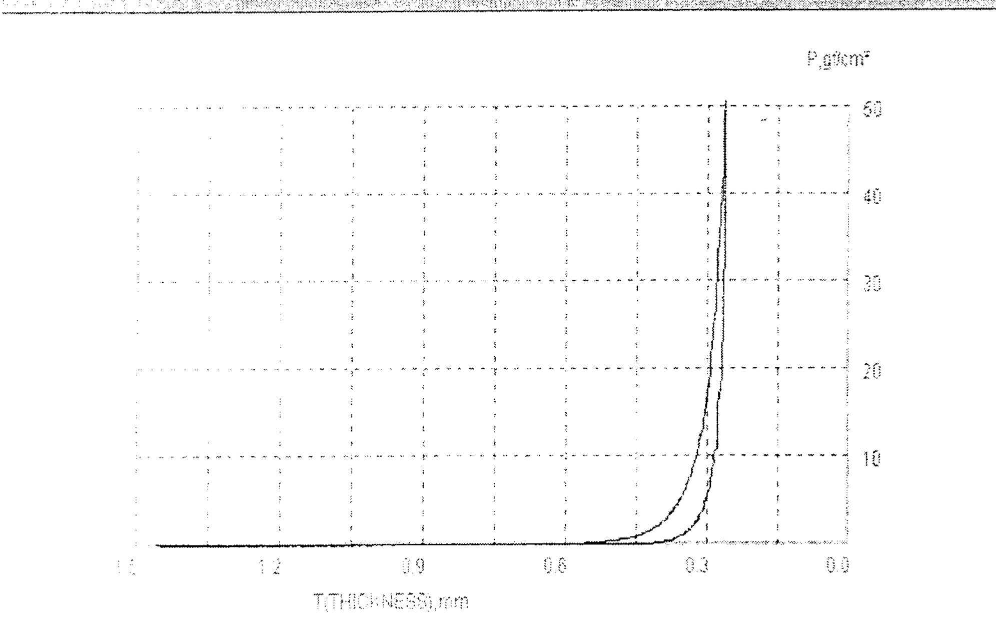
COMPRESSION PROPERTIES USING COMPRESSION TESTER (KES-FB-3)

PC35/65 BEFORE TREATMENT:

LC	WC	RC	TO	TM	INT	BINT	GAP
0.339	0.207	31.40	0.503	0.259	2.07	0.65	1.455
[-]	[gf.cm/cm²]	[%]	[mm]	[mm]	[-]	[-]	[mm]

Sens. : 2 × 5
Velocity : 50 sec/mm
Stroke : 5 mm/10V
Area : 2 cm²

Note



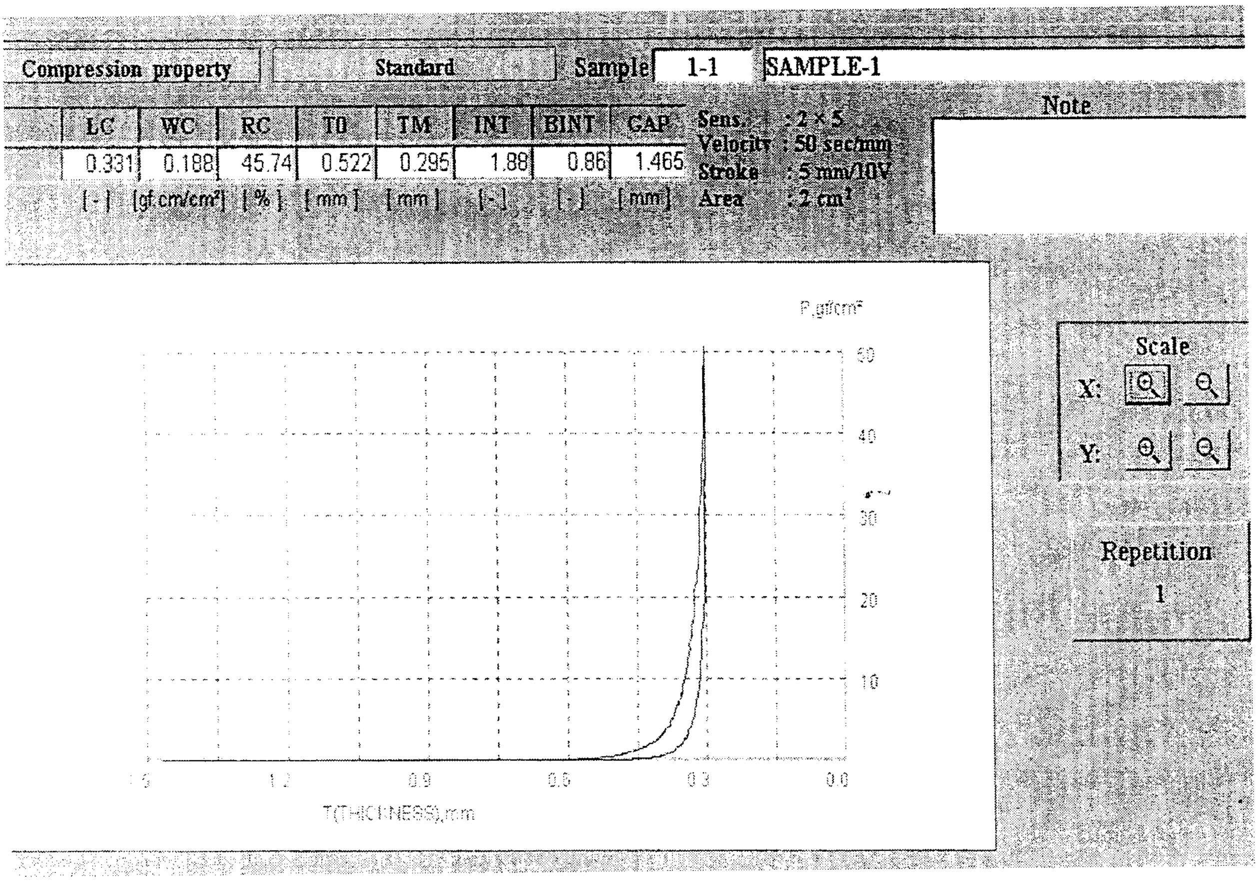
Scale
X:
Y:

Repetition
1

INFERENCE:

- The linear compression was found as 0.339
- Compressional energy was found as 0.207 gf.cm/cm².
- Compressional resilience was found to be 31.40 %
- GAP value was found to be 1.455mm.

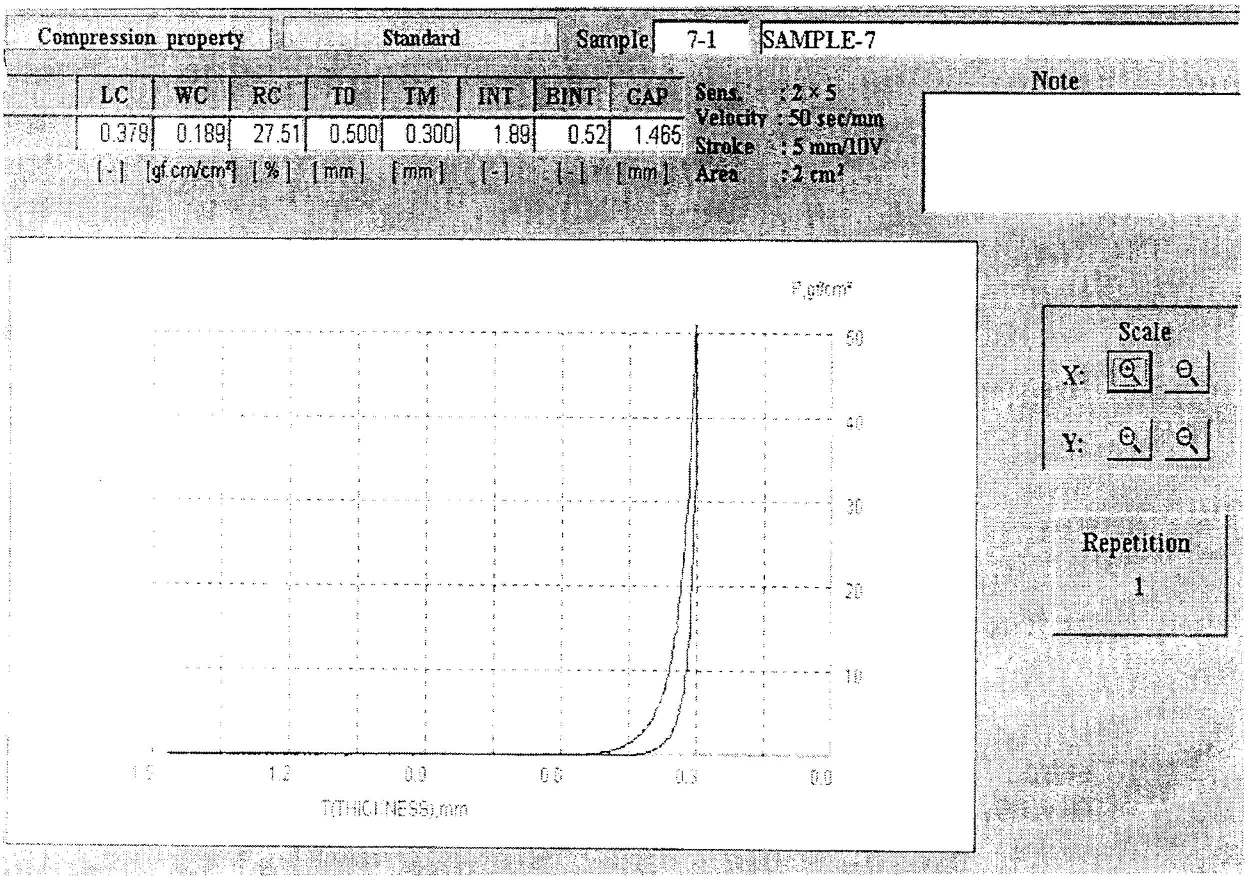
PC 35/65 TREATED WITH 20% CONC, AT 50°C & 45MINS:



INFERENCE:

- The linear compression was found as 0.331
- Compressional energy was found as 0.188 gf.cm/cm^2.
- Compressional resilience was found to be 45.74 %
- GAP value was found to be 1.465mm.

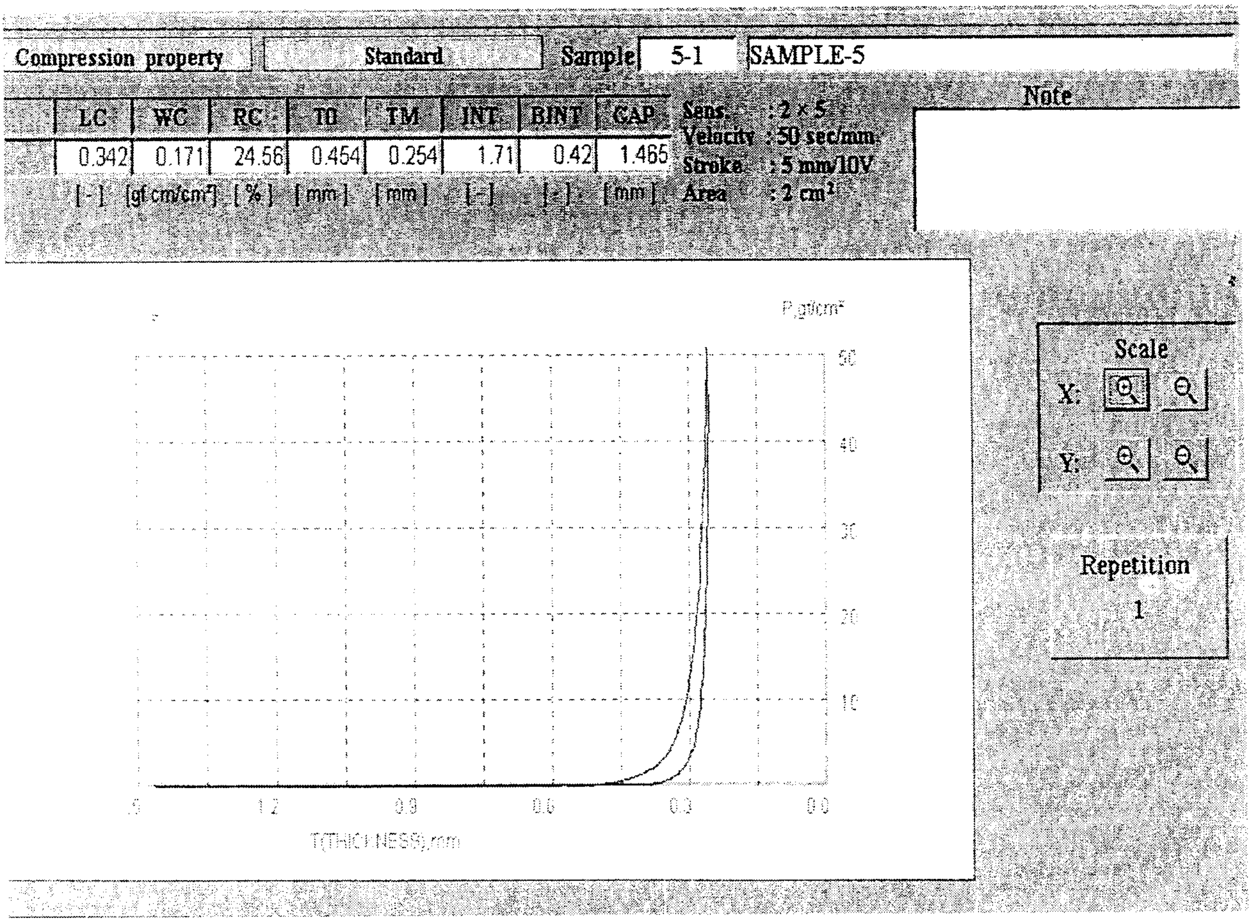
PC 35/65 TREATED WITH 18% CONC, AT 70°C & 45MINS:



INFERENCE:

- The linear compression was found as 0.378
- Compressional energy was found as 0.189 gf.cm/cm^2.
- Compressional resilience was found to be 25.51 %
- GAP value was found to be 1.465mm.

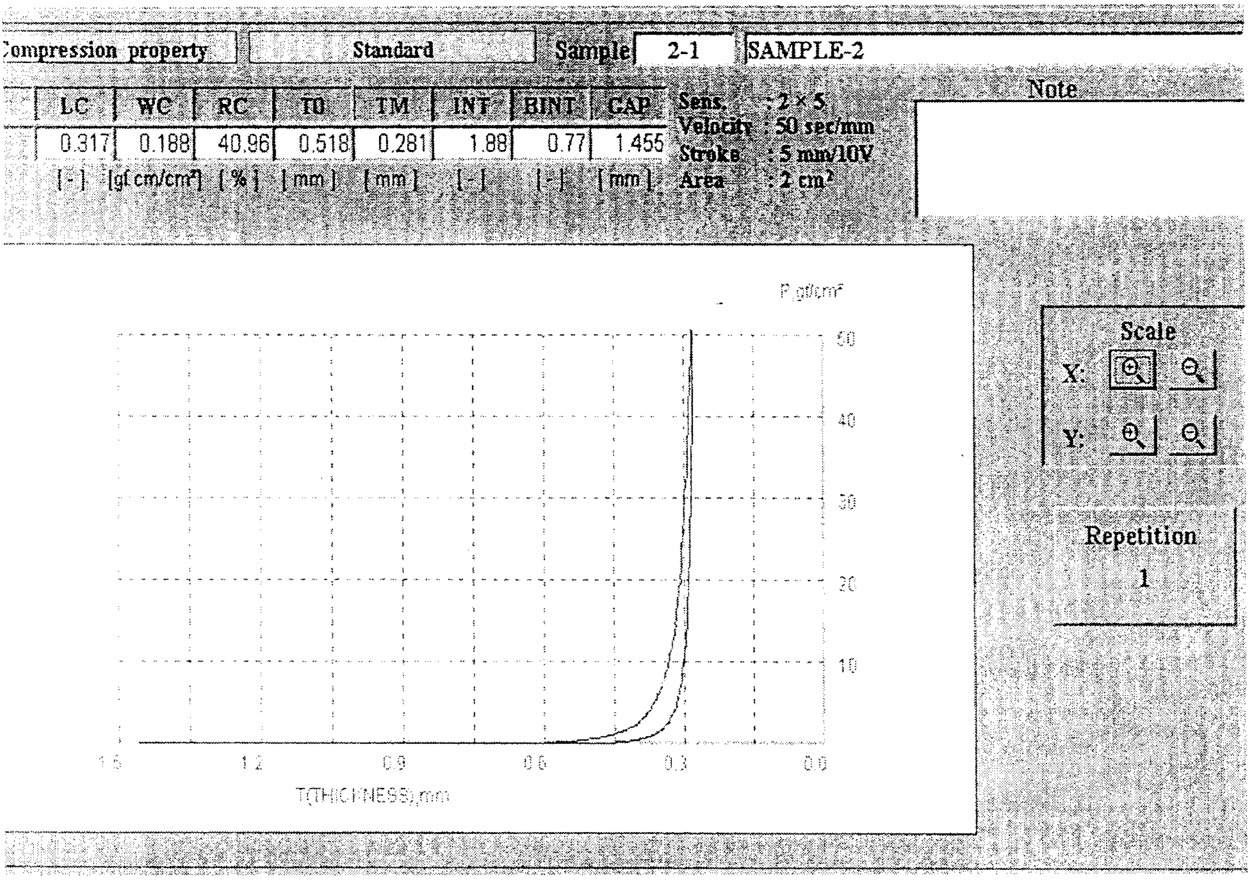
PC 65/35 BEFORE TREATMENT:



INFERENCE:

- The linear compression was found as 0.342
- Compressional energy was found as 0.171 gf.cm/cm^2.
- Compressional resilience was found to be 24.56 %
- GAP value was found to be 1.465mm.

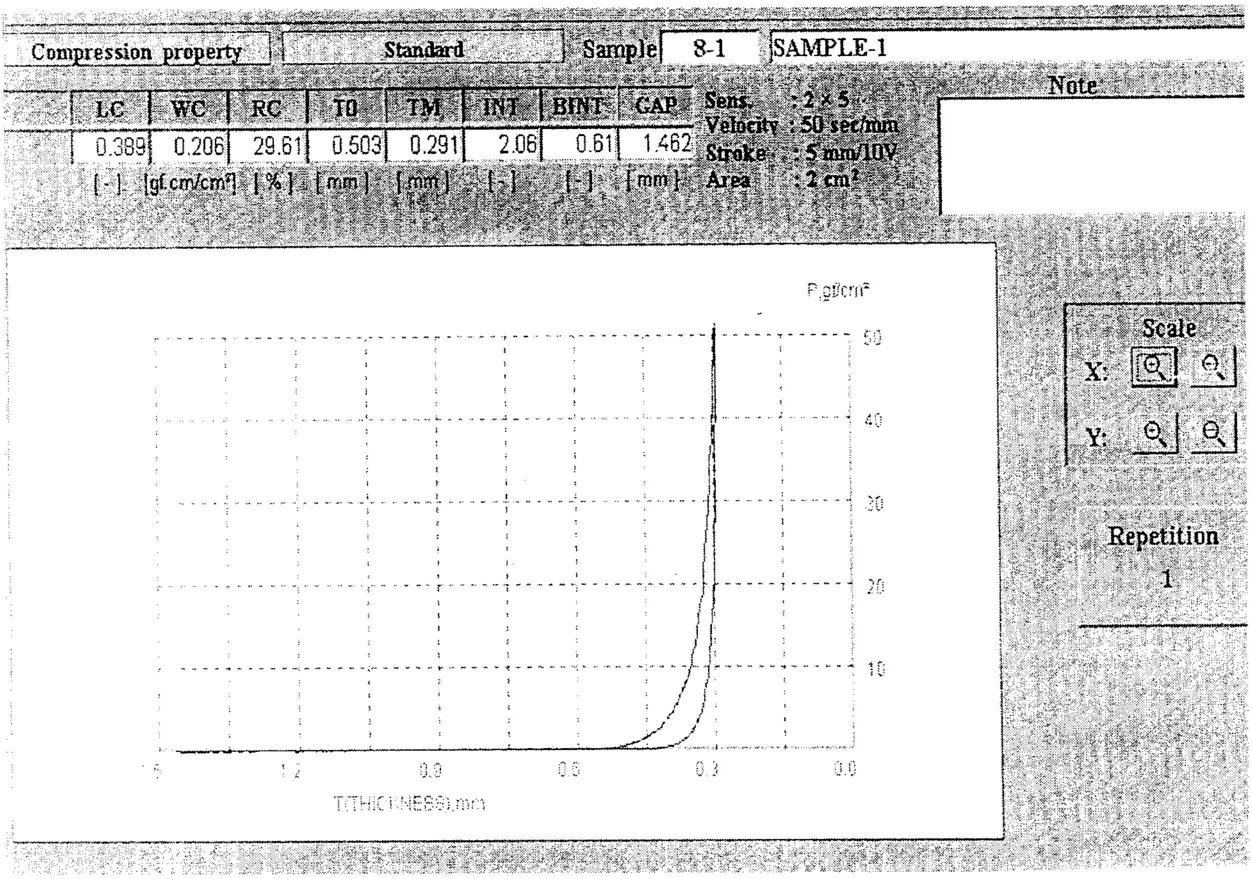
PC 65/35 TREATED WITH 20% CONC, AT 50°C & 45MINS:



INFERENCE:

- The linear compression was found as 0.317
- Compressional energy was found as 0.188 gf.cm/cm^2.
- Compressional resilience was found to be 40.96 %
- GAP value was found to be 1.455mm.

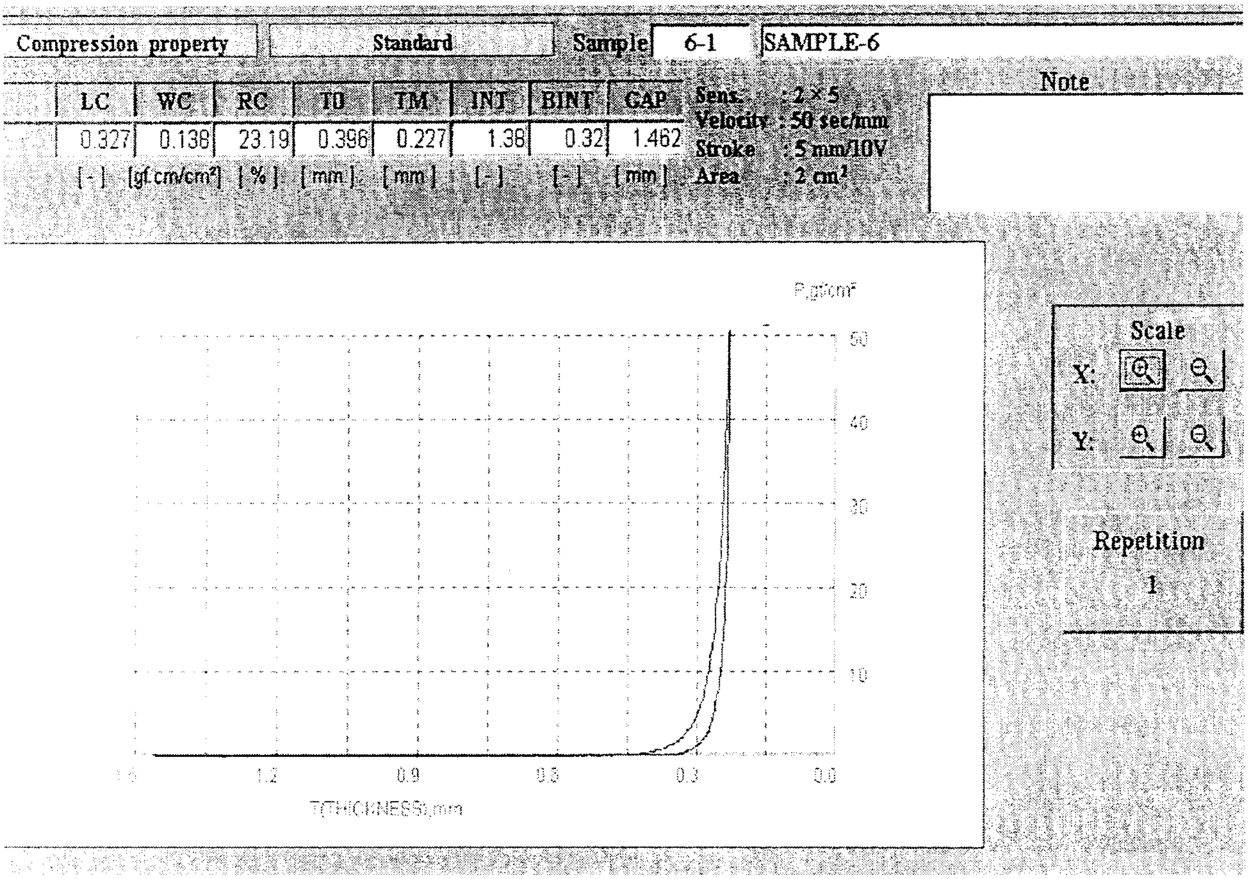
PC 65/35 TREATED WITH 18% CONC, AT 70°C & 45MINS:



INFERENCE:

- The linear compression was found as 0.389
- Compressional energy was found as 0.206 gf.cm/cm^2.
- Compressional resilience was found to be 29.61 %
- GAP value was found to be 1.462mm.

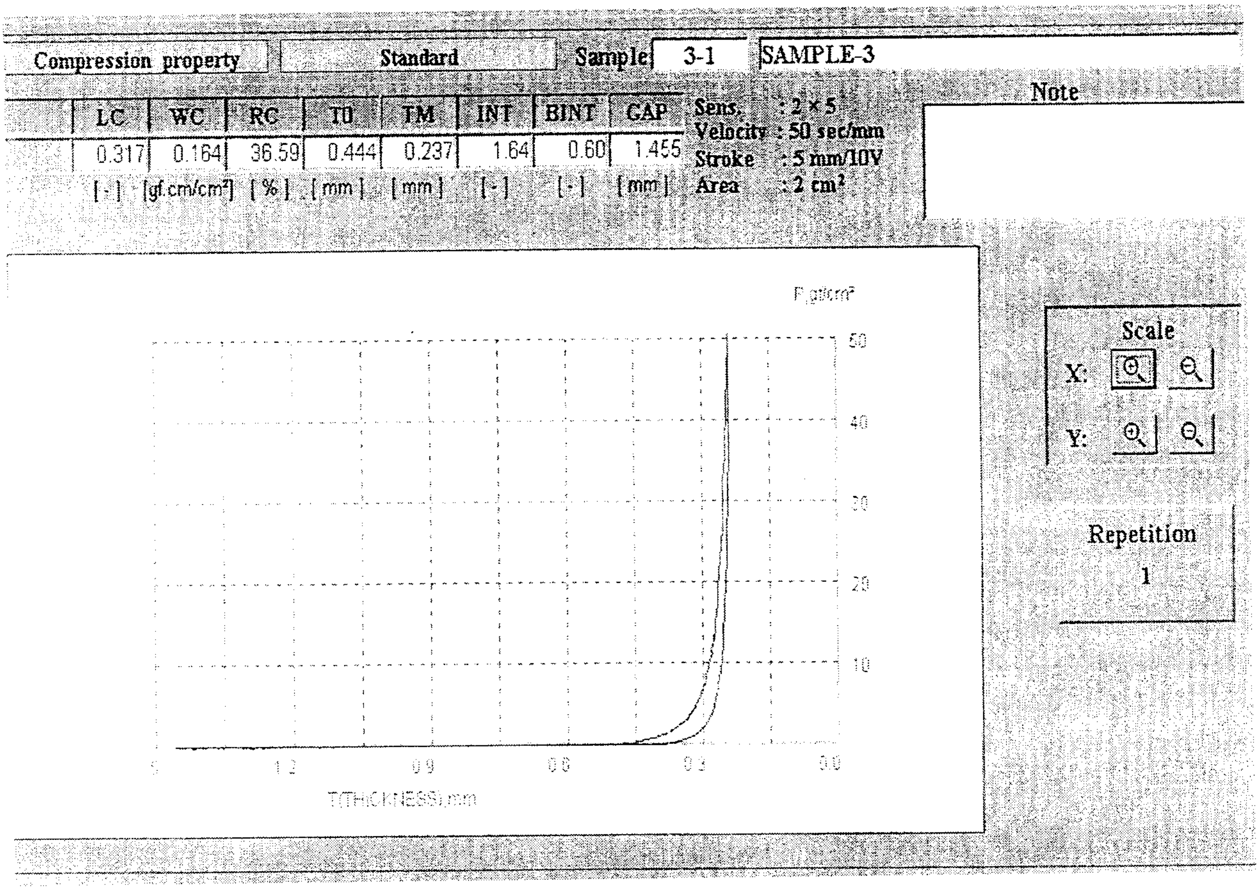
100% PET BEFORE TREATMENT:



INFERENCE:

- The linear compression was found as 0.327
- Compressional energy was found as 0.138 gf.cm/cm^2.
- Compressional resilience was found to be 23.19 %
- GAP value was found to be 1.462mm.

100%PET TREATED WITH 20% CONC, AT 50°C & 45MINS:



INFERENCE:

- The linear compression was found as 0.317
- Compressional energy was found as 0.164 gf.cm/cm^2.
- Compressional resilience was found to be 36.59 %
- GAP value was found to be 1.455mm.

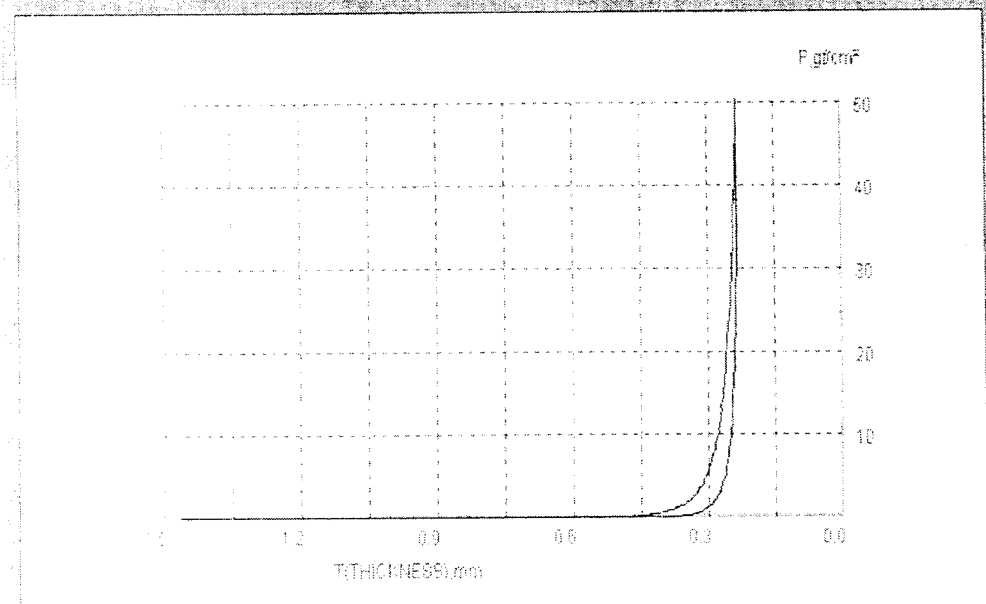
100%PET TREATED WITH 18% CONC, AT 70°C & 45MINS

Compression property | Standard | Sample 9-1 | SAMPLE-9

LC	WC	RC	T0	TM	INT	BINT	GAP
0.331	0.158	32.91	0.420	0.229	1.58	0.52	1.462
[-]	[gf.cm/cm²]	[%]	[mm]	[mm]	[-]	[-]	[mm]

Sens. : 2 × 5
Velocity : 50 sec/mm
Stroke : 5 mm/10V
Area : 2 cm²

Note



Scale
X:
Y:

Repetition
1

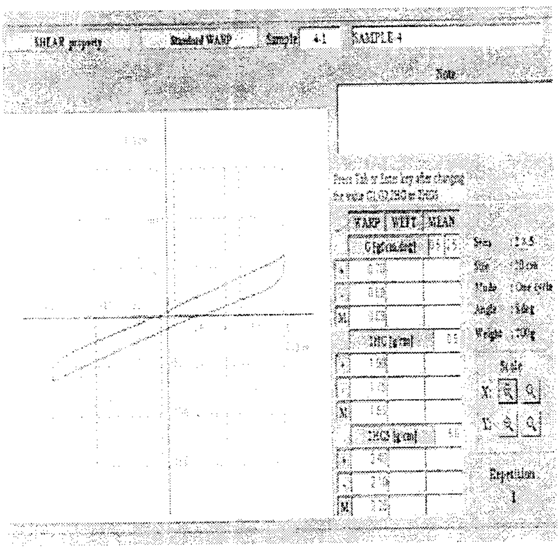
INFERENCE:

- The linear compression was found as 0.331
- Compressional energy was found as 0.158 gf.cm/cm^2.
- Compressional resilience was found to be 32.91 %
- GAP value was found to be 1.462mm.

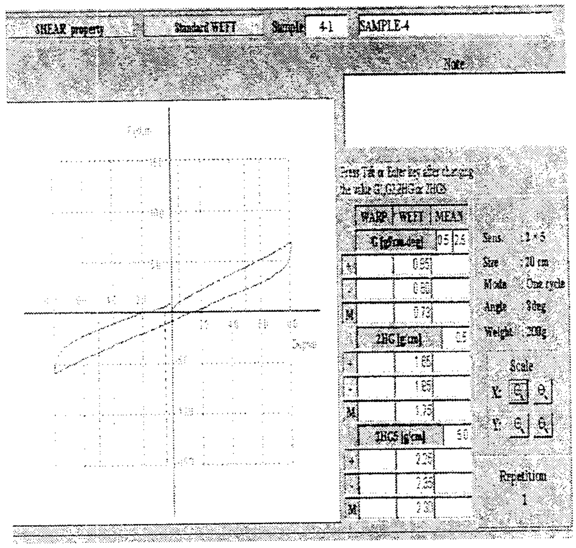
SHEAR PROPERTIES USING TENSILE & SHEAR TESTER (KES-FB-1)

PC35/65 BEFORE TREATMENT:

WARP WAY



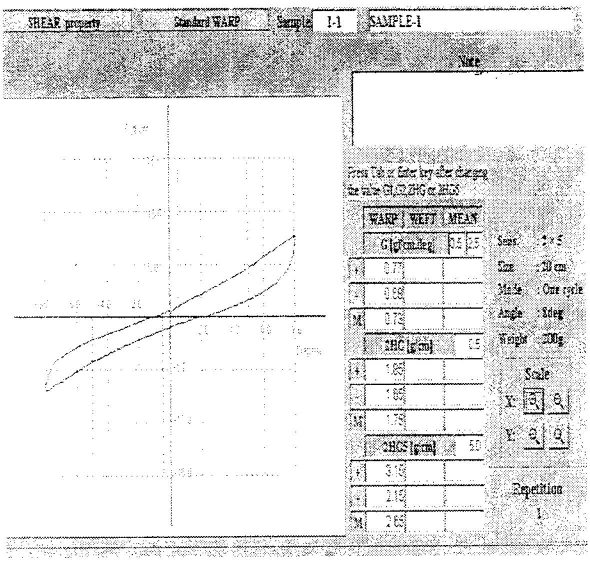
WEFT WAY



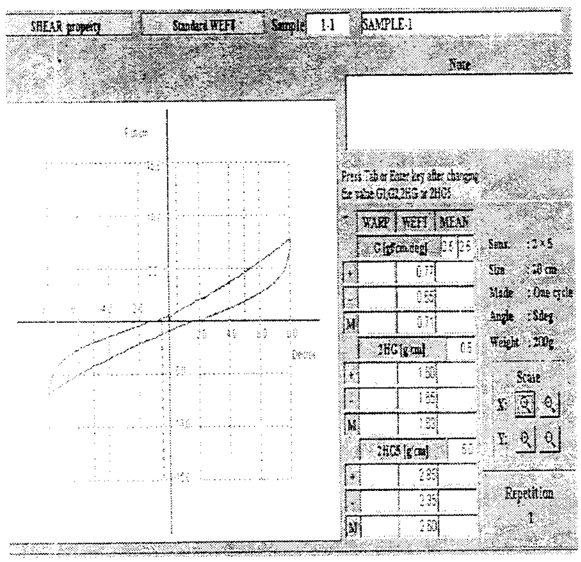
PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.69**	**0.73**	**0.71**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**1.83**	**1.75**	**1.79**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**2.25**	**2.3**	**2.28**

PC 35/65 TREATED WITH 20% CONC, AT 50°C & 45MINS:

WARP WAY



WEFT WAY

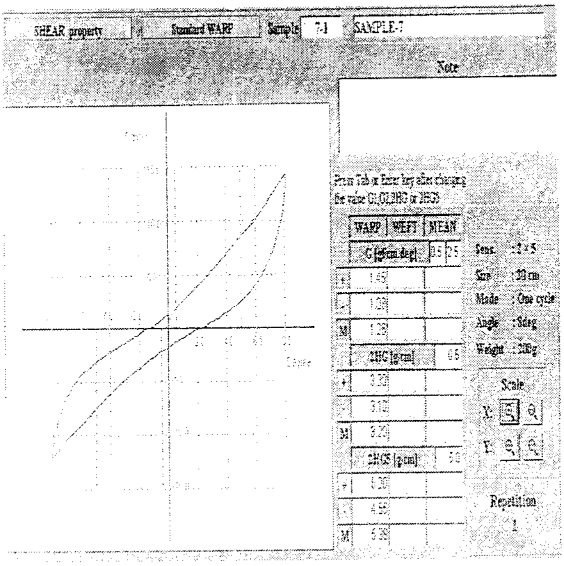


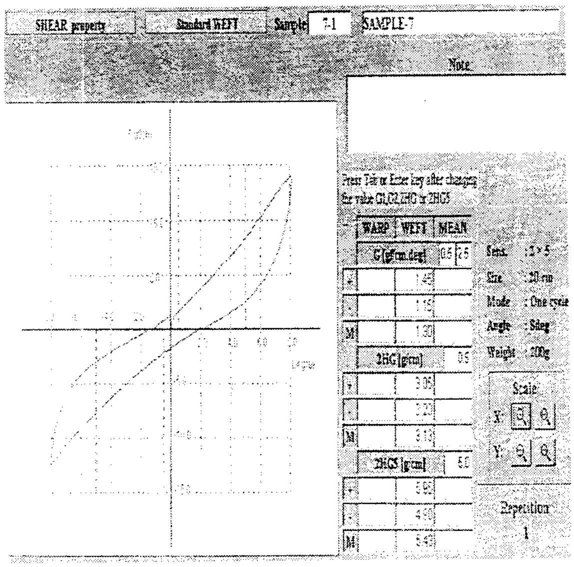
PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.73**	**0.71**	**0.72**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**1.75**	**1.63**	**1.69**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**2.65**	**2.60**	**2.63**

PC 35/65 TREATED WITH 18% CONC, AT 70°C & 45MINS:

WARP WAY

WEFT WAY

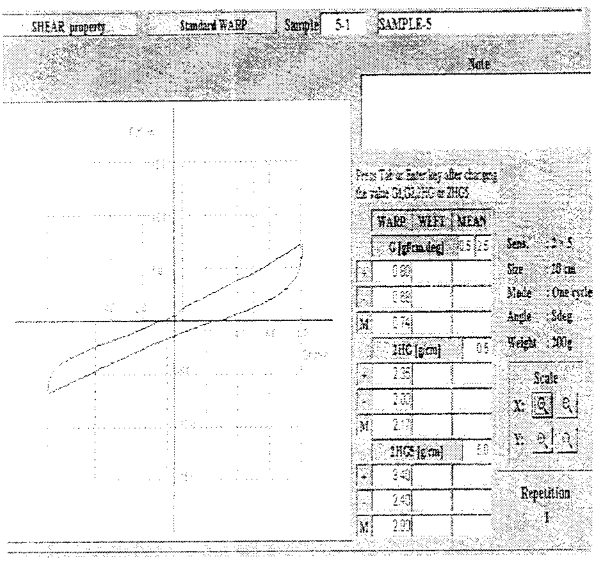




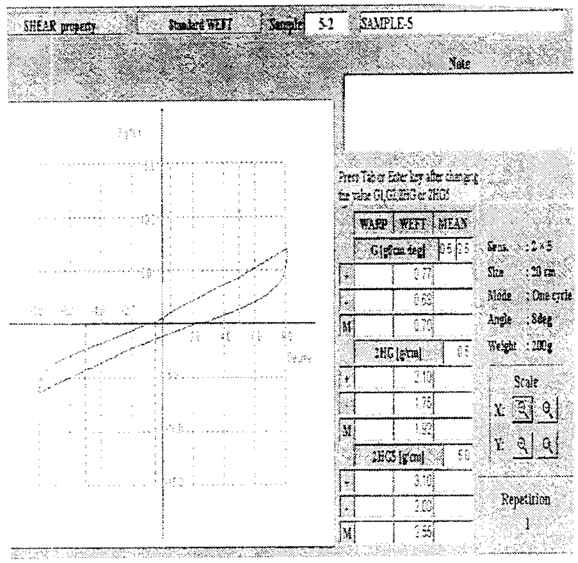
PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**1.26**	**1.30**	**1.28**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**3.20**	**3.13**	**3.16**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**5.38**	**5.43**	**5.40**

PC 65/35 BEFORE TREATMENT:

WARP WAY



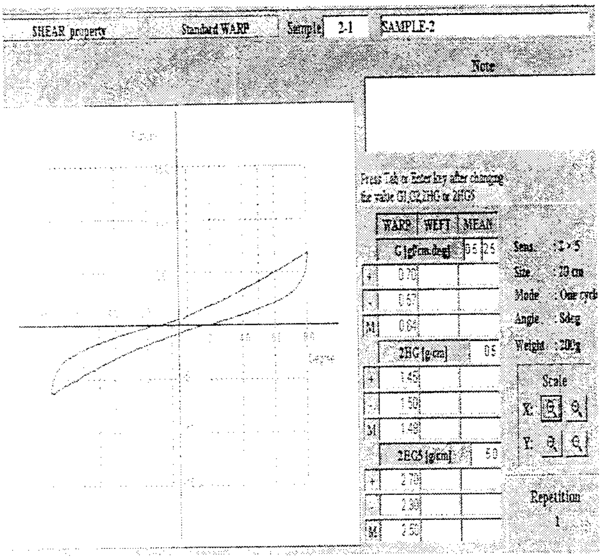
WEFT WAY



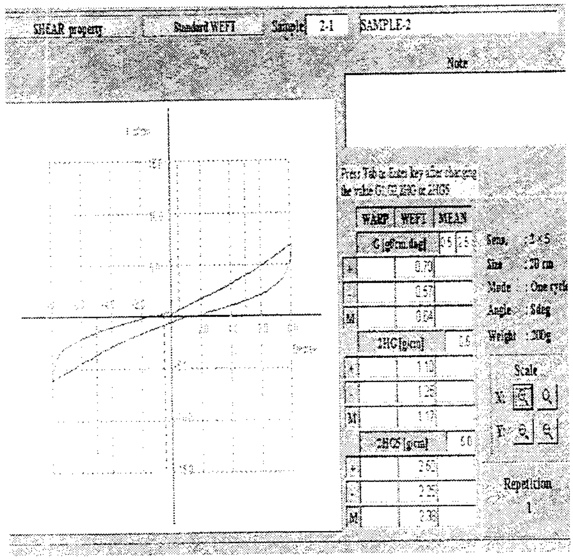
PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.74**	**0.70**	**0.72**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**2.17**	**1.92**	**2.04**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**2.90**	**2.55**	**2.73**

PC 65/35 TREATED WITH 20% CONC, AT 50°C & 45MINS:

WARP WAY



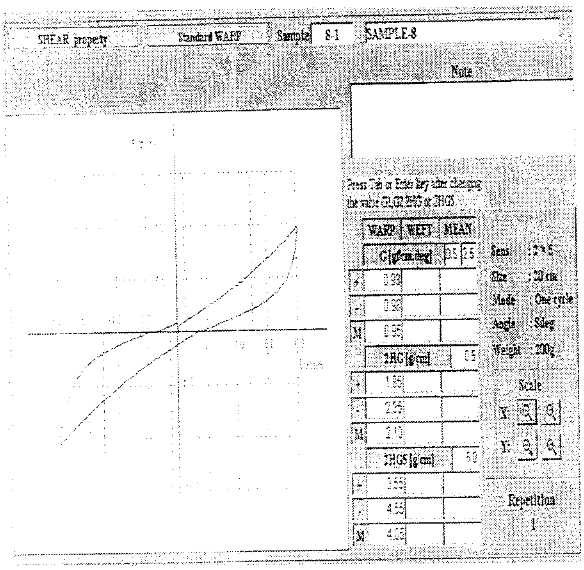
WEFTWAY



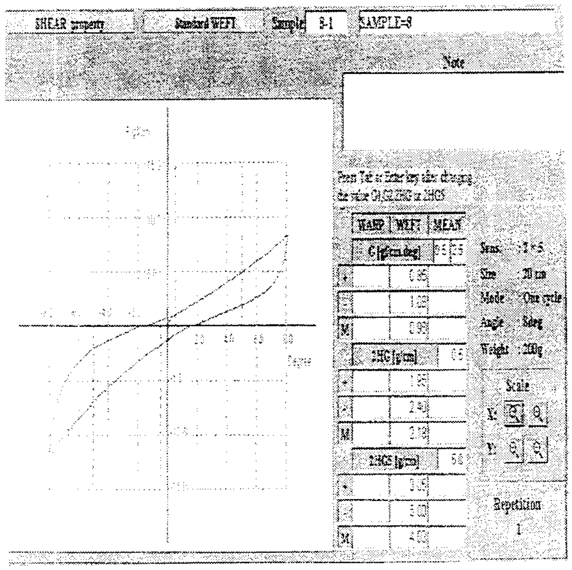
PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.64**	**0.64**	**0.64**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**1.48**	**1.17**	**1.88**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**2.50**	**1.33**	**1.92**

PC 65/35 TREATED WITH 18% CONC, AT 70°C & 45MINS:

WARP WAY



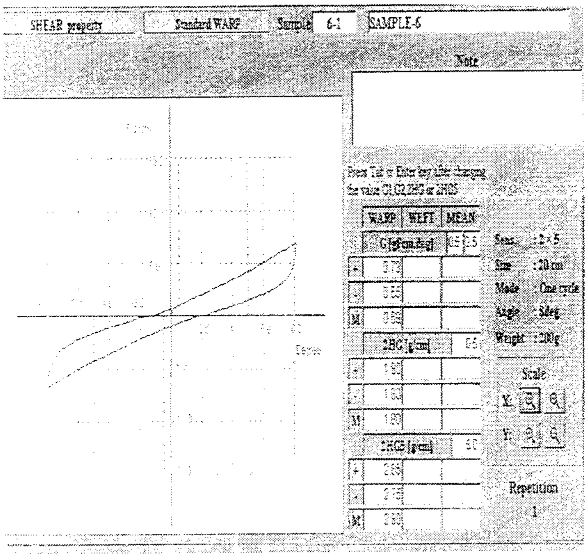
WEFT WAY



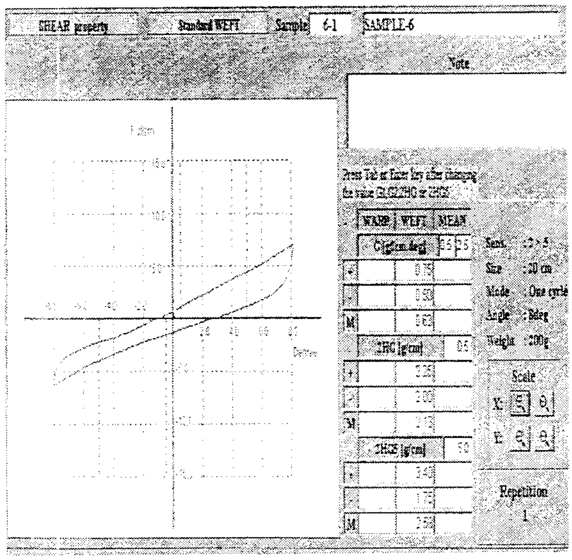
PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.95**	**0.96**	**0.96**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**2.10**	**2.18**	**2.14**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**4.05**	**4.03**	**4.04**

100% PET BEFORE TREATMENT:

WARP WAY



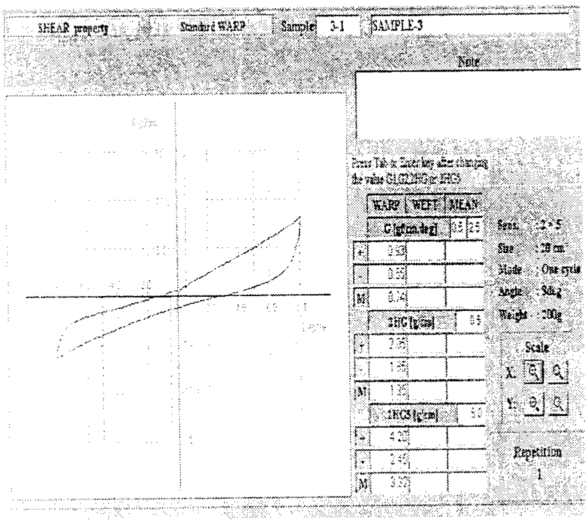
WEFT WAY



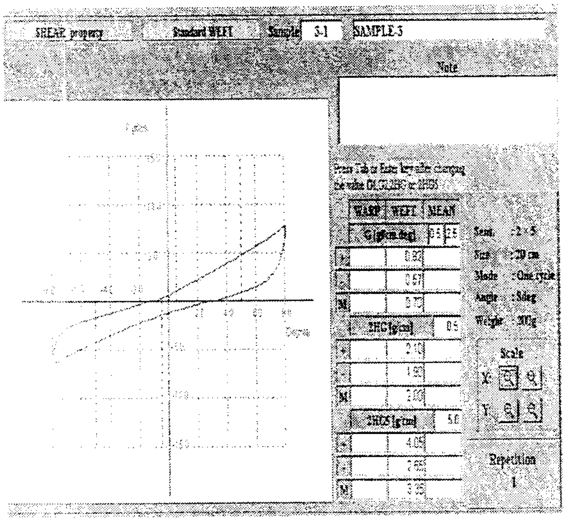
PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.69**	**0.63**	**0.66**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**1.80**	**2.13**	**1.96**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**2.80**	**2.58**	**2.69**

100%PET TREATED WITH 20% CONC, AT 50°C & 45MINS:

WARP WAY

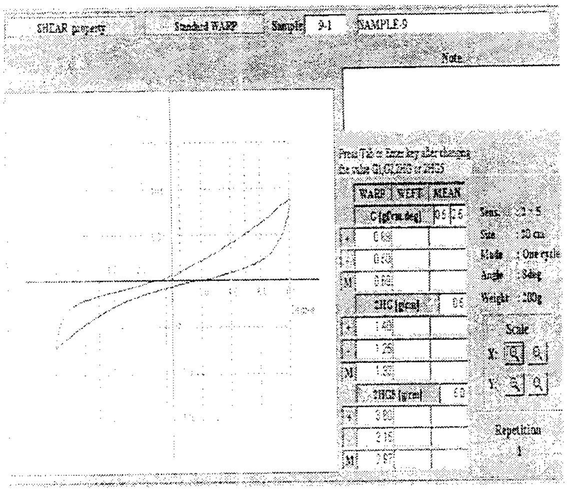


WARP WAY

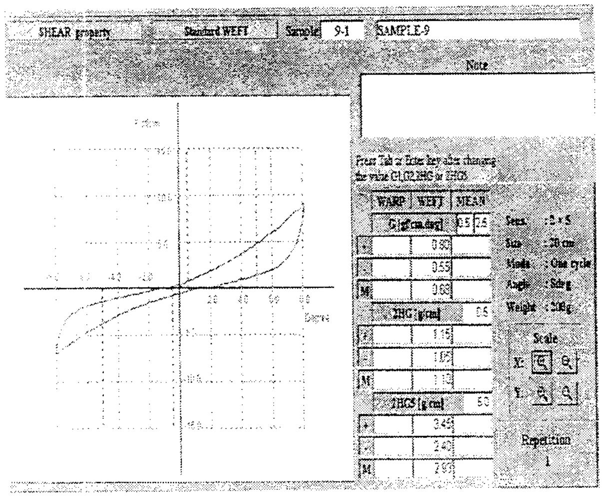


PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.74**	**0.70**	**0.72**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**1.95**	**2.00**	**1.98**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**3.32**	**3.35**	**3.34**

WARP WAY



WEFT WAY



PROPERTIES	WARP WAY	WEFT WAY	MEAN
Shear Stiffness (G gf cm.Deg)	**0.69**	**0.68**	**0.68**
Hysteresis of Shear Force at 0.5deg of Shear angle (2HG gf/cm)	**1.33**	**1.10**	**1.21**
Hysteresis of Shear Force at 5deg of Shear angle (2HG gf/cm)	**2.97**	**2.93**	**2.95**

CONCLUSIONS

Among various properties the term comfort has been in close contact with the day to day wear. The current market demands not only the quality but also with the consistency in cost structure along with all the functional and wear properties.

In this project the market available polyester/cotton blend woven fabric is suitably treated with the special process to improve the mechanical related properties.

In conclusion, the comfort properties of blended woven fabrics showed a significant variation with the chemical treatment (alkali hydrolysis). In Alkali hydrolysis of polyester /cotton blend woven fabric the weight loss remains significantly less. The weight loss may be attributing to the scouring loss of cotton. During alkali hydrolysis the compression & shearing property of polyester/cotton blend woven fabric has significantly improved.

The following changes contributed to the improvement in the comfort characteristics.

- The blend PC35/65 shows good wicking property as the treatment time and temperature increases.
- 100% PET & the blend PC65/35 shows good wicking property as the treatment concentration increases, time and temperature decreases.

PET has been improved for alkaline hydrolysis with 20% concentration at 50°c for 45mins.

- The shear stiffness property is improved for PC35/65 & PC65/35 treated with alkaline hydrolysis at 50°C with 20% concentration for 45mins whereas for 100% PET, shear stiffness improves for treatment with alkaline hydrolysis at 50°C with 20% concentration for 45mins.

- Crease recovery of PC35/65 & 100% PET is improved for alkaline hydrolysis at 18% concentration with 70°C temperature for 45 mins.

- Crease recovery of PC65/35 is improved for alkaline hydrolysis at 20% concentration with 50°C temperature for 45 mins.

- Abrasion Resistance for PC35/65, PC65/35 & 100% PET has been improved by alkaline hydrolysis treatment at 18% concentration, 70°C Temperature for 45 mins.

- Stiffness has been improved for the blends PC35/65 & PC65/35 for the alkaline hydrolysis at 20% concentration, 50°c for 45 mins.

- Stiffness has been improved for the blends PC35/65 & PC65/35 for the alkaline hydrolysis at 18% concentration, 70°c for 45 mins.

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SAMPLES

TREATED