DESIGNING AND APPLICATION OF ANTI-FLY FINISH IN HOME TEXTILES

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **"DESIGNING AND APPLICATION OF ANTI-FLY FINISH IN HOME TEXTILES"** is the bonafide work of **S.Divya Bharathi, G.Shree Laleitha, A.Vaanmathi** who carried out the project work under my supervision.

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EXTERNAL EXAMINER

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ABSTRACT

Our project aims to protect mankind from flies and mosquitoes, which are the major causes of spreading diseases. A special finish like anti-fly finish has become necessary in textile products. Literature survey has been made to find out the availability of natural fly repellent finish, various parameters for finishing, type of fabric used and to evaluate the finished and unfinished samples both subjectively and objectively. Herbal finishes are given to textile materials instead of chemicals to avoid side-effects. It would be more effective if we give such a finish in Home Textile materials rather giving it in garments which has direct contact with human body. Natural resources like Citronella oil, Neem oil, Jojoba oil and Lemon grass oil are used for finishing . Method of application adopted for finishing is Pad-Dry method, which increases the durability of the finish. Characteristics of the finished material like strength, durability, wash fastness, etc is analyzed for its performance. Home Textile products like apron, table cover, mitten and pot holder are designed and produced in accordance with the application.

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CHAPTER 1

INTRODUCTION

The world textile industry is going through revolutionary changes aimed at meeting the unique needs of the modern customers. Textiles worn as protection and self expression on the human body used as decoration and comfort elements. Health and hygiene are the primary requirements of human beings and they expect these requirements to be fulfilled in textile materials .To protect mankind from flies and mosquitoes, which are the major causes of spreading diseases a special finish like anti-fly finish has become necessary.

Natural finishing agent comprises those substances that are obtained from plants and animals. Natural finishes have many advantages such as non-toxic, non-irritant, bio-degradable, cost effective, easy availability, etc. Finishing is done to improve product appearance, properties and quality. 'Further finish' would mean modification of the fabric or its surface to meet certain desired specifications. Specialty finishes involves fragrance release, anti-microbial finish, flame retardant finish, etc.

Recently in India, there have been outbreaks of many diseases spread by flies that endangered thousands of innocent lives. The World Health Organization (WHO) estimates that each year millions of people are affected by such diseases.

It would be more effective if we give anti-fly finish in Home Textile materials rather giving it in garments which has direct contact with human body. Since, flies cause much of trouble in domestic areas our project concentrates in Home Textile products like apron, table cover, mitten, pot holder etc.

CHAPTER 2

LITERATURE REVIEW

Nowadays most of the finishing process is carried out by using chemicals which may cause side effects. This is a major problem which has to be taken care of. Though flies cause much of problem in domestic areas, specialty finishes are not concentrated in home textile products. Here, we studied about the various specialty finishes, herbal products, designing of home textiles in accordance with the application and about various testing methods. With the help of this study we aim to overcome the above mentioned difficulties.

A.Habeish [1] from his research entitled "preparation of insect repellant cotton fabric through treatment with a finishing formulation containing cypermethrin" concluded that treatment of cotton fabric with a finishing formulation based on cypermethrin , polymeric binder and a cross linking agent impart toxic activity against flies. Bioassay results reveal that treated fabric obtained, either by impregnation method or by surface coating method.

Washing cypermethrin treated fabrics does not substantially reduce the insecticidal effect after washing. Because of these attributes, cypermethrin is potentially a good candidate insecticide for treatment of mosquito nets .

Hamdy.I.A [2] from his research entitled "insect repellent cellulose-based fabric using coating process" concluded that the surface coating method provides high personal protection against mosquitoes , especially the repellent action(about 100%). The coated fabric surface is higher than those of the blank samples.

especially at higher concentrations of chemicals. The effect of the treatment method , whether impregnation or surface coating on the ability of treated fabrics to keep insecticide's fragrance after washing, is expressed as percentage retention.

M.Kanimozhi [3] from her research entitled "effect of mosquito-repellent finish fabric on cotton fabric" concluded that "Finishing is done to improve product appearance , properties and quality" , further "finish" would mean the modification of the fabric . The objective of the study was to find out the availability of natural mosquito repellent finishes , optimize the various parameter for finishing, compare the effect of natural mosquito repellent finish on selected cotton fabrics, and to evaluate the finished and unfinished samples after wash, both subjectively and objectively.

C.Eschreck [4] from his research entitled "techniques for the evaluation of insect repellents" concluded that although repellent research has been relatively meager when compared with other entomological studies , such as the use of insecticides, many diverse techniques have been proposed as a method of evaluating insect repellents. This paper attempts to present a critical appraisal of the current status of repellent testing techniques used in the search for materials that protect humans from arthropod bites.

On field of research renewed interests is that of insect repellents as a method of protecting humans, plants and animals, the protein of civilian and military personnel from biting pests and vectors of disease in recreational and wilderness areas, where other control methods are not economical, remains a serious problem.

LI Feiyue 1 [5] from his research entitled "Research in Mosquito Repellent and Its Formulation" has concluded that research progress of natural repellent and

synthesized repellent were introduced. Natural repellent mainly comes from plant volatile oil, and has the characteristic of little toxicity, safety, environmental friendliness and so on. Its research is mainly concentrated on screening the high active constituent. The repellency of chemical synthesized repellent is better, but the toxicity and environmental friendliness were all worse than natural repellent. The research progress of mosquito repellent formulation was introduced comprehensively. New formulation can enhance the repellency and the human safety, and the slow release technology is the present advanced preparation technology nowadays.

Ansari.M.A [6]from the research entitled on "Effectiveness of personal protection against mosquitos" says, from mosquitoes to gnats, no-see-ums, insects and other outdoor pests are far more than just annoying inconveniences. Geraniol Insect Repellent Wristband is a proven, effective alternative to synthetic traditional pesticides, protecting your near and dear one from biting insects while avoiding the risks coupled with chemicals. It's a safer and most effective choice against biting insects. Geraniol, a plant based active ingredient in wristband is a proven and tested repellent.

[7] Journal titled "Natural Insect and Rodent Repellents - Quick & Simple" says, as for actual skin protection, consider a 30% concentration of oil of eucalyptus, which prevents bites for up to two hours. Another organic skin protector is 2% soybean oil, which works for almost that long. In comparison, Citronella works poorly, keeping mosquitoes away for only 20 minutes. Another organic and natural substance involves mixing garlic juice and water in a 1 to 5 ratio, shaking it up and spraying it on your skin and it can work for up to six hours.

M. S. Fradin and J. F. Day [8] "Comparative Efficacy of Insect Repellents against flies"says about Americos Insrep C (Insect Repellent Capsule) Americos Insrep C is an insect-repelling capsule, which contains products extracted from natural materials. It is different from other repelling chemicals in that it is an intelligent insect repelling chemical, which maintain a long lasting effect by its application to the textiles and the various habitats of the mite

CHAPTER 3

AIM AND SCOPE

❖ To produce home textile products with anti-fly finish.

❖ Analyse and characterize the above produced fabrics by various tests such as

- Fly repellent test
- Tensile strength test
- Stiffness test
- Abrasion resistance test
- Impact strength test

CHAPTER 4

MATERIALS AND METHODS

4.1. MATERIALS:

The materials used for producing home textile products are 100% cotton, 100% vicose, 50:50 cotton / viscose blend. The herbal products used as finishing agents for anti-fly finish are Citronella oil, Jojoba oil, Neem oil and Lemon grass oil.

4.2. PROCESS SEQUENCE:

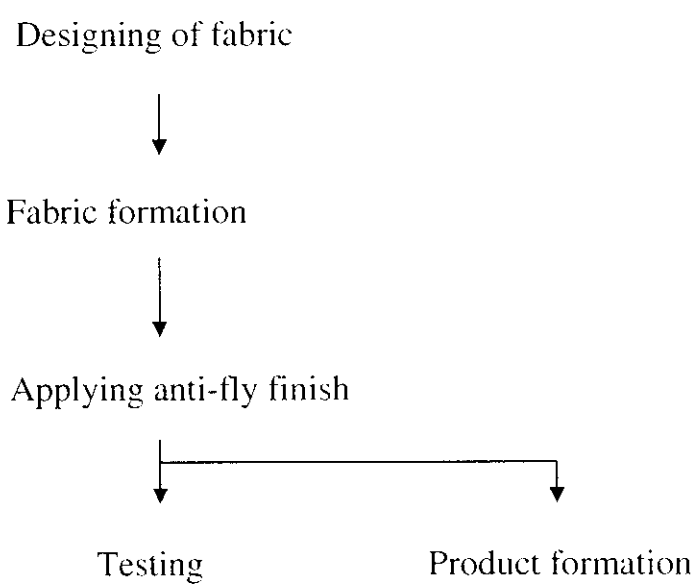

Figure: 1 Process sequence

4.2.1. DESIGNING OF FABRIC:

Precisely the home textile products which are about to be used for anti-fly finish are designed. Making of Theme board, color board and Forecast board is done and the theme is applied on the home textile products. There are certain color combinations which repel flies. Such colors are used in our theme which will also play its role in fly repellency.

4.2.1.1. THEME BOARD:

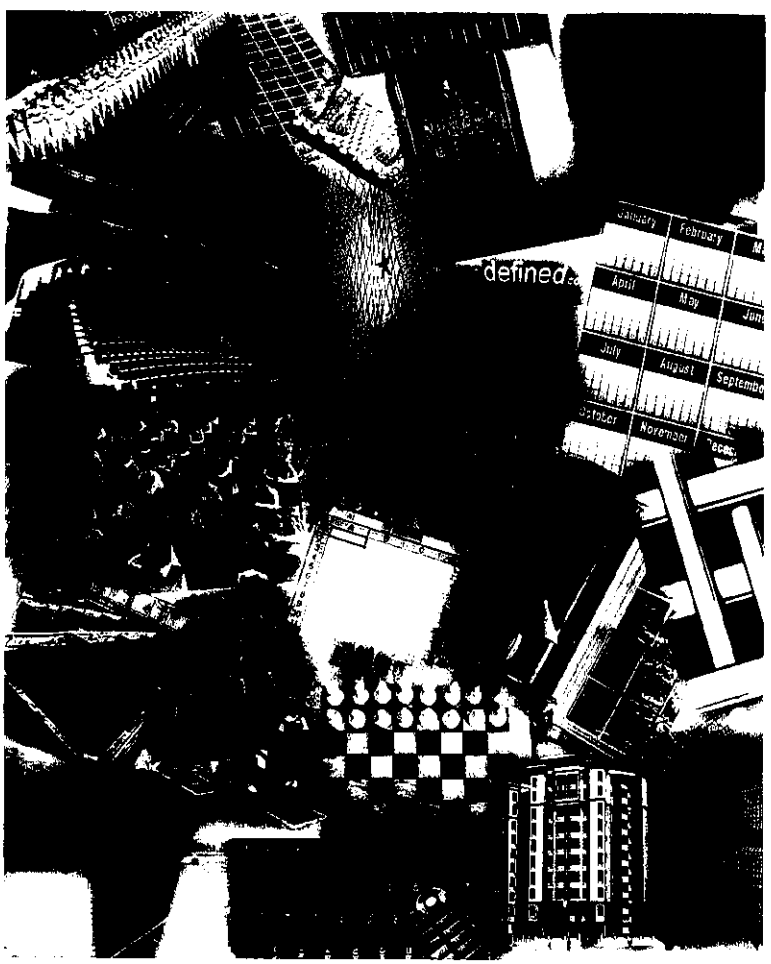

Figure: 2 Theme Board

Theme board is a blog that involves a particular topic, category or subject, which is developed and expanded. The theme board explains the theme which is going to be applied on fabric. The theme we have made is **checks**. The above figure shows the checked effect seen in various practical locations. This theme is brought into the fabric by colored yarns.

4.2.1.2. COLOR BOARD:

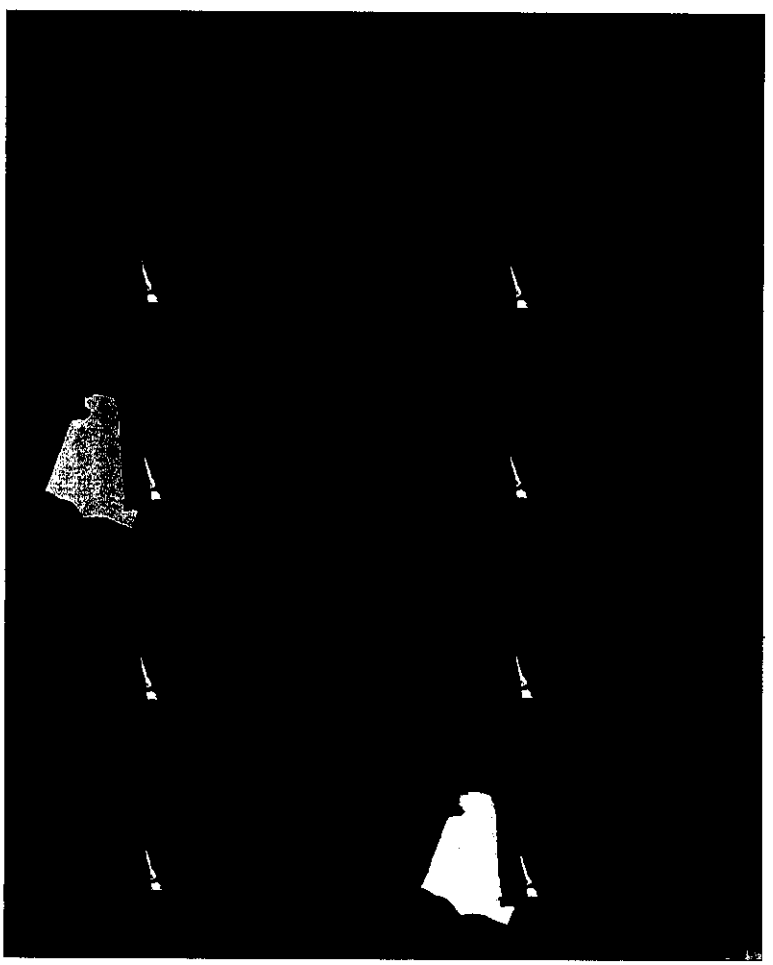

Figure: 3 Color Board

Color boards offer a visual comprehensive overview about the direction your clothing should look color wise. We achieve our color proposal researching and

taking into consideration the fashion market direction, season and climate. This color board consists of the colors favorable for summer season and our products are based on these colors.

4.2.1.3. FORECAST BOARD:

Figure: 4 Forecast Board

As the name represents, forecast board is used to forecast the theme and color of the fabric which is been designed. The design which is just represented in theme board is brought into visualization through forecast board. The figure shows the theme checks and the color used in our home textile products.

4.2.2. FABRIC FORMATION:

The theme is precisely decided and designed and it is implemented in the fabric. Three various materials are used in this project, 100% cotton yarn of count 7, 100% viscose yarn of count 9, 50:50 cotton/viscose blend yarn of count 10 is woven into fabric. The colored yarns used as warps and wefts brings the checked effect into the fabric by twill weave.

4.2.3. APPLYING ANTI-FLY FINISH:

The woven fabric is treated with finishing agents like Citronella oil, Jojoba oil, Neem oil and Lemon grass oil where Lemon juice is used as the binding agent. The application of anti-fly finish is done through Pad-Dry method, where the fabric is treated with the finishing agents in padding mangle and it is dried at room temperature.

S.No	Ingredients	Percentage
1.	Lemon grass oil	35%
2.	Neem oil	21%
3.	Jojoba oil	14%
4.	Citronella oil	56%

M:L =1:20,Temperature : 70^0 c ,Time : 1 hr

Table 4.1 Finishing Agents

4.2.4. PRODUCT FORMATION:

The treated fabrics are further made into home textile products like table cover, apron, mitten and pot holder. These are the widely used home textile products and thus repels the flies from home. The four products mentioned above are made in all the three treated materials cotton, viscose and cotton/viscose blend.

4.2.5. TESTING:

The following test methods are used to test the comfort properties, strength, dimensional stability and the performance of the fabric.

- Fly repellency test
- Fabric properties
- Tensile strength
- Stiffness test
- Impact strength
- Abrasion resistance
- Durability of finish

4.2.5.1. Fly repellency test:

The main objective of the project is to produce home textile products and give them anti-fly finish. The treated fabric sample is tested for fly repellency in common areas where we find high fly population. The evidence for fly repellency in the fabric is photographed.

4.2.5.2. Fabric Properties:

Fabric properties have been studied by conducting various tests. Warp count, weft count, ends per inch, picks per inch, design of the fabric and cover factor are the tests carried out using Beasley's balance and counting glass.

4.2.5.3. Tensile strength:

Standard	ASTM C1583
Unit	Elongation-mm
	Tenacity-gf/tex
Sample	20x2.5 cm

Table 4.2 Tensile strength testing details

Tensile strength testing is used to determine how the material will react to forces being applied in tension. As the material is being pulled, its strength along with how much it will elongate is found. One of the properties determined about a material is its ultimate tensile strength (UTS). This is the maximum load the specimen sustains during the test.

4.2.5.4. Stiffness test:

Standard	ASTM D6758-08
Unit	mm
sample	20x2.5 cm

Table 4.3 Stiffness test details

Stiffness testing is done to determine the dimensional stability of the fabric. The sample is placed under the template and it is moved horizontally. When the sample bends and coincides with the mark in the instrument, the reading is noted from scale.

4.2.5.5. Impact strength:

Standard	ASTM D4508
Unit	Inchxlbs
Sample	20x2 cm

Table 4.4 Impact strength test details

This test is carried out to find the impact strength of the fabric. The fabric sample is cut in between to a certain length, one end is attached to the fixed holder and another end is attached to the pendulum. The pendulum is released and the strength required to tear the fabric is found here.

4.2.5.6. Abrasion resistance:

Standard	ASTM D4158-08
Cycles	50
Weight applied	400 g

Table 4.5 Abrasion resistance test details

Abrasion resistance test is used to find the resistance of the fabric againt abrasion. The sample fabric is placed under a weight and abraded against a rough

surface for 50 cycles. The weight loss of the sample after the test gives the abrasion resistance value.

4.2.5.7. Durability of finish:

A standard washing method by using standard detergent in the washing machine is carried out to analyze the durability of the finish on the fabric.

CHAPTER 5

RESULTS AND DISCUSSION

5.1. FLY REPELLENCY TEST:

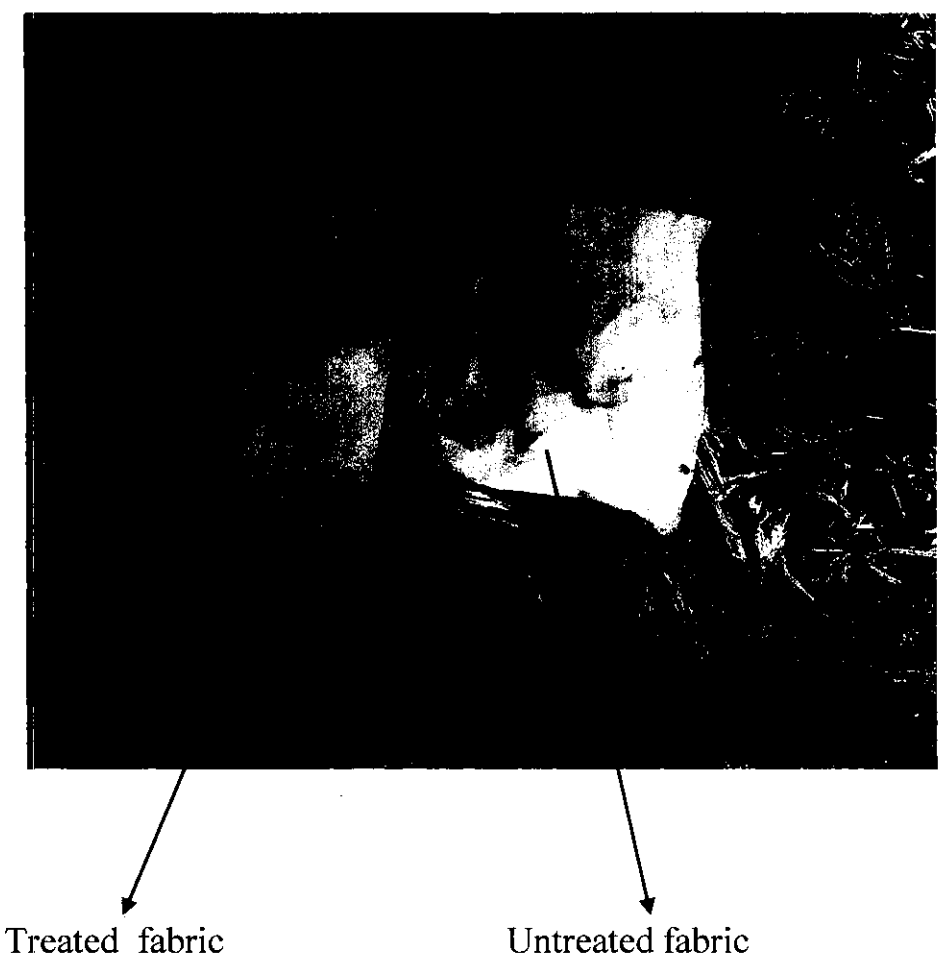

Figure: 5 Fly repellency test-1

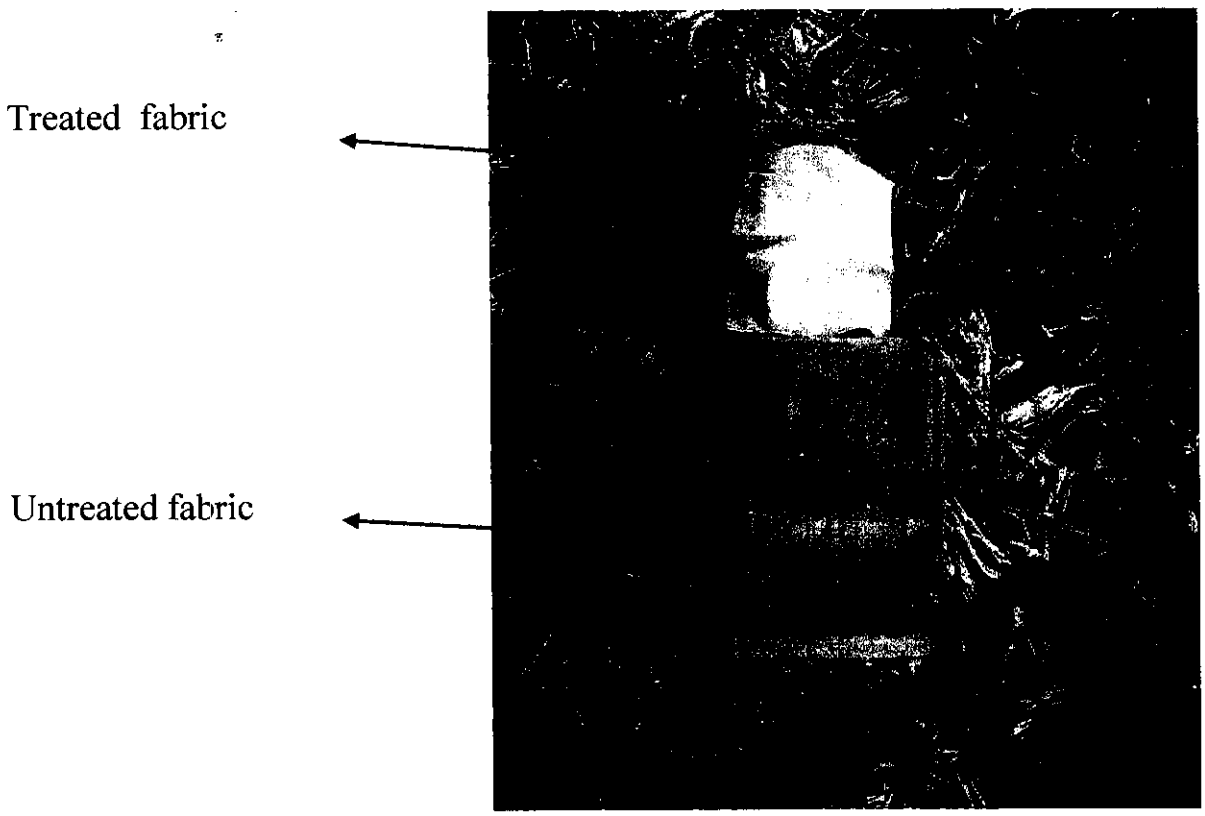

Figure: 6 Fly repellency test-2

From the above figure it is evident that the fabric treated with anti-fly finish has the tendency to repel flies. The test was carried out in a fruit stall having high fly population. Treated and untreated fabrics were placed together for testing and the number of flies rested on the treated fabric was comparatively low.

5.2. FABRIC PARTICULARS:

SPECIFICATIONS	COTTON	VISCOSE	VISCOSE/COTTON
Fabric count-warp way(Ne)	7	9	10
Fabric count-weft way (Ne)	6	9	9
Ends/inch	58	53	65
Picks/inch	56	50	53
Cover factor	16.29	9.25	11.59

Table 5.1 Fabric particulars

The above table shows the fabric particulars including the warp way and weft way count of Cotton, Viscose and Cotton Viscose blend and also the Ends/inch , Picks/inch and cover factor values are found using the ASTM standards.

5.3. TENSILE STRENGTH:

5.3.1. Extension at maximum load (mm):

Material	Warp		Weft	
	Untreated	Treated	Untreated	Treated
Cotton	17.8	16.7	20	18.15
Viscose	15.20	21	19.70	18.30
Viscose/Cotton	11.90	14.05	22.75	18.80

5.2. Extension at maximum load

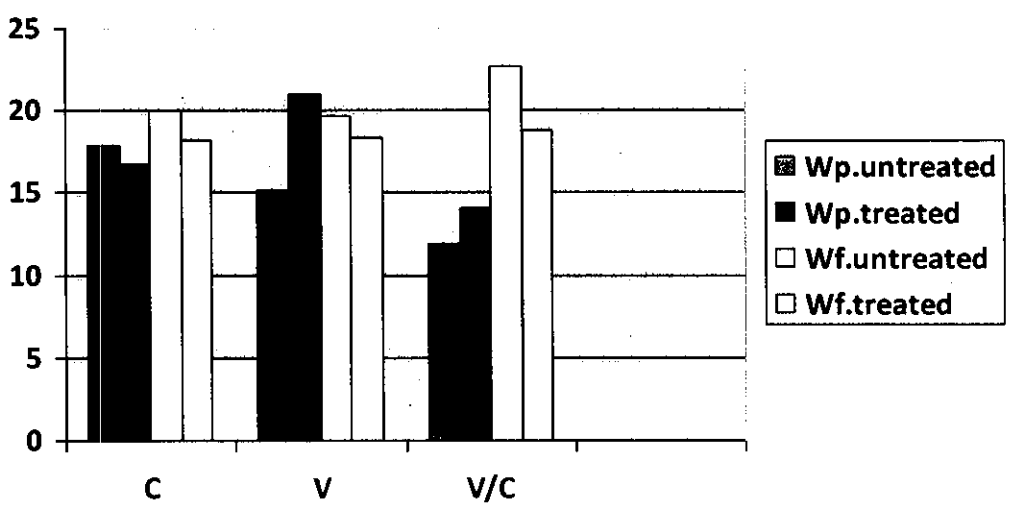

Figure: 7 Extension at maximum load

The extension of the fabric at maximum load decreases in treated fabric when compared to untreated fabric. But in case of Viscose and Viscose/Cotton the warp way extension at maximum load increases in treated fabric when compared to untreated.

5.3.2. Tenacity (gf/tex):

Material	Warp		Weft	
	Untreated	Treated	Untreated	Treated
Cotton	1790.21	1616.56	1480.75	1569.65
Viscose	1132.41	1032.98	1140.82	1159.53
Viscose/Cotton	1348.09	1441.91	1175.88	1217.27

5.3. Tenacity

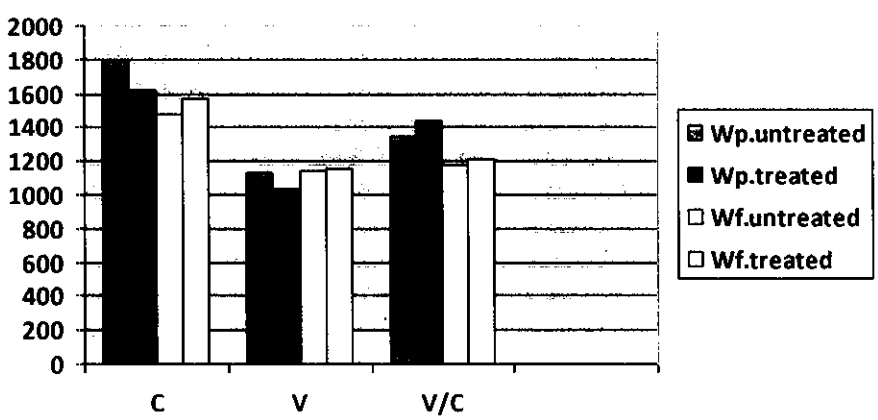

Figure: 8 Tenacity

From the result it is evident that the tenacity of treated Cotton and Viscose fabric decreases in warp way when compared to untreated fabrics and the tenacity increases for treated fabrics in weft way.

5.4. STIFFNESS TEST:

Materials	Warp		Weft	
	Untreated	Treated	Untreated	Treated
Cotton	2.0333 cm	2.208cm	2.0888 cm	2.210cm
Viscose/ Cotton	1.8440 cm	2.155cm	1.9221 cm	1.966cm
Viscose	2.2633 cm	2.241 cm	2.0190 cm	1.866 cm

5.4. Stiffness Test

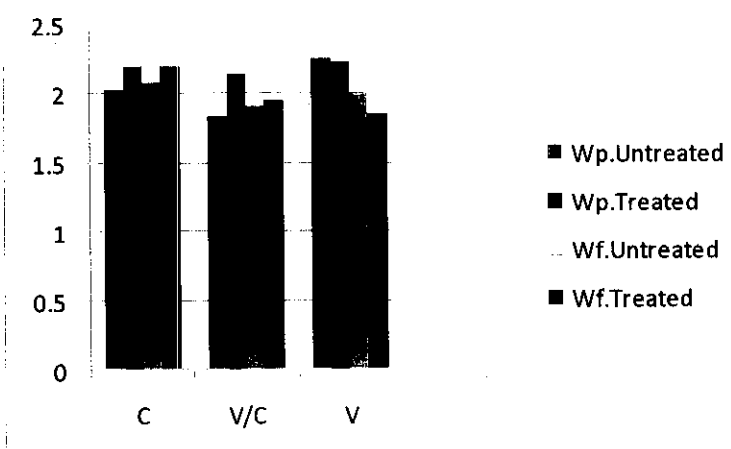

Figure: 9 Stiffness

From the result it is evident that the stiffness of the Cotton and cotton/viscose blend fabric has increased after being treated with the anti-fly finish. But in case of Viscose fabric the stiffness has been decreased.

5.5. IMPACT STRENGTH:

Materials	Warp		Weft	
	Untreated	Treated	Untreated	Treated
Cotton	105	103	104	109
Viscose/ Cotton	101	103	104	93
Viscose	90	90	95	92

5.5. Impact Strength

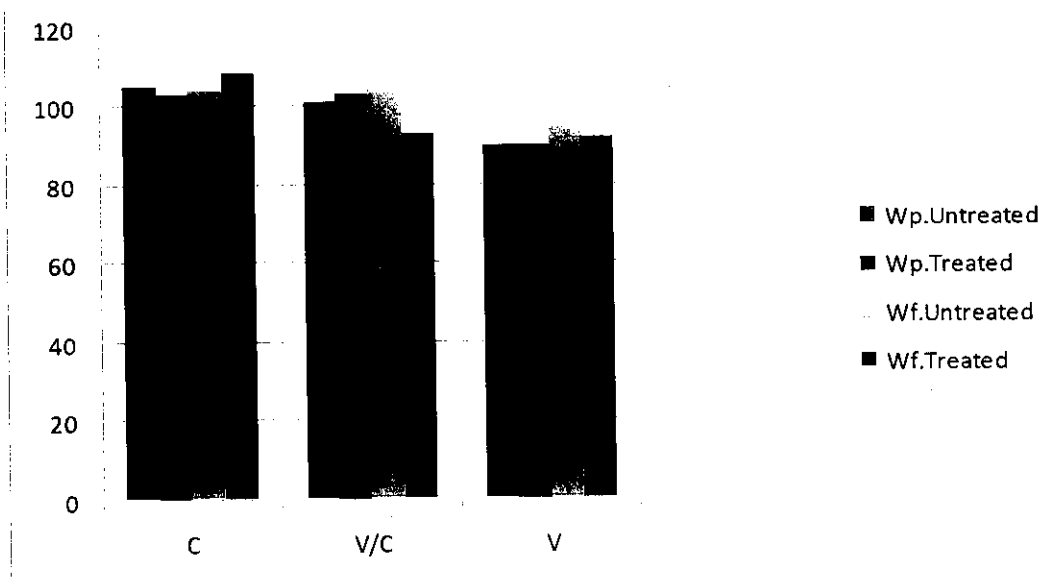

Figure: 10 Impact Strength

The impact strength of the untreated and treated fabrics more or less remains the same with slight variations in the values. Thus it is evident that the application of finish does not affect the fabric's impact strength.

5.6. ABRASION RESISTANCE:

Materials	Untreated	Treated
Cotton	6.8 mg	7.5 mg
Viscose/ Cotton	5.8 mg	6.2 mg
Viscose	7.4 mg	8 mg

5.6. Weight loss in abrasion

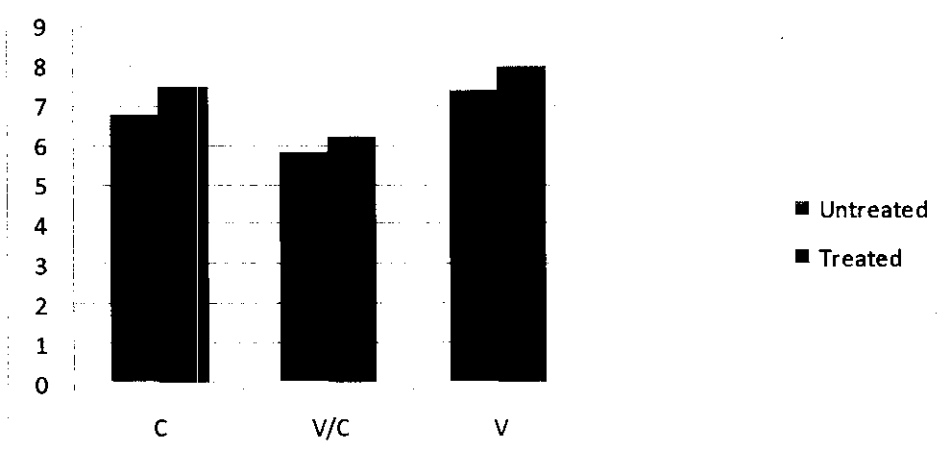

Figure: 11 Weight loss in abrasion

From the above table and chart it is evident that the weight loss in treated fabric is high when compared to untreated fabric. It may be attributed due to the effect of application of finish.

5.7. THICKNESS:

Material	Untreated	Treated
Cotton	0.65 mm	0.66mm
Viscose/ Cotton	0.45mm	0.50mm
Viscose	0.37mm	0.41mm

5.7. Thickness

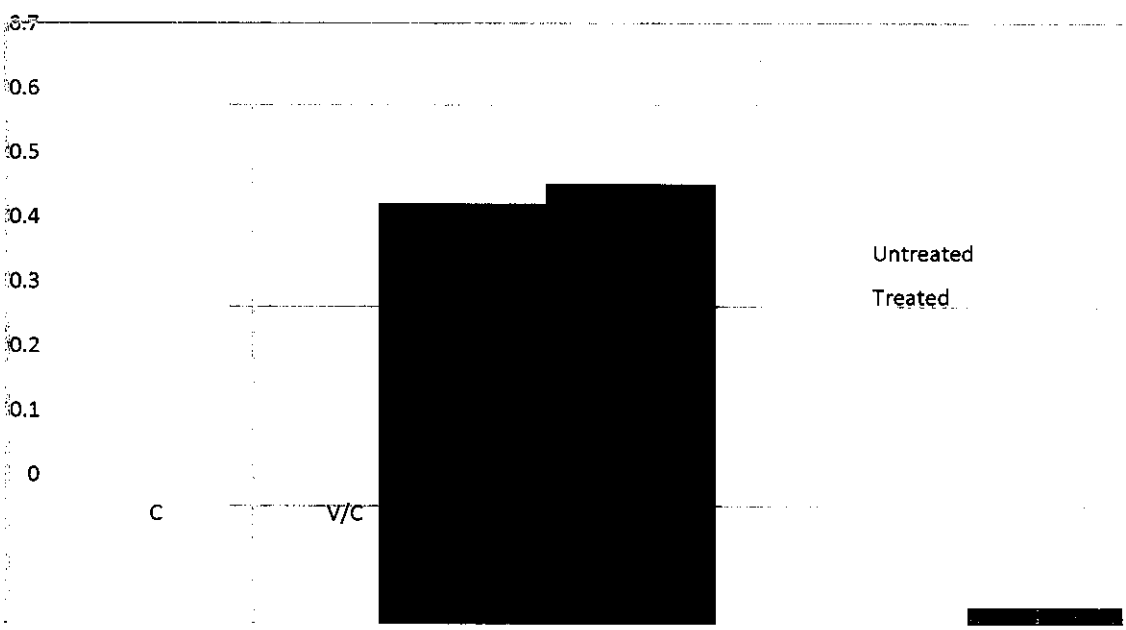

Figure: 12 Thickness

From the above chart it is understood that the thickness of the fabric increases after the application of finish.

5.8. Durability of finish:

It was found that the applied finishing agent will withstand on the fabric up to 17 washes. So the applied finishing agent is sufficient to repel the fly for a long period.

CHAPTER 6

CONCLUSION

From the above study we conclude the following:

- The fabric has the tendency to repel flies after being treated with anti-fly finish.
- The extension of the treated fabric at maximum load decreases and the tenacity also decreases in warp way but increases in weft way.
- The stiffness and thickness of the fabric gets increased after being treated with the finishing agent.
- Impact strength more or less remains the same in the treated and untreated fabric.
- The finish withstands up to 17 washes.

So, from the above result we conclude that the finishing agents used for anti-fly finish serves its purpose and it is recommended that it can be applied to all kind of home textile products.

CHAPTER 7

SCOPE FOR FUTURE WORK

- The same finishing agents can be tried for other materials
- Application of finishing agents to the material can be varied
- The same finishing agents can be tried for other than home textile products.
- An alternative finishing agents can be identified for anti-fly finish

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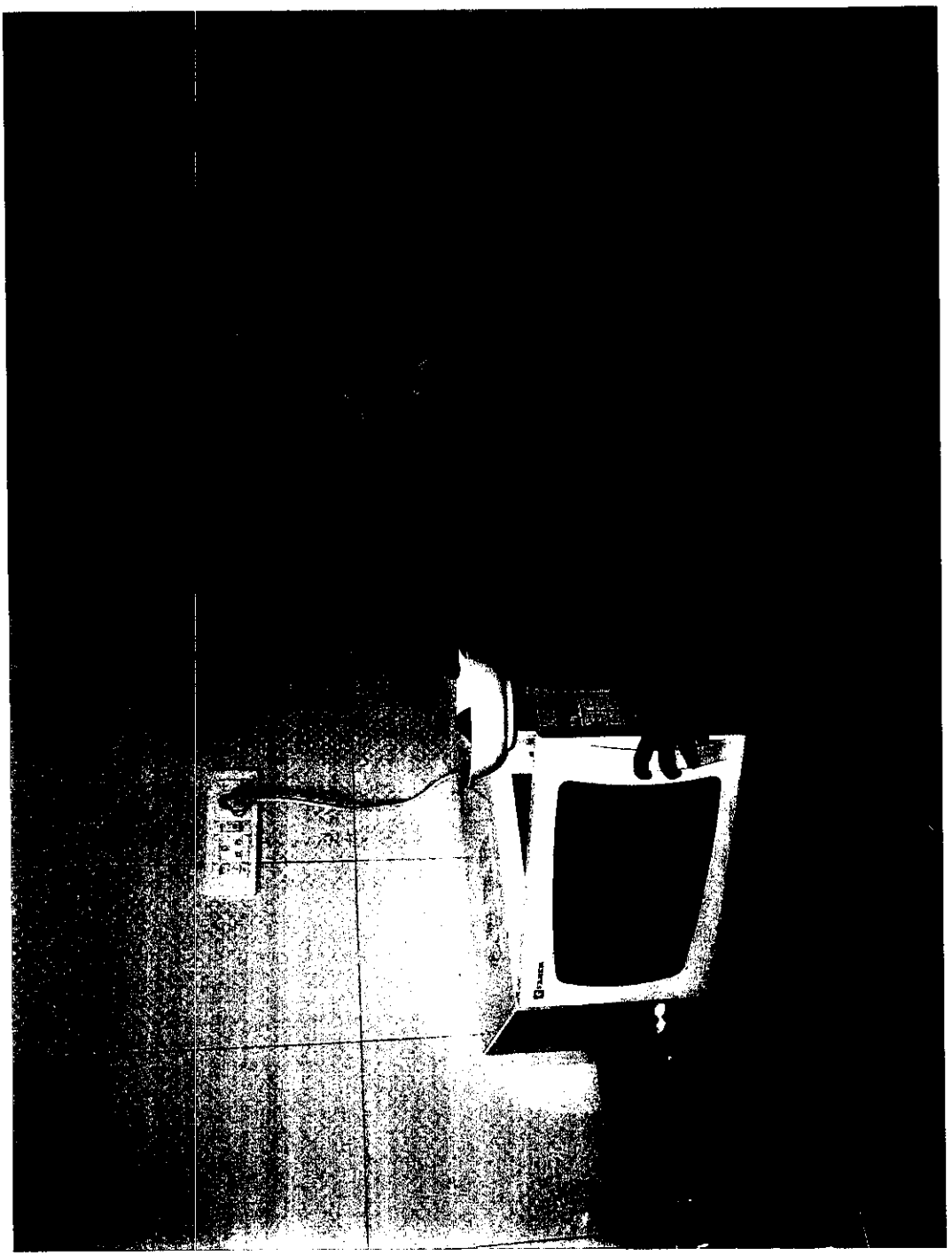
CHAPTER 8

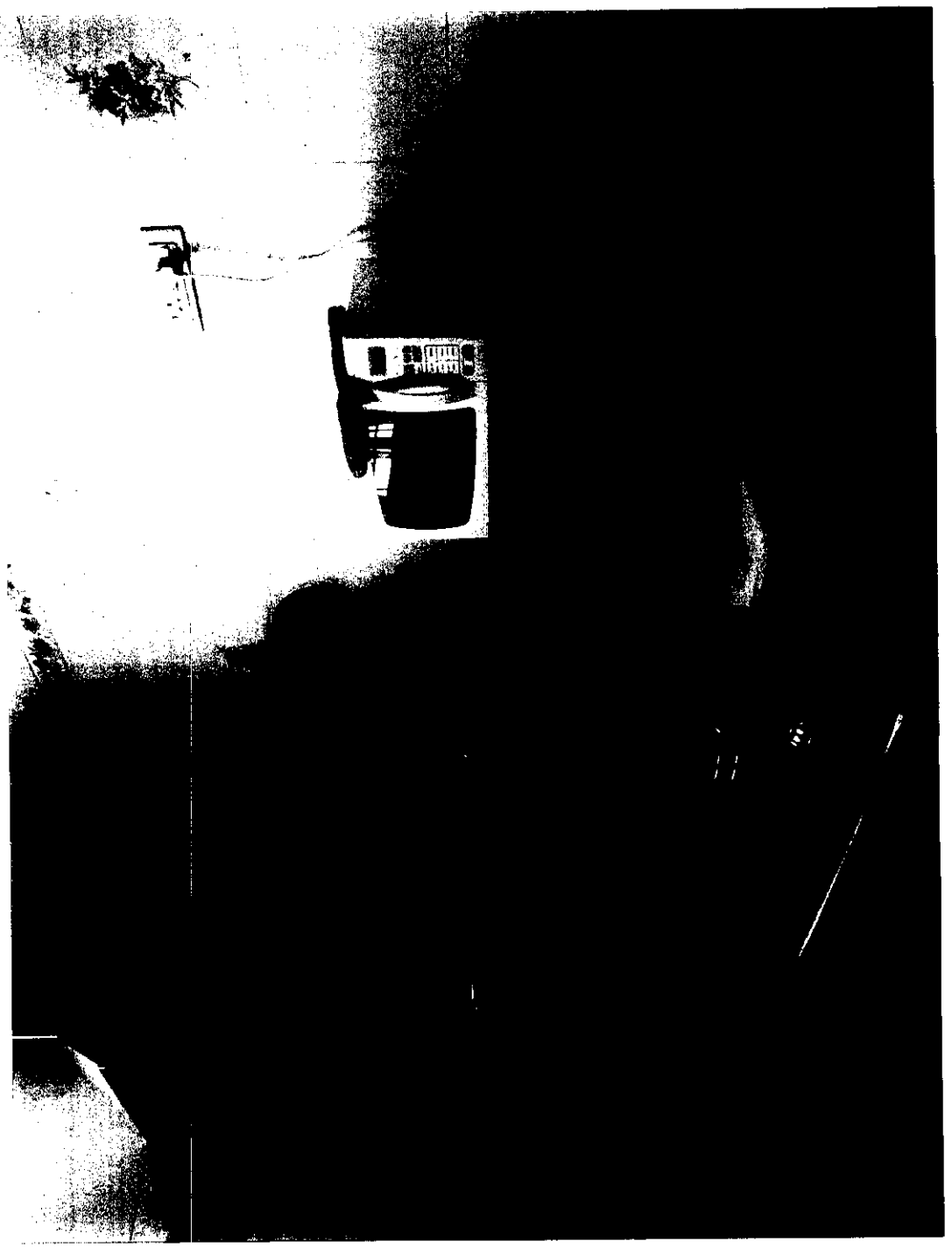
APPENDIX

Products made from 100% pure cotton, 100% pure viscose and viscose/cotton blend fabric.

Products made from 100% pure cotton fabric.

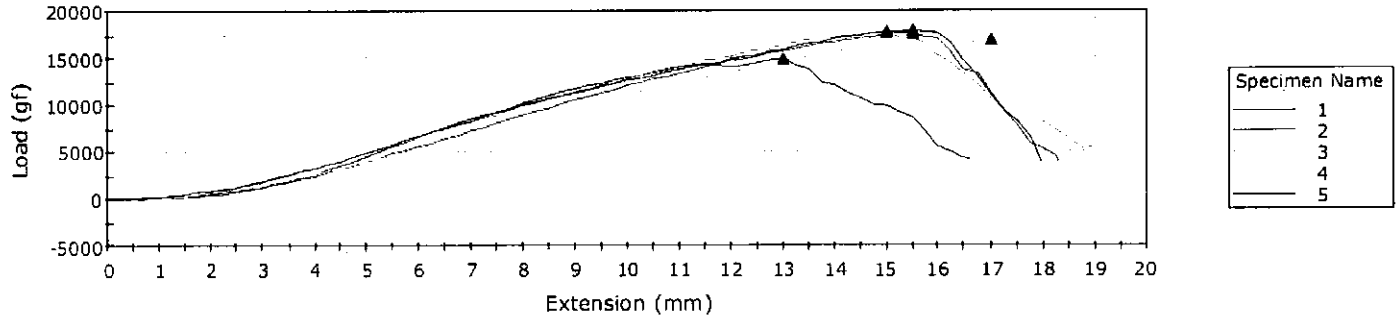


Products made from 100% pure cotton fabric.



Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: 100% Viscose Untreated - Warp
Thickness (mm)

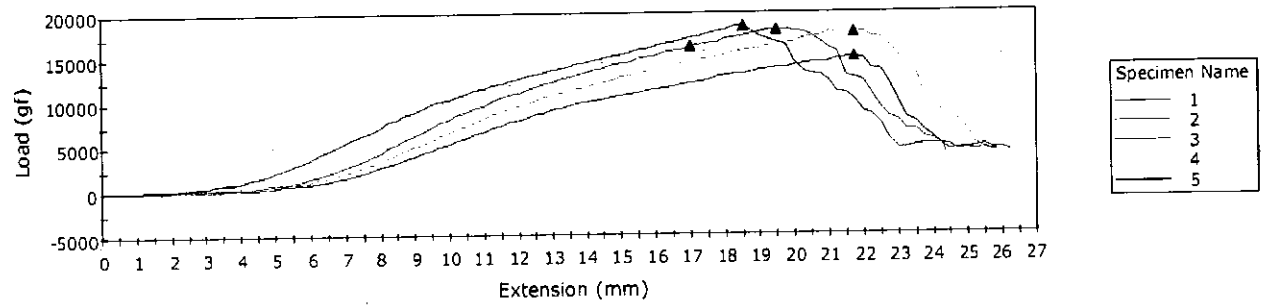
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	14817.72	13.00	987.85
2	17649.32	15.50	1176.62
3	17709.17	15.00	1180.61
4	16848.26	17.00	1123.22
5	17906.16	15.50	1193.74
Minimum	14817.72	13.00	987.85
Maximum	17906.16	17.00	1193.74
Range	3088.44	4.00	205.90
Median	17649.32	15.50	1176.62
Mean	16986.13	15.20	1132.41
Standard Deviation	1277.69771	1.44047	85.17985
Coefficient of Variation	7.52201	9.47680	7.52201

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: 100% Viscose Untreated - Weft
Thickness (mm)

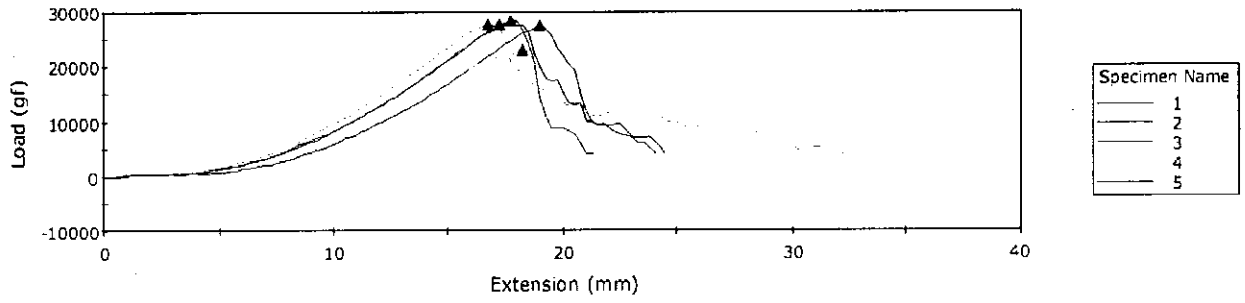
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	14971.60	21.75	998.11
2	18143.63	19.50	1209.58
3	17812.77	21.75	1187.52
4	16194.24	17.00	1079.62
5	18439.14	18.50	1229.28
Minimum	14971.60	17.00	998.11
Maximum	18439.14	21.75	1229.28
Range	3467.54	4.75	231.17
Median	17812.77	19.50	1187.52
Mean	17112.28	19.70	1140.82
Standard Deviation	1478.19282	2.07191	98.54619
Coefficient of Variation	8.63820	10.51738	8.63820

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Cotton Untreated - Warp
Thickness (mm)

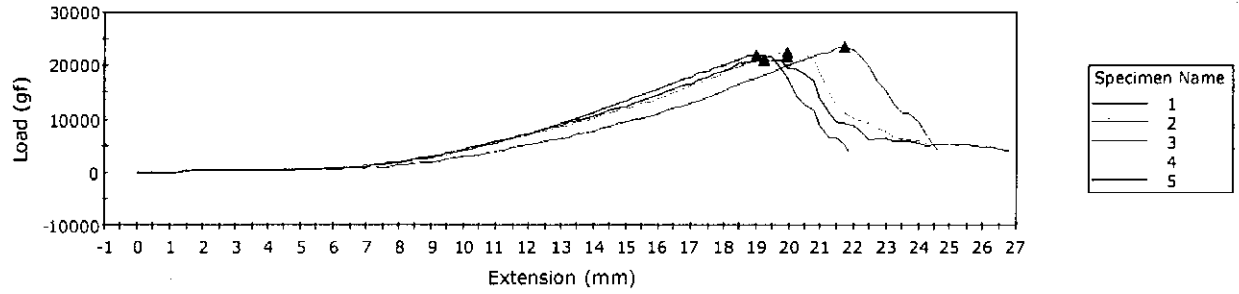
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	27435.52	19.00	1829.03
2	28377.01	17.75	1891.80
3	27659.10	16.75	1843.94
4	22980.35	18.25	1532.02
5	27813.51	17.25	1854.23
Minimum	22980.35	16.75	1532.02
Maximum	28377.01	19.00	1891.80
Range	5396.66	2.25	359.78
Median	27659.10	17.75	1843.94
Mean	26853.10	17.80	1790.21
Standard Deviation	2192.69911	0.87323	146.17994
Coefficient of Variation	8.16554	4.90580	8.16554

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Cotton Untreated - Weft
Thickness (mm):

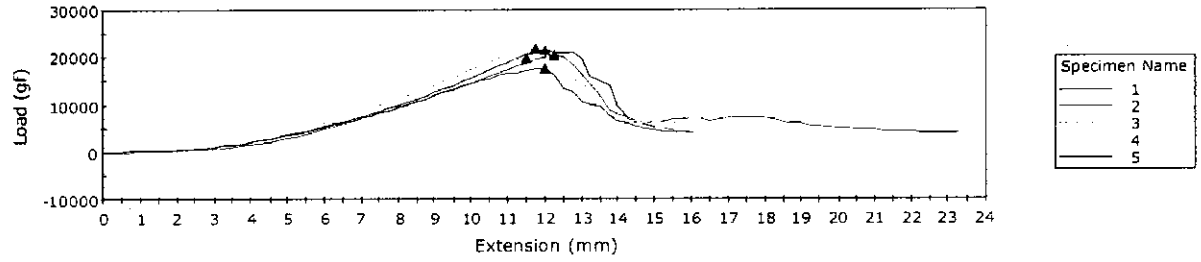
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	21115.06	19.25	1407.67
2	23568.59	21.75	1571.24
3	22678.15	20.00	1511.88
4	21785.17	20.00	1452.34
5	21909.30	19.00	1460.62
Minimum	21115.06	19.00	1407.67
Maximum	23568.59	21.75	1571.24
Range	2453.53	2.75	163.57
Median	21909.30	20.00	1460.62
Mean	22211.25	20.00	1480.75
Standard Deviation	940.04319	1.07530	62.66955
Coefficient of Variation	4.23228	5.37654	4.23228

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Cotton Viscose Untreated - Warp
Thickness (mm):

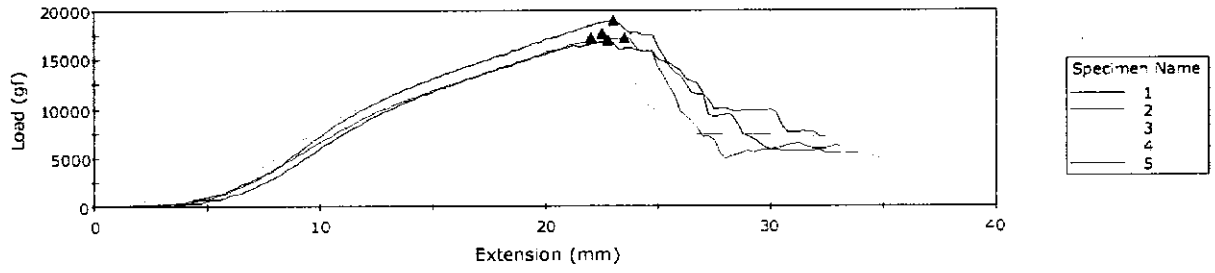
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	21488.04	12.00	1432.54
2	20458.42	12.25	1363.89
3	21588.48	11.75	1439.23
4	19930.85	11.50	1328.72
5	17641.14	12.00	1176.08
Minimum	17641.14	11.50	1176.08
Maximum	21588.48	12.25	1439.23
Range	3947.34	0.75	263.16
Median	20458.42	12.00	1363.89
Mean	20221.39	11.90	1348.09
Standard Deviation	1602.47019	0.28506	106.83135
Coefficient of Variation	7.92463	2.39548	7.92463

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Cotton Viscose Untreated - Weft
Thickness (mm)

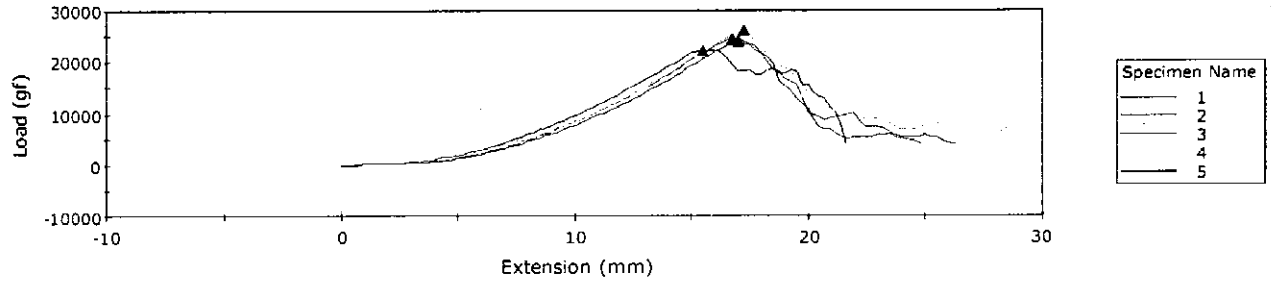
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	17018.90	22.75	1134.59
2	17221.64	23.50	1148.11
3	17636.58	22.50	1175.77
4	17274.87	22.00	1151.66
5	19039.00	23.00	1269.27
Minimum	17018.90	22.00	1134.59
Maximum	19039.00	23.50	1269.27
Range	2020.11	1.50	134.67
Median	17274.87	22.75	1151.66
Mean	17638.20	22.75	1175.88
Standard Deviation	814.14400	0.55910	54.27627
Coefficient of Variation	4.61580	2.45760	4.61580

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Treated Cotton - Warp
Thickness (mm)

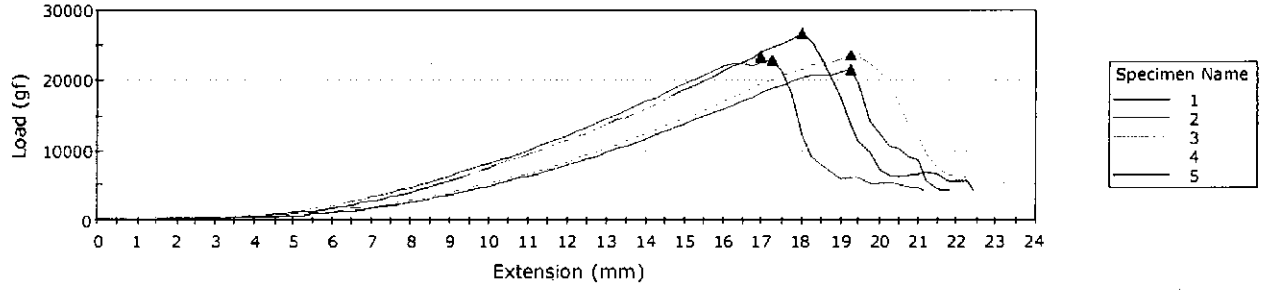
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	22347.84	15.50	1489.86
2	24495.56	16.75	1633.04
3	26080.20	17.25	1738.68
4	24334.15	17.00	1622.28
5	23984.14	17.00	1598.94
Minimum	22347.84	15.50	1489.86
Maximum	26080.20	17.25	1738.68
Range	3732.36	1.75	248.82
Median	24334.15	17.00	1622.28
Mean	24248.38	16.70	1616.56
Standard Deviation	1332.84281	0.69369	88.85619
Coefficient of Variation	5.49663	4.15390	5.49663

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Treated Cotton - Weft
Thickness (mm):

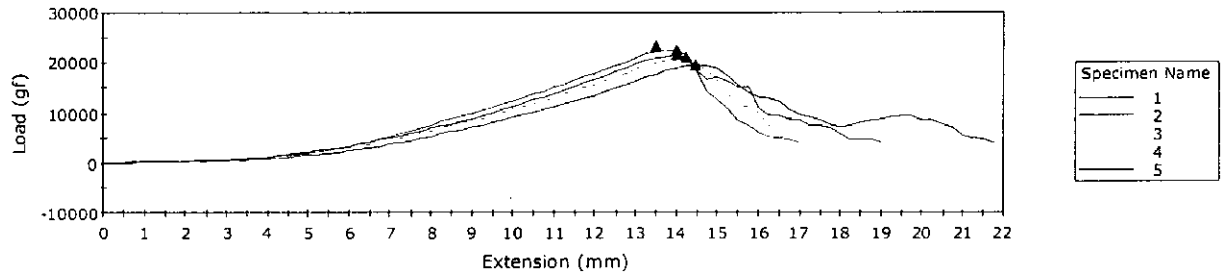
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	26594.47	18.00	1772.96
2	22769.27	17.25	1517.95
3	23496.55	19.25	1566.44
4	23344.06	17.00	1556.27
5	21519.50	19.25	1434.63
Minimum	21519.50	17.00	1434.63
Maximum	26594.47	19.25	1772.96
Range	5074.97	2.25	338.33
Median	23344.06	18.00	1556.27
Mean	23544.77	18.15	1569.65
Standard Deviation	1873.92452	1.06949	124.92830
Coefficient of Variation	7.95898	5.89258	7.95898

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Treated Cotton Viscose - Warp
Thickness (mm)

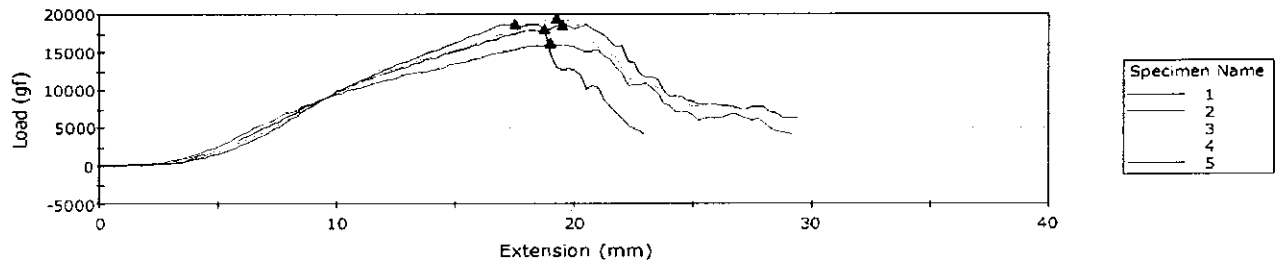
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	19594.84	14.50	1306.32
2	22579.71	14.00	1505.31
3	21203.87	14.25	1413.59
4	23454.09	13.50	1563.61
5	21311.08	14.00	1420.74
Minimum	19594.84	13.50	1306.32
Maximum	23454.09	14.50	1563.61
Range	3859.25	1.00	257.28
Median	21311.08	14.00	1420.74
Mean	21628.72	14.05	1441.91
Standard Deviation	1470.92056	0.37066	98.06137
Coefficient of Variation	6.80078	2.63813	6.80078

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Treated Cotton Viscose - Weft
Thickness (mm)

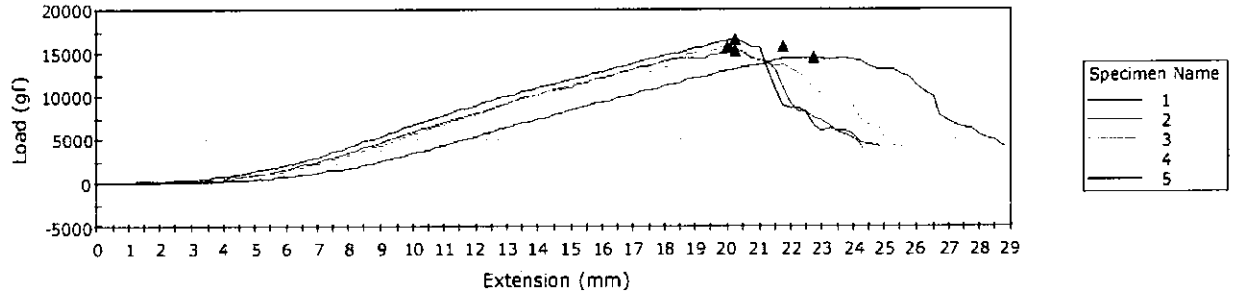
Specimen 1 to 5



		Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
	1	18618.27	19.50	1241.22
	2	16137.26	19.00	1075.82
	3	19555.01	19.25	1303.67
	4	18140.12	18.75	1209.34
	5	18844.93	17.50	1256.33
Minimum		16137.26	17.50	1075.82
Maximum		19555.01	19.50	1303.67
Range		3417.75	2.00	227.85
Median		18618.27	19.00	1241.22
Mean		18259.12	18.80	1217.27
Standard Deviation		1291.11780	0.77853	86.07452
Coefficient of Variation		7.07108	4.14116	7.07108

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Treated Viscose - Warp
Thickness (mm)

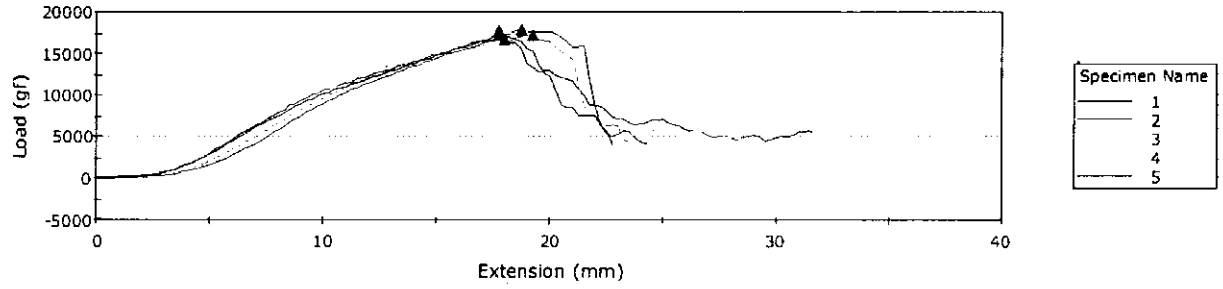
Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	16468.15	20.25	1097.88
2	15096.58	20.25	1006.44
3	15747.57	20.00	1049.84
4	15677.29	21.75	1045.15
5	14483.57	22.75	965.57
Minimum	14483.57	20.00	965.57
Maximum	16468.15	22.75	1097.88
Range	1984.58	2.75	132.31
Median	15677.29	20.25	1045.15
Mean	15494.63	21.00	1032.98
Standard Deviation	745.95146	1.19894	49.73010
Coefficient of Variation	4.81426	5.70929	4.81426

Project Title: Designing and Applying antifly finish in home textiles
Specimen Label: Treated Viscose - Weft
Thickness (mm)

Specimen 1 to 5



	Maximum Load (gf)	Extension at Maximum Load (mm)	Tenacity at Maximum Load (gf/tex)
1	16766.11	18.00	1117.74
2	17891.69	18.75	1192.78
3	17262.03	19.25	1150.80
4	17814.54	17.75	1187.64
5	17230.11	17.75	1148.67
Minimum	16766.11	17.75	1117.74
Maximum	17891.69	19.25	1192.78
Range	1125.58	1.50	75.04
Median	17262.03	18.00	1150.80
Mean	17392.89	18.30	1159.53
Standard Deviation	464.50511	0.67083	30.96701
Coefficient of Variation	2.67066	3.66580	2.67066