MOSQUITO REPELLENT FINISH ON HOME FURNISHING FABRICS

A PROJECT REPORT

Submitted by

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In partial fulfillment for the award of the Degree

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BACHELOR OF TECHNOLOGY

in

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(An Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

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KUMARAGURU COLLEGE OF TECHNOLOGY

(An Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

BONAFIDE CERTIFICATE

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TO WHOM SO EVER IT MAY CONCERN

The following final year B. Tech. Fashion Technology students of Kumaraguru College of Technology. Coimbatore-49

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Under the guidance of Dr.G.Ramakrishnan, **Associate Professor (TIFAC CORE)** has carried out a project on **Mosquito repellent finish on Home furnishing fabrics**. The finishing treatments were given at the laboratory of **M/s CLARIANT CHEMICALS (I) Ltd, TIRUPUR.**

The outcome of the finishing treatments is effective on the above fabrics and will be very useful to the society at large in control and prevention of diseases.

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We the students of the project give our entire honor to **'THE ALMIGHTY'** for blessing this combined works of our hand.

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ABSTRACT

In this project an attempt has been made to develop Mosquito repellent fabrics for home furnishing fabrics.2/20's Ne cotton yarns were procured from mills and used for the manufacture of the home furnishing fabrics as per the required fabric construction.

Subsequently the fabrics were finished using natural mosquito repellents by pad dry cure method such as eucalyptus, tulsi and combination of eucalyptus and tulsi oil. Performances of all the three samples were evaluated using modified excito chamber method (AATCC 24-1999) for mosquito repellency.

All the fabric samples were tested for properties such as air permeability, abrasion resistance and drape for before and after treatments and results have been reported.

From the performance test carried out on the three samples it was observed that the fabric treated with a combination of tulsi and eucalyptus had the highest mosquito repellency of 96%.

INTRODUCTION

1. INTRODUCTION

Today's era is the one of modernization of the textile industry or the world of textile. Every sector of textile and every field related to textiles is developing with the advancements taking place. Smart textiles or functional textiles are one such field. Protective textiles are among one such smart application of smart technology in textiles. Protective textiles refer to those textile products which have a functionality of giving protection from something in some or the other sense.

These can be mosquito repelling or may be insect repelling and also may be anti-bacterial and anti-fungal. These may also be heat and cold resistant or with any other property. Although this sector contributes 1% to the total sales of the smart textiles, still has a good scope for growth. Because of global warming the distribution of mosquitoes has expanded from tropical regions to northern latitudes, and that leads to a spread in sources of viral infection from mosquitoes.

Especially, the West Nile fever virus, which has infected many people around the world recently, has become a big issue. West Nile fever occurs routinely in Africa as its virus was first recognized in humans at the West Nile District of Uganda in 1937, and then infections were confirmed in Israel, France and South Africa and it is now showing signs of spreading further all over the world. The first outbreak occurred in New York City in 1999, which spread rapidly to over 4000 people all over the U.S. and killed over 240 people.

It is likely that the virus arrived via wild birds imported as pets and via plane or boat in an infected mosquito. Persons diagnosed with the disease have recently even been confirmed in the island country of Japan with the wave of globalization, and the Ministry of Health, Labour and Welfare requires cases be reported to prefectural governors under regulations for disease control and prevention.

Having observed from the above facts about mosquitoes and dangerous disease that it spread on humans, it was decided to take up this project on mosquito repellency for home furnishing fabrics.

LITERATURE SURVEY

2. LITERATURE SURVEY

2.1 PREVIOUS WORK DONE

V.Krishnaveni (2005) published a paper on mosquito repellent finish on textiles and found that cotton fabrics treated with mosquito repellent N-N Diethyl Benz amide gave 100% mosquito repellency.

Tanveer Malik, et,all (2004) Published a paper on mosquito repellent finish on textiles and observed that by giving a mosquito repellent finish to textile fabrics it can be protect human beings from dangerous disease. The paper also discussed many research and developments in the area of mosquito repellent textiles.

2.2 MECHANISM OF REPELLENT ACTION

The action of repellent agent for blood-sucking insects including mosquitoes can be broadly divided into two types which are actions to repel insects by acting on the olfactory and tactile senses.

Action of repellent on sense of smell is called transpiration repelling, and this has the effect of keeping insects away without them touching a surface processed with the repellent agent. How it works is that repellent molecules block insects humidity sensory holes, which makes humans inaccessible to insects by inhibiting the function of sensing moisture, while insects usually use warm and humid convection rising from the human body as a guide for contacting humans sensing an increase in atmospheric carbon dioxide concentrations.

Action of repellent stimulating sense of touch is called direct-contact repelling, and this drives insects off the processed surface before blood sucking even after touching the surface.

It is believed that repellent substances work on insects peripheral nervous systems when contact is made, causing a collaterally-expressed confusional state and inhibition under sub lethal doses before knockdown and lethal action.

Microencapsulation is one another technique which the clothing manufacturers of this field are using to add value to their ranges. This technology is still relatively new to the textile and apparel industry.

This innovative technology makes use of micro capsules which act as tiny containers of solids or liquids. These containers release their core contents under controlled conditions to suit a specific purpose.

With realization of Microencapsulation, Aninsen CLC-3600 makes possible anti-mosquito finishing on textiles which require washing fastness.
Microencapsulation is already used to impart a wide range of features, including:

1. Insect-repellent and insect-resist treatments
2. Anti-microbial and deodorizing finishes
3. The controlled release of active substrates

2.3 MATERIALS FOR MOSQUITO REPELLECY ON TEXTILES

- Natural mosquito repellents
- Synthetic mosquito repellents

2.3.1NATURAL MOSQUITO REPELLENTS

- Neem oil
- Tulsi oil
- Eucalyptus oil

NEEM

Neem is a fast-growing tree that can reach a height of 15-20 m (about 50-65 feet), rarely to 35-40 m (115-131 feet). It is evergreen, but in severe drought it may shed most or nearly all of its leaves. The branches are wide spread. The fairly dense crown is roundish or oval and may reach the diameter of 15-20 m in old, free-standing specimens.

The samples were padded in the padding mangle and then dried at 80 °C. Then curing was done at 120 °C. But the smell of neem oil, which is the main factor in repellent mosquitoes was found to be absent from the samples. Hence, recipe was precipitated. So neem oil is not suitable for this finish.

TULSI

- The Tulsi (also known as tulasi) plant or Holy basil (Ocimum sanctum) is an important symbol in the Hindu religious tradition. The name "Tulsi" means "the incomparable one".
- Tulsi is a venerated plant and Hindus worship it in the morning and evening.

- Tulsi grows wild in the tropics and warm regions. Dark (Krishna) tulsi and light or Rama tulsi are the two main varieties of basil. The former possesses greater medicinal value and is commonly used for worship.
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- Dark (Krishna) tulsi and light or Rama tulsi are the two main varieties or basil. The former possesses greater medicinal value and is commonly used for worship. Tulsi – Tulsi as a deity.
- The eugenol is responsible for providing necessars protection against mosquitos.

EUCALYPTUS

Eucalyptus oil has many germicidal and anti-congestion properties that helps in relieving various ailments.

Eucalyptus oil is derived from the leaves and stems of the eucalyptus tree, also known as Eucalyptus globules or fever tree, which is a tall tree with leaves that are pointed, bluish-green in color, and highly aromatic.

The Eucalyptus oil is extracted by a process of steam distillation, with about 110 pounds of the leaves or stems required to make 2 pounds of oil. It is thought that the therapeutic properties of eucalyptus oil was probably first known by the Aborigines of Australia, since the plant originates from there, who had used it to treat fevers and skin problems.

- Aroma therapists and herbalists today use eucalyptus oil for a wide variety of therapeutic benefits. The aromadendrene is responsible for providing necessars protection against mosquitos.

PROPERTIES OF EUCALYPTUS

Eucalyptol is the chief active ingredient that eucalyptus oil consists of, along with other elements like valeraldehyde, sequiterpene, terpineol, pinocarveol, pinen, camphen globulal, cineol, fenchen, and butylaldehyde.

Eucalyptus oil has a warming effect on muscles and feels cool on the skin. It has strong antiseptic, antiviral and antibacterial properties. It is also helpful for relieving fevers and coughs, lowering blood sugar, and is also a diuretic.

Mainly because of its anti-inflammatory properties, eucalyptus oil is often used as an ingredient in preparations made for relieving join, nerve, and muscle pains.

Psychologically, it helps in combating exhaustion and dispelling mental lassitude. Its beneficial effects can be felt when it is used. Many therapists consider eucalyptus oil as universal oil which can be used in its undiluted form on the skin of adults.

However, others advise caution about using it directly on the skin, and instead suggest that it be diluted in massage lotion or carrier oil.Eucalyptus oil is one of the most popular amongst the essential oils since one of its properties is enhancing the effects.

2.3.2 SYNTHETIC MOSQUITO REPELLENTS

- N-N Diethyl Benz amide
- Permethrin
- Prallethrin
- Deet
- Malathion
- Allethrin

These are the some of synthetic mosquito repellent chemicals, used by millions of people worldwide for 40 years; deet has a remarkable safety profile. As part of the 1980 epa registration standard for deet more than 30 studies were conducted to assess acute, chronic and sub chronic toxicity,mutagenicity,oncogenicity and developmental reproductive and neurologic toxicity.

The result of these studies did not require any change to the product to comply with epa safety standards, nor did they indicate any new toxicities with normal use.

Studies for high doses of deet orally administrated to mice and rats did not reveal any potential in humans for teratogenicity or oncogenicity.

2.4 RESEARCH AND DEVELOPMENT

The following research and development work have been found from the literature on mosquito repellency. They are as follows,

- The development of highly specific and efficient mosquito attractants.

- The design and optimization of novel trap systems for mosquitoes and other Hematophageous insects, for the professional and retail markets.

- The development of an effective approach for the monitoring and surveillance of dengue Mosquitoes in Brazil, using cheap attractants and simple traps.

- Using repellents and traps to create an efficient and non-toxic push and pull system to Control mosquitoes at home.

- The development of improved fly bait.

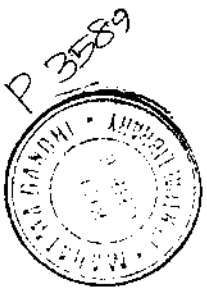
- Developing traps and attractants for sandflies.

OBJECTIVES

3. OBJECTIVES

- Providing mosquito repellent finish on woven home furnishing fabrics using natural mosquito repellent such as tulsi oil, eucalyptus oil, and combination of both.
- To evaluate the mosquito repellency for all the three types of natural repellents used on the above fabrics
- All the samples will be tested for properties such as air permeability, abrasion resistance and drape for before and after treatments so as to study the influence of finish on them.

MATERIALS AND METHODOLOGY



4. MATERIALS AND METHODOLOGY

4.1 MATERIALS

100% cotton home furnishing fabric with following constructional details have been procured from mills, and used for the study.

4.1.1 FABRIC USED

Type of weave : plain

Type of fabric : woven (100% cotton)

Count : $2/20^{s}$ Ne

Epi : 44

Ppi : 34

Crimp% : 12

Cover factor : 19.3

Gsm : 200

4.1.2 CHEMICALS USED

The following natural mosquito repellents were procured and used for the study.

NATURAL MOSQUITO REPELLENT

- Eucalyptus oil
- Tulsi oil
- Neem oil

4.2 METHODOLOGY

PADDING

A process of continuous dyeing in which the fabric in open width is padded with finishing chemical and, if necessary, with a wetting agent, nonionic acrylic binder, Nano softener and cured.

- Pick up – 70%
- Dry on wet

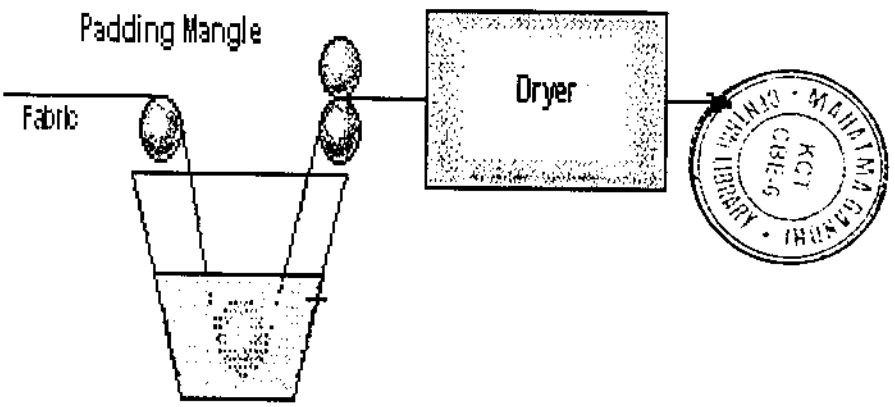


Fig.1.diagram showing the padding mangle

4.3 RECIPE USED FOR THE FINISHES

4.3.1 EUCALYPTUS OIL

RECIPE

Binder	6%
Eucalyptus oil	2%
DAP (Di – Ammonium phosphate)	1%
Water	91%

Table-4.1 shows the recipe for eucalyptus oil

The samples were padded in the padding mangle and then dried at 80°C. Then during curing was done at 120°C. But the smell of eucalyptus oil, which is the main factor in repellent mosquitoes was found to be absent from the samples. Hence, the process was modified and only padding and drying at room temperature was carried out.

4.3.2 TULSI OIL

RECIPE

Binder	6%
Tulsi oil	2%
DAP (Di-ammonium phosphate)	1%
Water	91%

Table-4.2 shows the recipe for tulsi oil

The samples were padded in the padding mangle and then dried at 80 °C. Then curing was done at 120 °C. But the smell of tulsi oil, which is the main factor in repellent mosquitoes was found to be absent from the samples.

Hence, the process was modified and only padding and drying at room temperature was carried out.

4.3.3 COMBINATION OF EUCALYPTUS AND TULSI

RECIPE

Binder	10%
Eucalyptus + Tulsi oil	3%
DAP (Di-ammonium phosphate)	1%
Water	86%

Table-4.3 shows the recipe for combination of eucalyptus and tulsi

The samples were padded in the padding mangle and then dried at 80 °C. Then curing was done at 120 °C. But the smell of Eucalyptus oil and tulsi oil which is the main factor in repellent mosquitoes was found to be absent from the samples.

Hence, the process was modified and only padding and drying at room temperature was carried out.

4.4 TESTING METHOD FOR MOSQUITO REPELLENCY

4.4.1 INDOOR TESTS

This procedure complies with a protocol which was developed for the shifting ware test, the germen equivalent of the consumer reports in the United States. The test rooms are air conditioned, and the number, age, and species of text specimen and specimen prepare the mosquitoes used in the study can be controlled. This test is a good alternative field tests: more realistic than cage tests, but possible at any time and at less expense.

4.4.2 CONE TEST

Cone test of an insecticide treated textile mosquitoes (usually malaria mosquitoes, anopheles gambiae) are introduced into a standardized cone for a defined time span, then removed and transferred to small cages to determine the knock down and knock dead rates.

4.4.3 CAGE TESTS

Cages tests are the quick and cost effective way determines the mosquito repelling qualities of treated textiles. They are ideal for product development. The tests follow the acknowledged protocol for cage tests of repellents. For such a test, volunteers cover a defined area of their forearms with the textiles and then present it to hungry mosquitoes in cage.

4.4.4 IMPROVED EXCITO CHAMBER METHOD

Release 30 mosquitoes in a 30 *30 cm mosquito rearing cage relative humidity 60 – 70%. Testing monitor keeps arm wrapped with rolled fabric in the cage for 2 minutes. Measure anti-mosquito effectiveness by counting the number of mosquitoes alighting on the arm during 2 minutes.

The formula for resting rate (%) is shown in the equation (1)

$$\text{Resting rate (\%)} = \frac{\text{The number of resting mosquitoes}}{\text{The number if mosquitoes under (30)}} \times 100 \quad \ldots\ldots\ldots (1)$$

The formula for Repelling rate (%) is shown in the equation (2)

$$\text{Repelling rate (\%)} = \frac{\text{The number of mosquitoes in control Group minutes that of tested group}}{\text{The number of mosquitoes in control group}} \times 100 \quad \ldots\ldots (2)$$

The mosquito repellent test was carried out according to a modified chinese standard GB/T 17322.10-1998. In brief, placing the test fabric sample (4x4 cm^2) over a person's hand back that is covered around by a rubber glove.Inserting the covered hand into a cage (40x30x30 cm^3) containing approximate 300 mosquitoes.

Commonly three tests are selected to perform the same exposure to mosquitoes. The average alighting number and the number of person stung during the time (2 min) that the textile is exposed to mosquitoes are recorded.

Fig.4.2.Diagram showing the Improved Excito Chamber

4.4.5 AATCC LAUNDERING PROCEDURE

All of the AATCC launderings in the examples were done following the AATCC test method 61-2003 test no. 2A. An AATCC standard wash machine (Atlas Launder-Ometer) and detergent (AATCC Standard Detergent WOB) was used.

Samples were cut into 5x15 cm swatches and put into a stainless steel container with 150 ml of 0.15 w/v % WOG detergent solution and 50 steel balls (0.25 in. in diameter) at 49°C for various washing time to mimic 10, 20 and 30 wash cycle of home/commercial launderings. Insecticide retention after launderings was measure and compared.

The instrument and test procedure that were used for in-situ determining te quantity of insecticide remaining in the fabric after launderings is set forth below:

Instrument: A Varian Cary 300 UV-Spectrophotometer.

4.5 TESTING PROCEDURE FOR OTHER FABRIC PROPERTIES

4.5.1 ABRASION RESISTANCE

Abrasion is one aspect of wear and is the rubbing away of the component fibres and yarns of the fabric. Abrasion may be classified into

i) Flex abrasion (the flat area of the fabric is abraded)
ii) Edge abrasion (the kind of abrasion occurs at folds and collars)
iii) Flat abrasion (rubbing is accompanied by flexing and bending.

- To determine the abrasion resistance of the given fabric sample.

PROCEDURE

- Prepare sample of 38mm dia
- The initial weight of the sample is found using electronic balance. Fix the sample in the mushroom shaped sample holder.

- Select suitable weight and place it on the sample holder.
- Start and run the machine for 50 cycles.
- Remove the sample holder from the machine and remove the sample from sample holder.
- Calculate the weight loss and abrasion resistance from the given formulae.

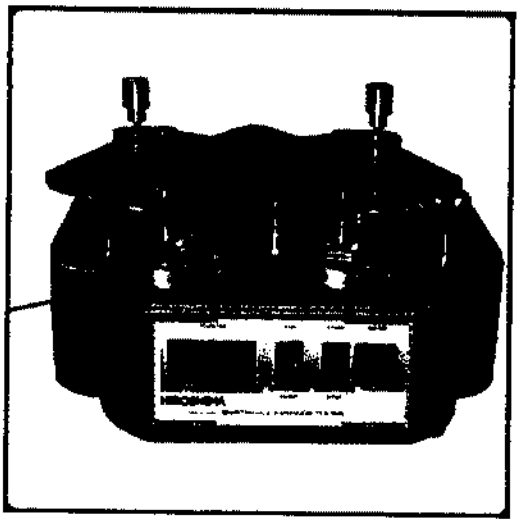


Figure-4.1 shows the Abrasion resistance tester

4.5.2 FABRIC DRAPE

Drape is the ability of a fabric to a assume a graceful appearance in use. Drape ability of a fabric can be determined using the instrument drape meter and is expressed in terms of drape co-efficient.

PROCEDURE

- Prepare a sample of the required size
- Open the transparent lid of drape meter

- Fix the sample over the bottom supporting disc. (platform should be at lowest position)
- Place the top supporting disc and secure it by tightening the screw.
- Release the supporting disc unit and allow to raise by means of a compressed spring. This allows the edge of the fabric to drape freely under its own weight.
- Close the lid and place a white paper over the lid. Switch on the light.

Draw the outline of the projected and area of the specimen. Calculate the drape co-efficient from the formulae.

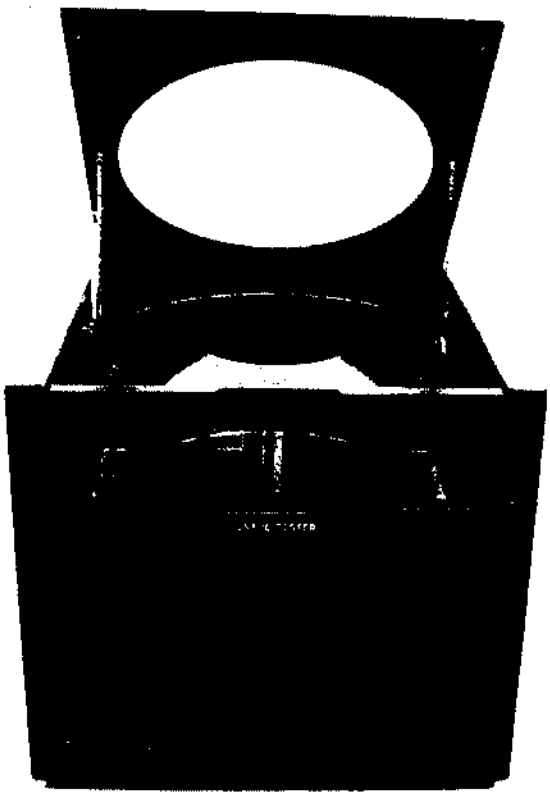


Figure-4.2 shows the Drape meter

4.5.3 AIR PERMEABILITY

Air permeability test provides the air permeability property of the composite. Air permeability is usually tested by shierly air permeability tester.

FORMULA

$$R = \frac{r*1000}{60*60*A}$$

r=rotometer reading (R1+R2+R3)

A=area of cross section

PROCEDURE

Choose the set of rings of given area (4.10cm) for which the test is conducted. Take the ring from one set, which have groove at one face and rubber lining at other face and then place this ring on the groove in sample holder the grooves in the ring must be download. The other mount to the other part of the sample holder by using the knurling bolts. Place the sample on the bottom sample holder. Place two parts of the sample holder in such a way the two rings have same axis. Move this screw so that two rings are tightened. Close all the rotometers by the knob, which are attached to the rotometers. Put the water in the upper cup which is provided at left side of the machine (in manometer type model). Set the zero in digital manometer. Switch on the vacuum pump. Slightly open the knobs of the rotometer and set the given suction pressure in the manometer (10mm of water column) Take the rotometer reading(eg: if rotometer reading are 20,7 and 0.5 LPM then the overall reading will be 20+7+0.5=27.5LPH). Take at least 10 readings from each sample and then determine the mean. Repeat same procedure for other specimen.

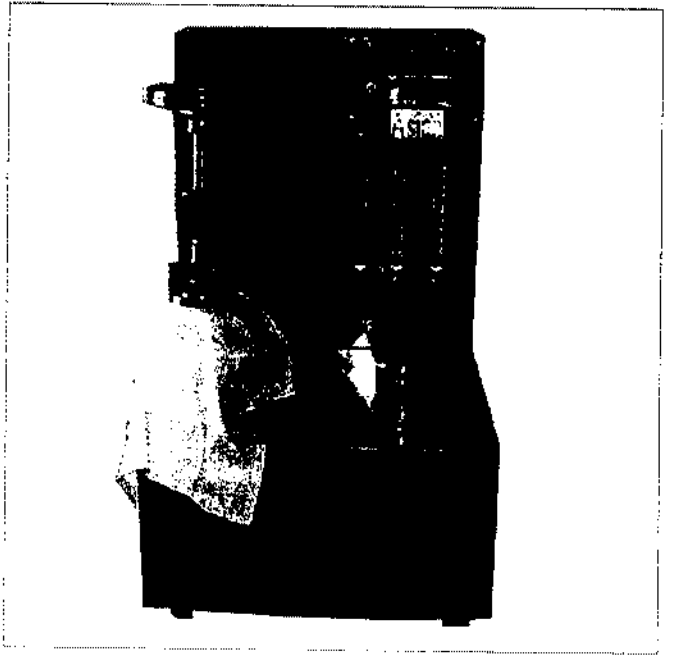


Figure-4.3 shows the Air permeability tester

EXPERIMENTAL PLAN

5. EXPERIMENTAL PLAN

The detailed experimental plan is given below.

↓

Procuring yarn & producing woven home furnishing fabric as per required constructions.

↓

Pretreatments.

↓

Identification of suitable natural mosquito repellent chemicals.

↓

Preparing the bath according to the recipe.

↓

Padding the fabric with the required recipe at different percentages.

↓

Drying the fabric at 70°C - 80 °C.

↓

Curing at low temperatures 120 °C for 3-4 mins.

↓

Soaps with 0.5 gpl soap for 15 mins.

↓

2 cold washes.

↓

Cold rinsing.

↓

Testing the finished fabric for mosquito repellency.

↓

All the samples were tested for other properties.

↓

Apply it in home furnishing.

RESULTS AND DISCUSION

6.1 TULSI

The result for fabric finished with Tulsi is given in table 6.1.

Method	Modified excito chamber method (AATCC24-1999)
No.of specimen exposed	25
No.of specimen in the cage	01
No.of specimen escaped	17
No.of specimen dead	03
Mosquito repellency in %	73

It is observed from the (table 6.1) above results, that the fabric treated with Tulsi had a mosquito repellency of 73%.

6.2 EUCALYPTUS

The result for fabric finished with Eucalyptus is given in table 6.2.

Method	Modified excito chamber method (AATCC24-1999)
No.of specimen exposed	25
No.of specimen in the cage	01
No.of specimen escaped	15
No.of specimen dead	02
Mosquito repellency in %	69

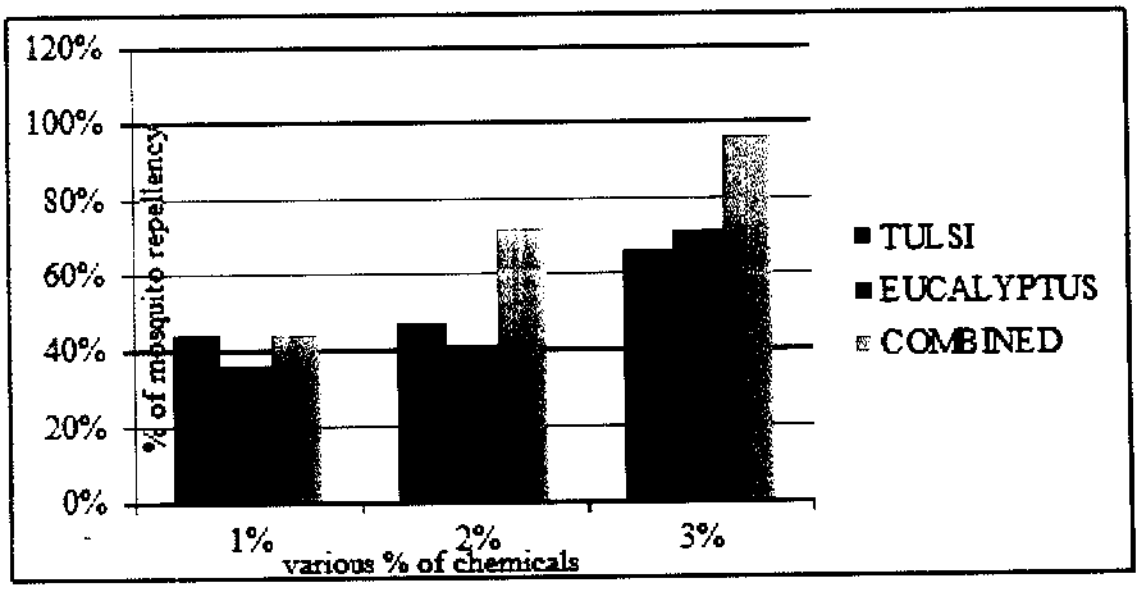
It is observed from the (table 6.2) above results, that the fabric treated with Eucalyptus had a mosquito repellency of 69%.

6.3 COMBINATION OF EUCALYPTUS AND TULSI OIL

The results for fabric finished with Eucalyptus and Tulsi is given in table 6.3.

Method	Modified excito chamber method (AATCC24-1999)
No.of specimen exposed	25
No.of specimen in the cage	01
No.of specimen escaped	20
No.of specimen dead	04
Mosquito repellency in %	96

From the above results (table 6.3) it is observed that the fabric treated with a combination of Tulsi and Eucalyptus had the highest repellency of 96%.

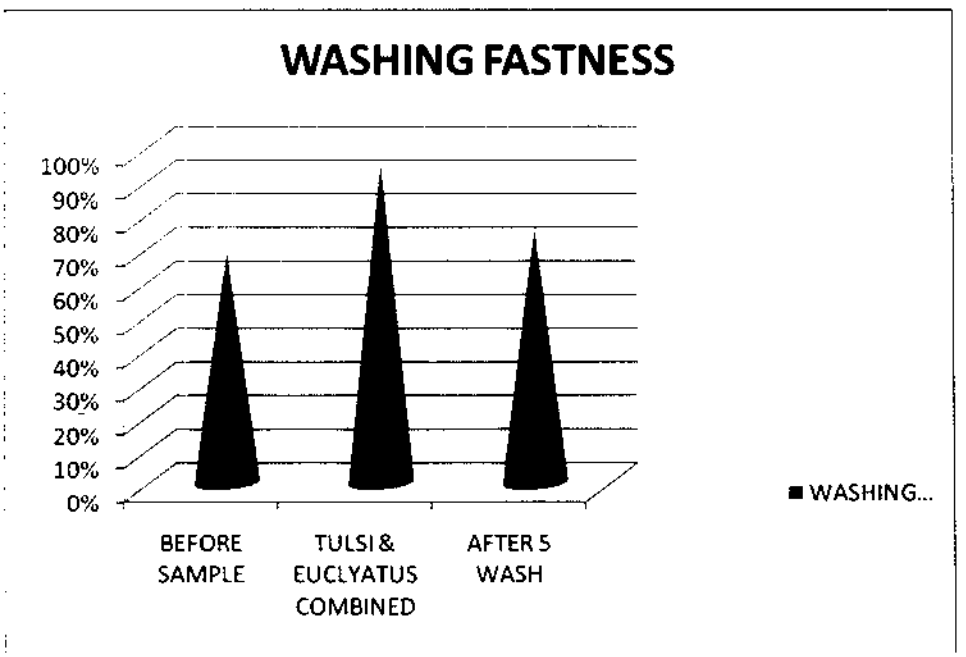


The figure 6.1 shows values of mosquito repellency for before and after treatment for different % of finishing.

6.4 WASHING FASTNESS

The result for washing fastness is given in table 6.4.

Method	Standard detergent WOB method (AATCC 61-2003)
No. of washes	5
Durability	16
No.of specimen exposed	25
No.of specimen in the cage	16
No.of specimen escaped	14
No.of specimen dead	04
Mosquito repellency in %	76

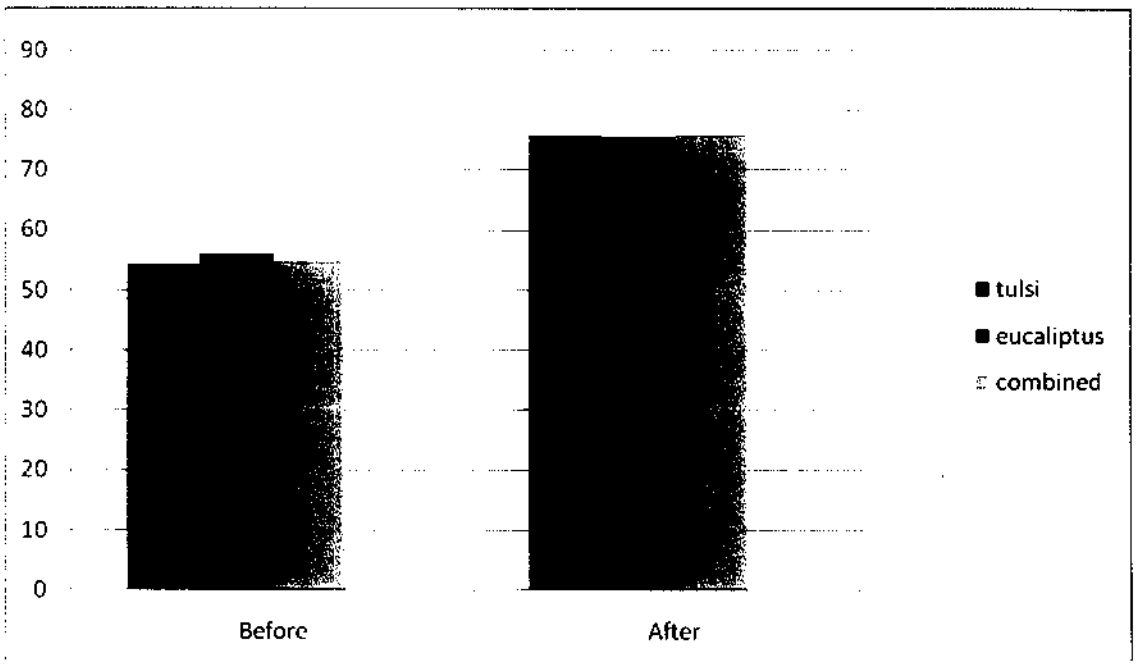


The figure shows values for before and after treatment for washing fastness.

6.5 FABRIC DRAPE TEST

The table6.5 shows the results of fabric drape

Fabric Drape %	Using Tulsi oil		Using Eucalyptus oil		Using Eucalyptus and Tulsi oil	
	Before	After	Before	After	Before	After
	54.35	76	56.24	75.60	54.98	76.20

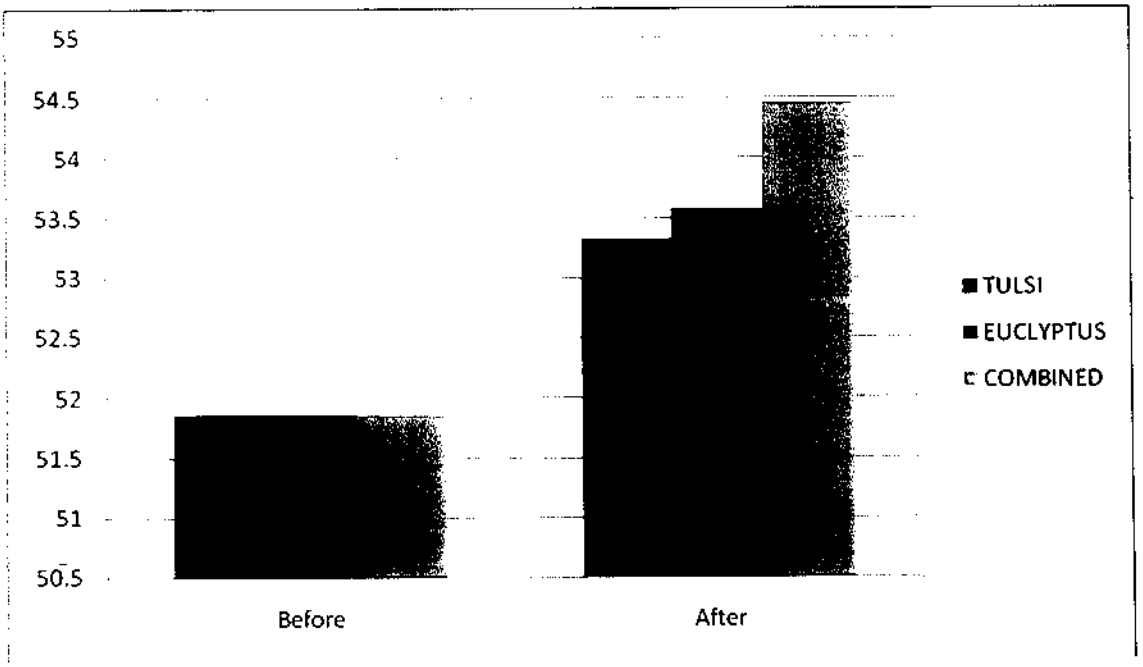


From the above results it is observed that the drape has increased by 20% after giving the finishing. The chemicals used makes finish given make the fabric soft.

6.6 AIR PERMEABILITY

The Table-6.6 Shows the Results of Fabric Air permeability for both before and after treatment using all the three mosquito repellents.

Air Permeability (cc/sec/cm)	Using Tulsi oil		Using Eucalyptus oil		Using Eucalyptus and Tulsi oil	
	Before	After	Before	After	Before	After
	51.86	53.32	51.86	53.57	51.86	54.46

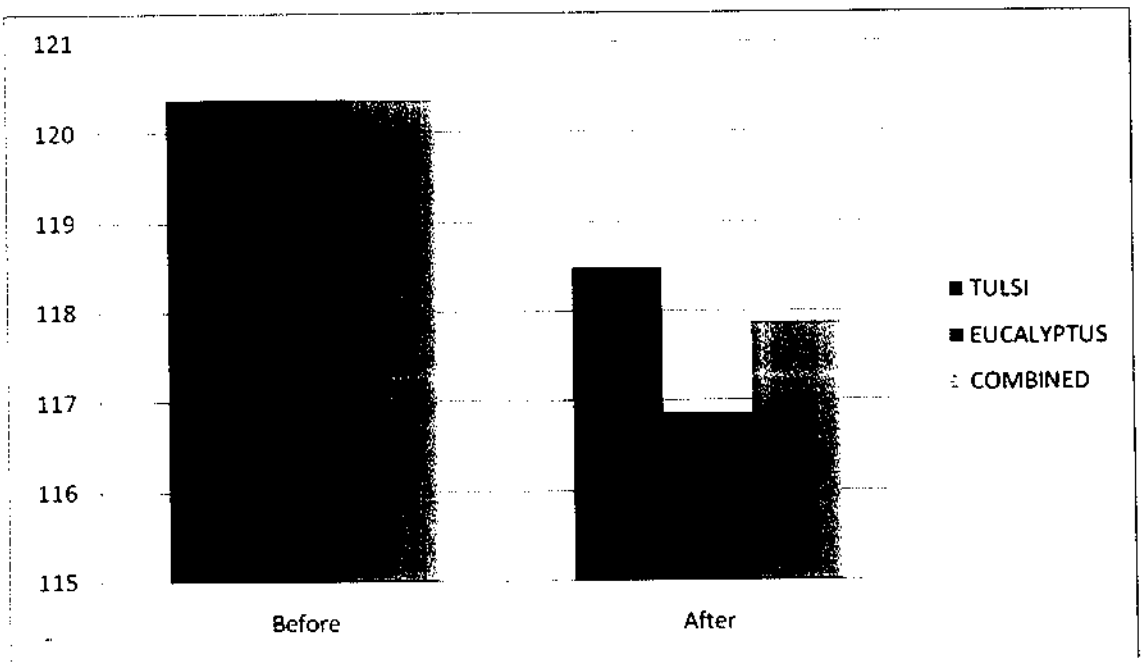


The above results reveal that the Air permeability has increased 2.5% after giving the finishing. This is due to finish given on the fabric which in turn binds all the protruding fibers and the yarn and their by making it compact.

6.7 ABRASION RESISTANCE

The Table6.7 Shows the Results of Fabric abrasion resistance (80 revolutions) for both before and after treatment using all the three mosquito repellents.

Abrasion %	Using Tulsi oil		Using Eucalyptus oil		Using Eucalyptus and Tulsi oil	
	Before	After	Before	After	Before	After
	120.36	118.49	120.36	116.85	120.36	117.88



The above results reveal that the abrasion resistance values have reduced after giving the finishing. The reduction is not significant. The reduction of abrasion resistance due to drop in individual fiber strength.

CONCLUSION

7. CONCLUSION

From the performance test carried out on the three samples it was observed that the fabric treated with a combination of tulsi and eucalyptus had the highest mosquito repellency of 96%.

All the fabric samples were tested for properties such as air permeability; abrasion resistance and drape for before and after treatments and results have been found meeting the requirements.

Hence it is suggested that fabric treated with combination of tulsi and eucalyptus can be used effectively for home furnishing fabrics.

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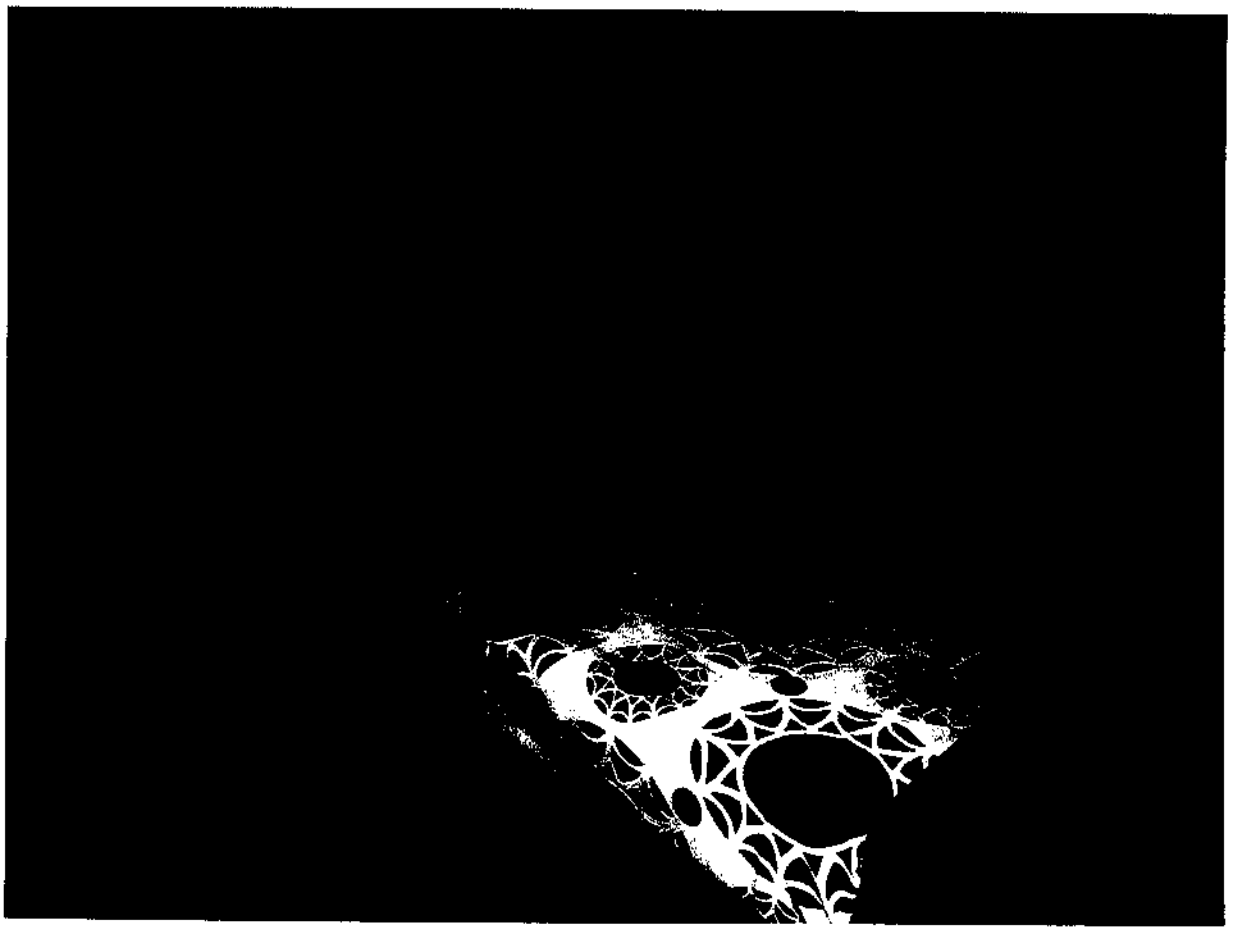
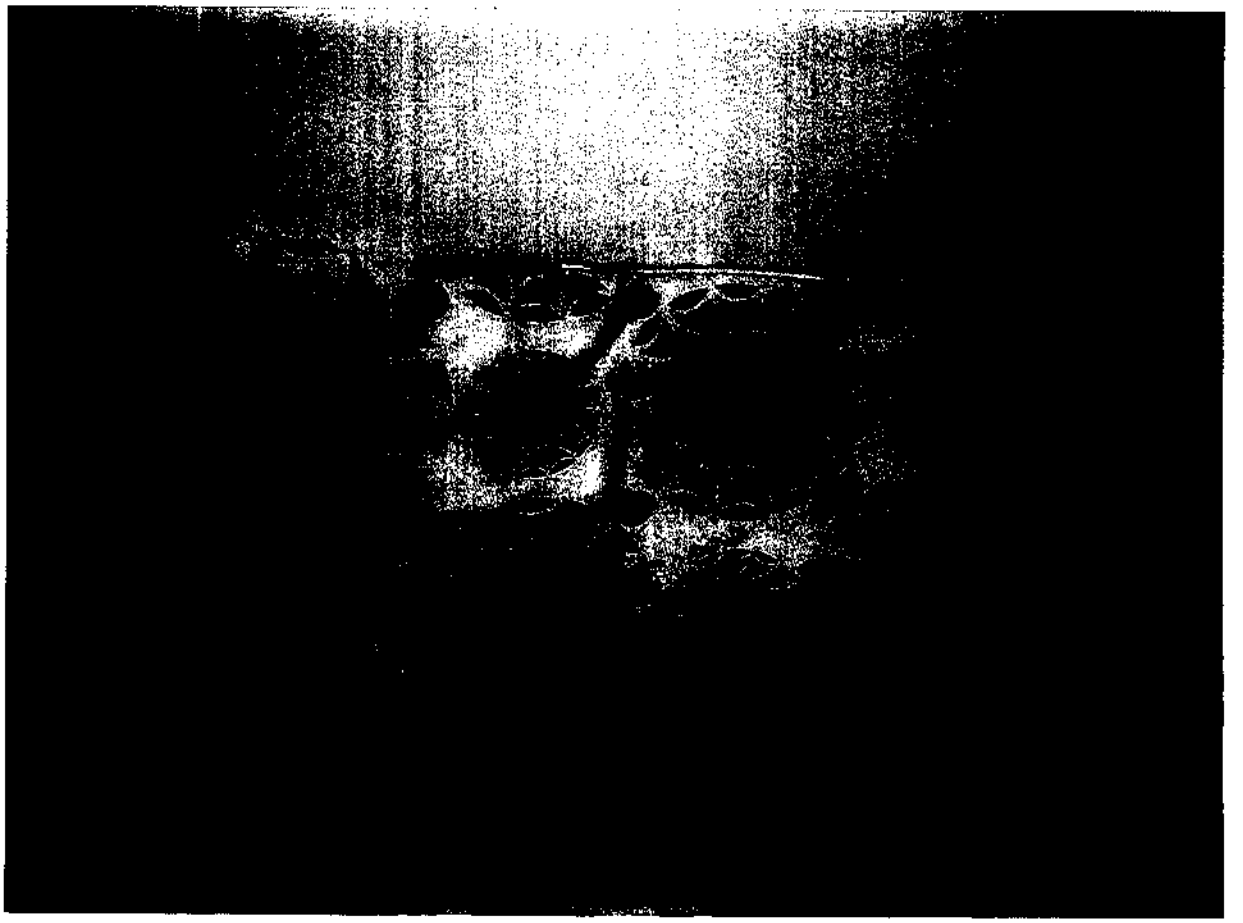
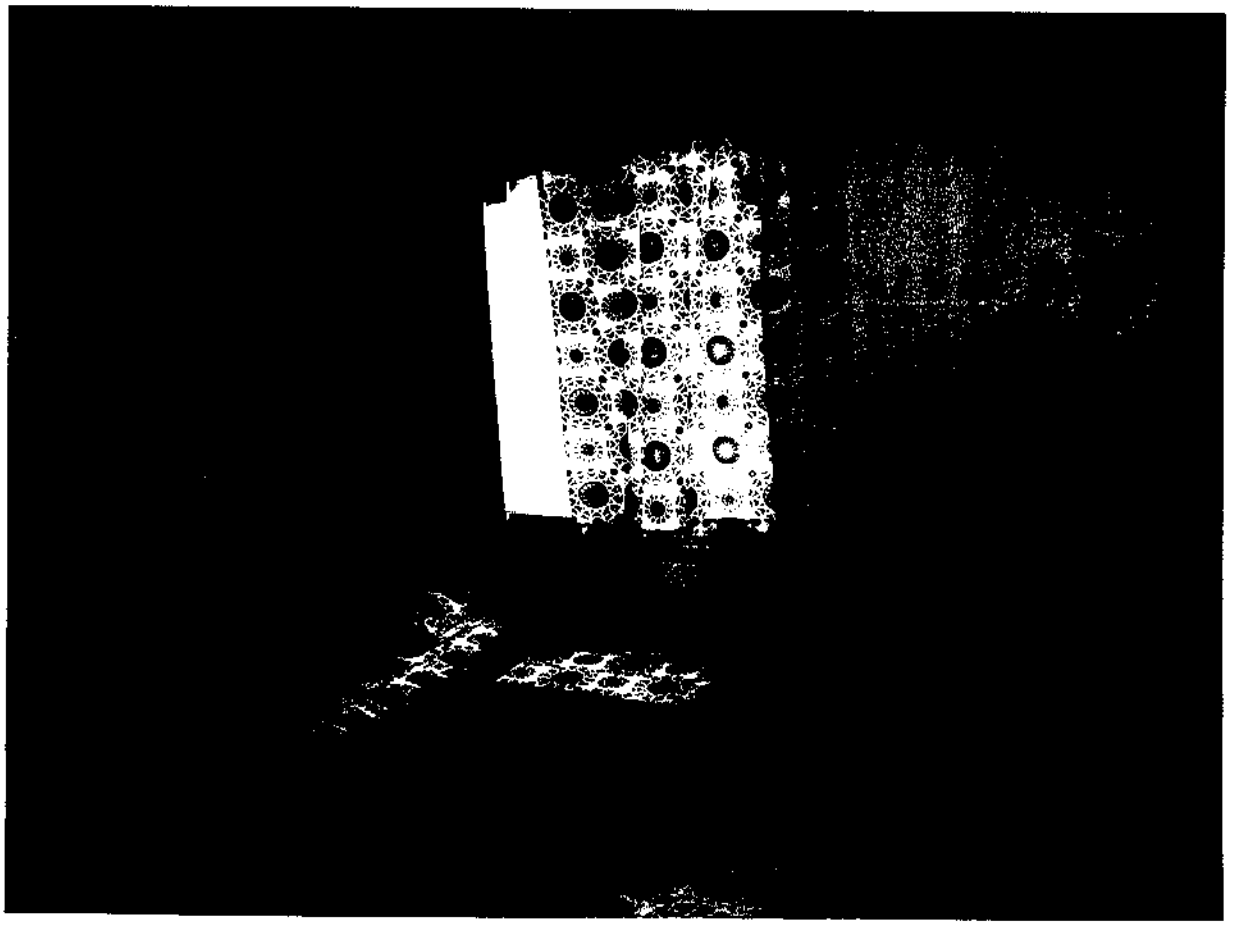
PHOTOGRAPHY







APPENDIX

BVQ
24/7, 2nd stage,
S.N. Poor,
Bangalore.

Test Report

Client's Name :Students,KCT Coimbatore
Sample(s) Number(s) : BVQ201101234
Date : 23/02/2011
Reference : PSG College
Samples : Fabric sample-Non-finished

Test performed : Mosquito Repellency Test – Improved Excito Chamber Method

Date of test : 01/03/2011.

S.No.	Samples	No. Of specimen Exposed	No. Of specimen in the cage	No. Of specimen Escaped	No. Of specimen Dead	Mosquito Repellency in %		
1.	Fabric	25	1	20	04	40		

Conclusion

The fabric sample has VERY POOR mosquito repellent activity.

Mosquito repellency test was performed according to modified AATCC 24 – 1999 by Modified Excito chamber method.

Dr.Manojkumar
Chief Scientist - ***BVQ***

BVQ
24/7, 2nd stage,
S.N. Poor,
Bangalore.

Test Report

Client's Name :Students,KCT Coimbatore
Reference : PSG College
Sample(s) Number(s) : BVQ201101238
Date : 24/02/2011

Samples : Treated Sample- 1% Tulasi and Eucalyptus oil combined (PAD DRY CURED)

Test performed : Mosquito Repellency Test – Improved Excito Chamber Method

Date of test : 01/03/2011.

S.No.	Samples	No. Of specimen Exposed	No. Of specimen in the cage	No. Of specimen Escaped	No. Of specimen Dead	Mosquito Repellency in %
1.	Fabric	25	1	8	01	44

Conclusion

The fabric sample has POOR mosquito repellent activity.

Mosquito repellency test was performed according to modified AATCC 24 – 1999 by Modified Excito chamber method.

Dr.Manojkumar
Chief Scientist - ***BVQ***

BVQ
24/7, 2nd stage,
S.N. Poor,
Bangalore.

Test Report

Client's Name :Students,KCT Coimbatore
Reference : PSG College
Sample(s) Number(s) : BVQ201101239
Date : 25/02/2011

Samples : Treated Sample- 2% Tulasi and Eucalyptus oil combined (PAD DRY CURED)

Test performed : Mosquito Repellency Test – Improved Excito Chamber Method

Date of test : 01/03/2011.

S.No.	Samples	No. Of specimen Exposed	No. Of specimen in the cage	No. Of specimen Escaped	No. Of specimen Dead	Mosquito Repellency in %
1.	Fabric	25	1	15	02	72

Conclusion

The fabric sample has FAIR mosquito repellent activity.

Mosquito repellency test was performed according to modified AATCC 24 – 1999 by Modified Excito chamber method.

Dr.Manojkumar
Chief Scientist - ***BVQ***

BVQ
24/7, 2nd stage,
S.N. Poor,
Bangalore.

Test Report

Client's Name :Students,KCT Coimbatore
Sample(s) Number(s) : BVQ201101236
Date : 23/02/2011
Reference : PSG College
Samples : Fabric sample-Treated Sample-Thulasi oil (PAD DRY CURED FABRIC)
Test performed : Mosquito Repellency Test – Improved Excito Chamber Method
Date of test : 01/03/2011.

S.No.	Samples	No. Of specimen Exposed	No. Of specimen in the cage	No. Of specimen Escaped	No. Of specimen Dead	Mosquito Repellency in %
1.	Fabric	25	1	17	03	73

Conclusion
The fabric sample has FAIR mosquito repellent activity.

Mosquito repellency test was performed according to modified AATCC 24 – 1999 by Modified Excito chamber method.

Dr.Manojkumar
Chief Scientist - ***BVQ***

BVQ
24/7, 2nd stage,
S.N. Poor,
Bangalore.

Test Report

Client's Name :Students,KCT Coimbatore
Reference : PSG College
Sample(s) Number(s) : BVQ201101237
Date : 24/02/2011

Samples : Fabric sample-Treated Sample-Tulasi and Eucalyptus oil combined (PAD DRY CURED)

Test performed : Mosquito Repellency Test – Improved Excito Chamber Method

Date of test : 01/03/2011.

S.No.	Samples	No. Of specimen Exposed	No. Of specimen in the cage	No. Of specimen Escaped	No. Of specimen Dead	Mosquito Repellency in %
1.	Fabric	25	1	20	04	96

Conclusion

The fabric sample has EXCELLENT mosquito repellent activity.

Mosquito repellency test was performed according to modified AATCC 24 – 1999 by Modified Excito chamber method.

Dr.Manojkumar
Chief Scientist - ***BVQ***

BVQ
24/7, 2nd stage,
S.N. Poor,
Bangalore.

Test Report

Client's Name :Students,KCT Coimbatore
Reference : PSG College
Sample(s) Number(s) : BVQ201101235
Date : 23/02/2011

Samples : Fabric sample-Treated Sample-Eucalyptus oil (PAD DRY CURED FABRIC)

Test performed : Mosquito Repellency Test – Improved Excito Chamber Method

Date of test : 01/03/2011.

S.No.	Samples	No. Of specimen Exposed	No. Of specimen in the cage	No. Of specimen Escaped	No. Of specimen Dead	Mosquito Repellency in %
1.	Fabric	25	1	15	02	69

Conclusion

The fabric sample has FAIR mosquito repellent activity.

Mosquito repellency test was performed according to modified AATCC 24 – 1999 by Modified Excito chamber method.

Dr.Manojkumar
Chief Scientist - ***BVQ***