International Journal of Research in Engineering, Science and Management
Volume-2, Issue-5, May-2019
www.ijresm.com | ISSN (Online): 2581-5792


# Development of Mosquito Repellent Finished Fabric by using Natural Herbal Extraction of Vitex Negundo Plants

K. Rafiq[1], C. Premalatha[2]
[1]*M.Tech. Scholar, Department of Textile Chemistry, S.S.M. College of Engineering, Komarapalayam, India*
[2]*Professor & HoD, Department of Textile Chemistry, S.S.M. College of Engineering, Komarapalayam, India*

***Abstract*: Mosquito repellent textiles are one of the revolutionary ways to promote the textiles field by providing the much demanded features of driving away mosquitoes particularly in the tropical region. Clothing always plays a vital role in the evaluation of human being culture at the forefront of both technological and artistic developments. Insect repellent help prevent and control the outbreak of insect-borne diseases such as malaria and dengue fever. Many chemicals have been used for purpose of mosquito repellence or killing. However, they are extremely harmful for human being as well. Synthetic repellent finishes are mostly affected human health and hygienic. In this work, it is a small effort in developing an eco-friendly mosquito repellent finished fabric using the herbal extract of vitex negundo plant. The selections are finished onto the fabric by direct application and pad dry cure method and evaluated using a mosquito repellency behavior test. Here we using different concentration level of extraction take place for treated fabrics. As the treated fabrics are subjected to washing, the wash durability of the finished fabric was evaluated at three intervals 5, 10, 15 washes. Before and after washing to find antimicrobial activity against of *S.aures* and *E.coli* for chosen better repellent fabrics to use commercial application.**

***Keywords*: Insecticide, textile, essential oil, vitex Negundo, mosquito repellent.**

## 1. Introduction

Vitex negundo is evergreen medicinal deciduous shrub. It is native to India and also found growing in Bangladesh, China, Philippines, Sri Lanka, and Japan. It is usually grown as a fencing for agriculture lands as well as house. The leaves are used as biopesticide and insecticide. The leaves are dried and kept with woolen clothes to repel insects. The smoke from the leaves is used as mosquito repellent.

### *A. Plant description*

Vitex negundo is a much-branched shrub up to 5 m tall or sometimes a small, slender tree with thin, gray bark. It belongs to plant family Verbenaceae. The word Vitex is derived from the Latin 'vieo' (meaning to tie or bind) because of the flexible nature of its stems and twigs.

### *B. Medicinal uses of vitex negundo*

Vitex negundo is a medicinal tree. It is used in the treatment of Vata and Kapha. The leaves are generally used as a fomentation in sprains, rheumatism, swelled testicles, contusions. The root is used as tonic, febrifuge, and expectorant, and the fruit nervine, cephalic, and emmenagogue. The leaves are often placed between the leaves of books to preserve them from insects. The leaves are also used to preserve rice and clothes from insects and to drive them away and the extract from it used as a carminative and emmenagogue. Pillows stuffed with leaves are slept on to remove catarrh and headache (they are also smoked for relief).

Fig. 1. Vitex negundo

This study mainly focuses on the development of mosquito repellent cotton fabrics using nanoparticle loaded with V. negundo leaf extracts. This research also deals with the effect of treated cotton fabrics against mosquitoes and to enhance the laundering durability of the fabrics.

## 2. Materials and methods

### *A. Materials used*

- 100% Bleached Cotton knitted fabric
- Vitex negundo

### *B. Herbal collection*

Vitex negundo leaves are collected and shade dried for

several days with room temperature of 30-400°C and its grinder for fine powder and it is prepared for extraction.

## 3. Extraction procedure

### A. *Extraction Preparation*

Ratio = 1:10
Ethanol = 500 ml
Vitex Negundo powder = 50 grams

Extraction is prepared by 1:10 ratio with 500 ml of Ethanol and 50 grams of Vitex Negundo powder. Using padding mangle machine the prepared extracted was curing 120oc by using curing chamber.

Fig. 2. Extraction preparation

Then the extraction was tightly closed with cover for 24 hours for better results than it was filtered by using filter paper for un patchiness.

### B. *Pad dry cure technique*

In this method of finishing, finish is impregnated with treatment liquor or foam by the help of squeeze rollers. The squeezing of fabric is done to an extent where required pick-up or add-on is achieved. The level of pick-up is predetermined based on the application and fibre type of the fabric. Padding is followed by drying in order to remove excess of water present in the liquor prepared. The pick-up can be established by the help of short piece of fabric.

Fig. 3. Padding mangle

## 4. Antimicrobial activity

### A. *Microorganisms used*

Escherichia coli MTCC7242. Staphylococcus aureus MT CC96

### B. *Zone of Inhibition Test for Antimicrobial Activity*

A Zone of Inhibition Test, also called a Kirby-Bauer Test, is a qualitative method used clinically to measure antibiotic resistance and industrially to test the ability of solids and textiles to inhibit microbial growth. With this method, approximately one million cells from a single strain are spread over an agar plate using a sterile swab, then incubated in the presence of the antimicrobial object (ex: an oxacillin disk,). If the bacterial or fungal strain is susceptible to the antimicrobial agent, then a zone of inhibition appears on the agar plate.

### C. *Agar diffusion evaluation method*

Antimicrobial activity of Vitex Negundo against staphylococcus aureus (S.aureus) and Escherichia coli (E.coli) was tested. In order to test the antimicrobial activity of Vitex Negundo, the bacterial isolates Agar diffusion test was done and the results are listed as follows.

### D. *SEM Analysis*

Scanning Electron Microscopy (SEM) is a test process that scans a sample with an electron beam to produce a magnified image for analysis. The method is also known as SEM analysis and SEM microscopy, and is used very effectively in microanalysis and failure analysis of solid inorganic materials.

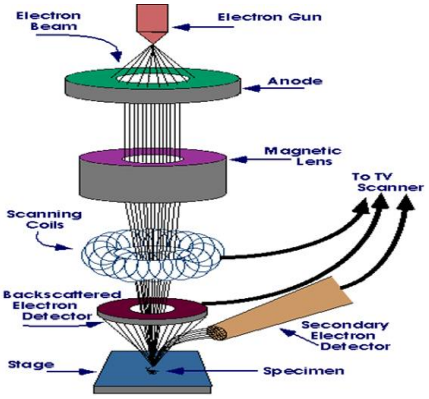


Fig. 4. SEM analysis

Electron microscopy is performed at high magnifications, generates high-resolution images and precisely measures very small features and objects. Laboratory Testing Inc. near Philadelphia, PA (USA) offers scanning electron microscope services, using a complete system that includes Energy Dispersive X-ray Spectroscopy (EDS) capabilities.

### E. *Cage test*

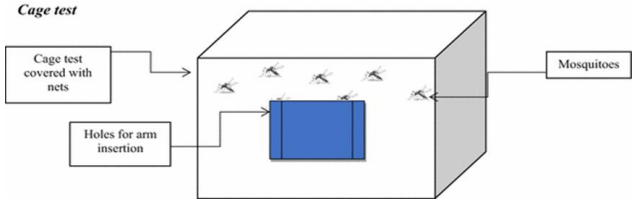


Fig. 5. Mosquito cage test

Mosquitoes were starved for 24 hours and 20 mosquitoes were placed in the cage (45 × 15 × 30 cm).

## 5. Result and discussion

### *A. Agar diffusion evaluation method*

Antimicrobial activity of Vitex negundo against staphylococcus aureus (S.aureus), Escherichia coli (E.coli) was tested. In order to test the antimicrobial activity of Adhatoda Vasica, the bacterial isolates Agar diffusion test was done and the results are listed as follows.

Agar used : AATCC Bacteriostasis agar
Temperature : 37ºC
Time : 24 – 48 hours
Control sample size : 19mm in diameter (circular swatch)

After incubation period, zone of inhibition was measured using zone scale and results were tabulated. The following pictures show the inhibition zone levels for directly applied fabric.

5% 10% 15%

Fig. 6. Untreated and treated cotton fabric of Vitex negundo against Staphylococcus aureus

5% 10% 15%

Fig. 7. Untreated and treated cotton fabric of Vitex negundo against E Coli

### *B. Scanning electron microscope (SEM) analysis*

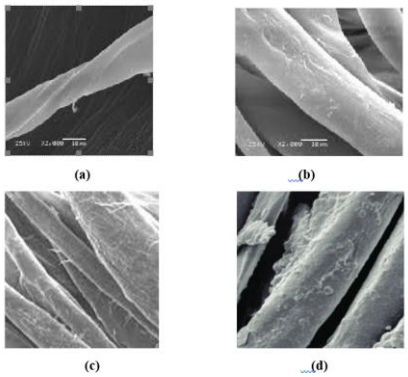


Fig. 8. SEM Report of cotton Knitted Fabric (a) Untreated, (b) Treated with Vitex Negundo (5%) (c) Treated with Vitex Negundo (10%) (d) Treated with Vitex Negundo (15%)

The scanning electron microscope (SEM) is a type of electron microscope that images the sample surface by scanning it with a high-energy beam of electrons in a RASTER scan pattern. The presence, binding and availability of treated on the fabric were analyzed using scanning electron microscopy. The SEM photographs as shown in Fig. 8.

### *C. Cage test*

Table 1
Overall Mosquito Repellency %

| Time of Observation (Mins) | 5% | 10% | 15% |
|---|---|---|---|
| 5 | 80 | 70 | 80 |
| 10 | 80 | 60 | 90 |
| 15 | 60 | 80 | 90 |

Above the results we are analysis different concentration level at 5%, 10% and 15% of Vitex Negundo finished cotton knitted fabric. The result of 5% concentration is maximum 80% repellency, 10% concentration is maximum 80% repellency, 15% concentration is maximum 90% repellency occur. Here we conclude 15% concentration level of fabric is treated with Vitex Negundo is better mosquito repellency finished fabric.

## 6. Conclusion

The herbal extract taken from Vitex negundo has been done successfully by simple ethanol extracting techniques. Using that herbs extracts as pad dry cure method. Then it is found that they exhibit potential for antimicrobial activity against Staphylococcus aureus and Escheichia coli in clearly measurable terms. In this antimicrobial activity test, the cotton knitted fabric is treated with Vitex negundo medicinal plant. The result of cotton untreated knitted fabric zone of inhibition is zero and Vitex negundo treated with cotton knitted fabric zone of inhibition 5% of S.aureus is greater than 5% E.coli, zone of inhibition 10% of S.aureus is greater than 10% E.coli and zone of inhibition 15% of E.coli is greater than 15% S.aureus. The Vitex negundo extract finished fabrics have been found to have better mosquito repellent property of 90 % by using pad dry cure technique.

## References

[1] Prof. Ashwin Thakkar, Dharmendra Bihola and Nidhi Bokade, (2018), “Application and Assessment of Performance of Natural Mosquito Repellent on Fabric”, International Journal for Scientific Research & Development, Vol. 6, 894-896.
[2] Banupriya J and Maheshwari V, (2013), Effects of Mosquito Repellent finishes by Herbal Method on Textiles, International Journal of Pharmacy & Life Sciences, Vol. 4, 3133-3134.
[3] Dhara Shukla, Samudrika Wijayapala and Padma S Vankar, (2018), “Effective Mosquito Repellent from Plant Based Formulation”, International Journal of Mosquito Research, 5(1):19-24.
[4] Granch Berhe Tseghai, (2016), “Mosquito Repellent Finish of Cotton Fabric by Extracting Castor Oil,” International Journal of Scientific & Engineering Research, Volume 7, Issue 5, 874-878.
[5] Mohanraj S, vanathi P, (2012),” Antimicrobial Effectiveness of Vitex Negundo Leaf Extracts”, Indian Journal of Fibre & Textile Research, Vol.37, pp. 389-392.
[6] Rajendran Ramasamy, Radhai Rajan and Rajalakshmi Velmurugan, (2014), “Development of Mosquito Repellent Fabrics using Vitex negundo loaded Nanoparticles”, Malaya Journal of Biosciences, pp. 19–23.