

Mosquito Repellent Finish on Cotton Fabric using Justicia Adhatoda Vasica Extract by Micro Encapsulation

M. V. Vijay Karthigeyan¹, C. Premalatha²

¹M.Tech. Student, Department of Textile Chemistry, S. S. M. College of Engineering, Komarapalayam, India

²Professor, Department of Textile Chemistry, S. S. M. College of Engineering, Komarapalayam, India

Abstract: Mosquitoes are the important multi characterization of insects, which are causing different type of diseases. They are highly spreading the deadly diseases like malaria, dengue, filariasis and chickungunya. Mosquito repellent textile is the most important advancement in the textile field by providing much needed features of driving away mosquitoes. Many researchers were proved that chemicals used for mosquito repellents are more harmful and poisonous. Eco friendly mosquito repellents can be one of the effective tools for protecting human from vector borne diseases. This work is a small effort in developing of an Eco friendly mosquito repellent finished fabric using the herbal extract of the Justicia Adhatoda. We have used microencapsulation technique for applying mosquito repellent finish on the cotton fabric. Microencapsulated binding on finished cotton samples were tested and confirmed by scanning electron microscopy analysis. Microencapsulated finished cotton fabrics were evaluated for mosquito repellency behavior test and durability test.

Keywords: Mosquito repellent, Ecofriendly, Cotton fabric, Justicia Adhatoda, Microencapsulation.

1. Introduction

Mosquitoes are the carrier of many diseases. Mosquito repellent textile protects human from the mosquito bite and there by promising safety from diseases like dengue, malaria, etc. Mosquito repellents are defined as substances applied to a surface to make the substrate and its surrounding unpleasant or unattractive for mosquitoes. A mosquito repellent finish can be applied to the textile material either by natural or chemical repelling agents.

A. Classification of mosquito repellents

Mosquito repellents can be categorized in two main groups namely synthetic repellents produced from chemicals and biological repellents offered by nature.

B. Synthetic repellent

Synthetic repellents are most commonly used for mosquito repellent and are said to have excellent repellency against mosquitoes. However, they are not environmental friendly and some are associated with allergies, skin irritations and asthmatic reactions. Abbreviations and Acronyms

C. Natural or plant-based repellent

The natural repellents are thought to be less toxic, environmental friendly and harmless to fabrics. Medicinal plants like Notchi, Neem, Tulasi, Turmeric and Justicia Adhatoda, etc. are used for induction of organic mosquito repellent activity.

2. Materials and methods

A. Materials used

1) Bleached cotton woven fabric

The fabric was purified by scouring at 100°C for 60 min. using a solution containing Na₂CO₃ (2g/l, wetting agent, 1%), then thoroughly washed with water and dried at ambient conditions.

2) Adhatoda vasica

Adhatoda vasica is a well-known plant drug in Ayurvedic and Unani medicine. Adhatoda leaves have been used extensively in Ayurvedic Medicine primarily for respiratory disorders. The medicinal properties of Adhatoda vasica, called Vasa or Vasaka in Sanskrit have been known in India and several other countries for thousands of years. The leaves, flowers, fruit, and roots are extensively used for treating cold cough, whooping cough, chronic bronchitis and asthma as sedative, expectorant and antispasmodic. The plant leaves were collected from local sources and prepared for extraction. The materials were grinded to fine powder and these powdered materials used for the preparation of aqueous and methanol extracts.

B. Extraction preparation

Extraction has been prepared by 1:5 ratio with 500 ml of methanol and 100 grams of Adhatoda Vasica powder. Using stirrer machine, the prepared extracted was stirring used by pellet for 2 hours with a speed of 1280 rpm. 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.

C. Microencapsulation procedure

Microencapsulation has been done by using adhatoda vasica

as core material and gum Acacia willd as wall material. Ten gram of wall material was allowed to swell for half an hour by mixing with 100ml of hot water. To this mixture, 50ml of hot water added, stirred for 15 min maintaining the temperature between 40°C and 50°C. Ten ml of core material was added and stirred at 300-500rpm for further 15 min followed by drop wise addition of 20% sodium alginate solution (10ml) for 5- 10 min. The stirrer speed was reduced and then 5ml of 17% formaldehyde was added. The stirrer was stopped and the mixture was freeze dried. The cotton Bleached woven fabric was immersed in the microcapsule solution using padding mangle, squeezed and then dried at 80-85°C in an oven.

3. Result and discussion

A. Antimicrobial activity evaluation methods

Agar diffusion test is a preliminary test to detect the diffusive antimicrobial finish. Antimicrobial activity of Adhatoda Vasica 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 : 37°C
 Time : 24 – 48 hours

Control sample size: 19mm in diameter (circular swatch)

Treated samples and controlled samples were placed in lawn culture plates and allowed to incubate at 37°C for 24 - 48 hours. After incubation period, zone of inhibition was measured using zone scale and results were tabulated.

Table 1
 Antimicrobial activities of cotton fabric sample

S. No.	Material	Finish	Zone of Bacteriostasis (mm)	
			S. aureus	E. coli
1.	Cotton	Untreated	0	0
		Treated with Adhatoda Vasica	27	24

In this test, the cotton untreated fabric's zone of inhibition is zero and Adhatoda Vasica treated cotton fabric's zone of inhibition S.aureus is greater than E.coli.

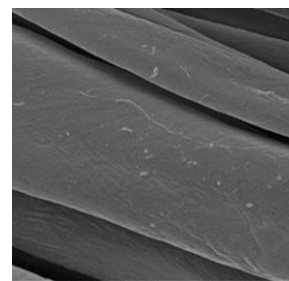
B. Scanning electron microscope (SEM) analysis

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 are shown in Fig. 1.

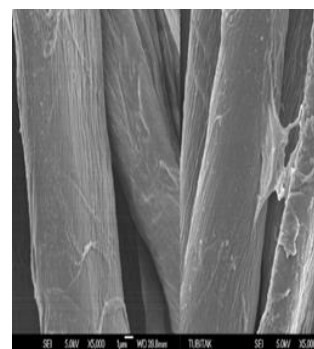
C. Evaluation of microcapsules treated fabrics

SEM has been used to analyze the shape, size and distribution of microcapsules on the treated fabrics. The SEM photographs shown in figure a & b indicates that the microcapsules produced are of small spherical shape and uniform size distribution. As a result it is clear that the capsules are firmly binded on the

surface of the cotton fabrics.



(a) Untreated



(b)

Fig. 2. SEM Report of cotton Fabric (a) Untreated, (b) Treated with Adhatoda Vasica

D. Cage test

The mosquitoes used in this experiment were caught using a net while biting humans between 7 pm and 10 pm. Mosquitoes were starved for 24 hours and 20 mosquitoes were placed in the cage (45 × 15 × 30 cm).

Table 2
 Efficacy of mosquito repellent finish N=25

Time of Observation (Mins)	A (controlled sample)	B Treated sample (Adhatoda Vasica)	Repellency %
5	17	8	68
10	19	6	76
15	16	9	64
20	22	3	88
25	20	5	80

A – Number of mosquitoes settled on controlled sample
 B – Number of mosquitoes settled on finished sample
 N – No. of mosquitoes exposed in each cage

E. Wash durability test

Wash durability by subjecting the sample to washing and testing its durability. The cotton fabric was subjected to washing by industrial machines and the durability of the washed fabric was assessed by IS / ISO 105 - C10:2006 B(2) test method.

The change in colour of the test specimen has been observed grey scale rating as 3, which means after 15 washes, the applied extract of *Justicia Adhatoda* stays in the fabric and it was not lose its content with fabric much after several washes.

4. Conclusion

The herbal extract taken from *Adhatoda Vasica* has been successfully done by simple methanol extracting techniques. Using that herbal extracts as core material and as wall material followed by its application onto fabric using micro encapsulation method. In antimicrobial activity test, *S.aureus* is active inhibition while compare to *E.coli* treated cotton fabric. The *Adhatoda Vasica* extract finished fabrics have been found to have better mosquito repellent property of 90 % by using microencapsulation technique. The wash durability of the

encapsulated samples shows better efficiency and the microencapsulated samples which have a high retention of the repellent activity.

References

- [1] Anish Sharmila M and Senthil Priya P, (2015), "Development of Mosquito Repellent Finished Cotton Fabric Using Eco Friendly Cymbopogancitros Oil", International Journal of Science, Technology & Management, Volume 4, Issue 2, 96 -101.
- [2] Gupta A and Singh A, (2017), "Development of Mosquito Repellent Finished Cotton Fabric Using Eco Friendly Mint", International Journal of Home Science, 3(2): 155-157.
- [3] Josephin Sheeba B and Selva Mohan T, (2012), "Antimicrobial Activity of *Adhatoda Vasica* against Clinical Pathogens", Asian Journal of Plant Science and Research, 2 (2): 83-88.
- [4] Ramya K and Maheshwari V, (2014), "Development of Eco Friendly Mosquito Repellent Fabric Finished with *Andrographis Paniculata* Plant Extracts", International Journal of Pharmacy and Pharmaceutical Sciences, Vol. 6, Issue 5, 114 -117.
- [5] Sandeep Kumar, Karuna Singh and Dwivedi K N, (2017), "Repellent Effect of Three Plants *Curcuma Longa*, *Cymbopogon Citratus*, *Adhatoda Vasica* Against Insect Pest Silverfish, *Acrotelsa Collaris*", World Journal of Pharmaceutical Research, Volume 6, Issue 5, 1518-1527.
- [6] Yuvasri V, Anchana devi C and Leela K, (2016), "Comparative Study on Microencapsulated Essential Oils for Mosquito Repellent Finished Cotton Fabrics", Journal of Medical Pharmaceutical www.jmpas.com and Allied Sciences, 161-176.