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Development of mosquito repellent finished cotton fabric using eco friendly mint

A Gupta and Dr. A Singh

Abstract
Finishing improves the fabrics performance and gives it special functional properties including the final touch. Eco friendly mint mosquito repellents may be one of the most effective tools for protecting human from vector borne diseases. Medicinal plants like *Tulasi, Neem, Notchi, Lemongrass, Citronella, Keelanalli* (*Phyllanthus nirum*), *cinnamon, eucalyptus, vetvier roots* (*Vetiveria zizanioides*), *and Turmeric* etc are used for induction of organic mosquito repellent activity. This work is a small effort in developing an Eco friendly mosquito repellent finished fabric using the herbal extract of the mint leaves. The selections are finished onto the fabric by pad-dry-cure method and evaluated using a Mosquito Repellency Behavioural test. As the textile fabrics are subjected to washing, the wash durability of the finished fabrics was evaluated at three intervals – 5th, 7th and 9th washes. After finishing, the finished fabric showed 100% of repellent activity for direct application method. This study helps in the development of a mosquito repellent fabric which protects the human beings from the mosquito bites and thereby promising safety from the mosquito borne diseases.

Keywords Mosquito repellent, Pad-dry cure, Mint Leaves, wash durability

Introduction
Mosquitoes are most medically significant vector and they transmit parasites and pathogens, which continue to have an overwhelming impact on the human beings. Also, they are the main cause of spreading the deadly diseases like malaria, dengue, filariasis and chickungunya [1, 2]. Among the increasing number of arthropodborne diseases, only a few are preventable by vaccines. There is no effective vaccine against malaria. Dengue, the only way to avoid it remains avoiding mosquito bites [3].

The use of the repellents such as lotions coils and liquidators are limited in their due to various reasons. This has necessitated the development of mosquito repellent fabrics. A textile fabric with the mosquito repellent is one of the revolutionary ways and the much needed feature of driving away the mosquitoes. It protects the humans from the bite of mosquitoes and thereby promising safety from the mosquito borne diseases [4]. The use of medicinal plants as a source of relief from illness can be traced back to over five million years in the early civilization of china, India and North East, which is as old as mankind. It has been estimated that in developed countries such as US, plant based drugs contribute about 25% of the total drugs, while in fast developing countries such as India and China, the contribution is about 80%. Thus the economic importance of medicinal plants is much more to developing countries than the rest of the world [5].

Plant products have been used traditionally by human communities in many parts of the world against the vectors and species of insects. The photochemical derived from plant sources can act as larvicides, insect growth regulators, repellents and have deterrent activities [6]. The present investigation focuses on developing an Eco friendly natural mosquito repellent fabric treated using the plant extracts of mint leaves. Mints are aromatic, almost exclusively perennial, rarely annual herbs. They have wide-spreading underground and over ground stolons and erect, square, branched stems. The leaves are arranged in opposite pairs, from oblong to lanceolate, often downy, and with a serrated margin. Leaf colors range from dark green and gray-green to purple, blue, and sometimes pale yellow. It is used as a cure for respiratory tract, kidney stone, headache, neck and back pain. It also has high repellent activity against mosquitoes and insects. The study also deals with the effect on treated fabrics against Mosquitoes and to enhance the laundering durability of the finished fabrics.

Material and Methods

In this study, cotton fabric was used for the study. The wet processing techniques used here were scouring, bleaching and dyeing. Then Mosquito Repellent finish is applied on the fabric by herbal process.

Mosquito Repellent finish by Herbal method Selection of the Medicinal Valuable Herb

The herbal plant was identified and collected from the natural sources in a pure form. The following plant was chosen for the study *mint leaves*. The procedure begins with the selection of natural herb, which was screened and identified. The extract was tested for its Mosquito Repellent which was done by Excito chamber method. *Mint leaves* has been around for a long time, and therefore has a long list of claims regarding its medicinal uses, including use as a tonic, a digestive aid, to treat depression, headache, respiration and as stone relief, and stimulant for production of bile.

Assessment of the Mosquito Repellent Effect of Mint leaves

Plant-based repellents have been used for generations in traditional practice as a personal protection measure against host-seeking mosquitoes. Knowledge on traditional repellent plants obtained through ethno botanical studies is a valuable resource for the development of new natural products.

Procedure

Extraction from the mint leaves

Mint leaves selected source were cleanly and safely collected from both living area and the forest area that were grown under optimal environmental condition that is free from disease and contamination. Fresh mint leaves were dried under shadow and it's grinded.

Filtration

Required amount of dry powder is mixed with methanol; the container was closed and kept overnight.

After overnight incubation, the extract was filtered through filter paper.

Dried and ground mint leaves

Evaporation / condensation

After filtering the herb extract, methanolic solvents were evaporated and the herb extract were condensed.

Methanol extraction of mint leaves

Evaluation of the highest mosquito repellency effect using cage box repellency chamber by herbal method

Cage test are the quick and cost effective way to determine the mosquito repelling qualities of treated materials. A box of 30×30×30 cm made out of transparent glasses with 25 ^{0}C ±2^{0} C temperature and 60 to 70 percent humidity was maintained. In the glass box finished and unfinished fabrics was placed. Release 20 mosquitoes in the box and allow it for 2 minutes. Mosquito were deprived of all the nutrition and water for a minimum of 4 hours before exposure. Laboratory tests were performed during daylight hours only and each test was replicated four times. Note down the anti-mosquito effectiveness by counting the number of mosquitoes which will rest on the unfinished and finished samples during 2 minutes. Escaped specimens and those remaining inside the chamber, for the treated samples, were held separately in small holding containers with food and water.

Mosquito cage box

Results and Discussion

This research work has given a new idea in finishing of cotton fabric with herb (leaves) for Mosquito Repellent activity (M*int).*The treated fabrics were found to be very hygienic. The details results were presented below:

Standardization process of mosquito repellent property

The mosquito repellent property of the *mint plant* extract treated fabrics was shown in Table 1. The samples treated by pad-dry-cure method showed about 100% efficiency acts as the mosquito repellent. Only 15 per cent concentration was required for methanol extraction of mint leaves powder. Cotton samples was finished with 25 per cent mint leaves extract for 90 minutes and dried at 90°c for 5 minutes. Mordanting of this cotton sample was done with 10 per cent citric acid for 60 minutes at 120°c for 2 minutes.

Table 1: standardized finishing condition for organic mosquito repellent finish for cotton fabric

S. No.	Organic mosquito repellents	Conc. of o.m.r.	Extract Conc.	Padding time	Dry temp. & time	Curing conc.	After treatment	Curing temp. & time
1.	Untreated Cotton fabric	-	-	90 mins	90.C for 5 mins	-	60 mins	120° for 2 mins
2.	Mint leaves	15%	25%	90 mins	90.C for 5 mins	10%	60 mins	120° for 2 mins

Assessment of Wash durability

The samples treated by the direct application method showed good resilience activity until 9th washes as the extracts are only coated on the surface of the fabrics without any bonding on to the fabrics, which are removed during repeated washings.

Conclusion

Mint leaves extracts treated fabrics have found to have good mosquito repellent property by direct application method. Vector borne diseases are one of the major problems in developing countries. To avoid such sort of disease transmission to humans can be avoided using mosquito repellent fabrics. This form of natural extraction of the mosquito repellent finishes is very safe and ecofriendly and protect the body from mosquitoes. The sample treated with mint leaves extract is effective, economical and eco-friendly.

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