

# MOSQUITO REPELLENT TEXTILE BY USING PLANT EXTRACTS

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**Abstract-**The review is based on the naturally extracted mosquito repellent oils applied on textile materials and its benefits. These natural mosquito repellent oils work against nuisance biting insects or mosquitoes who transmit tropical diseases such as malaria, dengue, filariasis, Zika, chikungunya, yellow fever, etc.. These natural repellent oils are safer than synthetic chemicals. And now days use of naturally extracted mosquito repellent oil products are more popular due to environment friendly nature and concerning human health. So, from the non-toxicity and availability point of view the traditional use of repellent products should be promoted in society.

**Keywords:** Natural mosquito repellent, tropically transmitted diseases, environment friendly and non-toxic, lemon grass oil (Citronella oil), neem oil (Azadirachta Indica), pad-dry method, encapsulate.

## 1.1 Introduction

Mosquitoes are one of the most harmful vectors which transmit parasites in human body by spreading deadly diseases such as malaria and dengue and *chikungunya* fever, yellow fever, *filariasis*, etc.. And every year a lot of people die affected by these diseases. A variety of mosquito repellent products in the form of lotions, cream, coils, spray, liquidators are available in markets. But, these type of synthetic chemical contained products cause health hazards to human kinds. So, to overcome these problems, mosquito repellent fabrics are used for unlimited safety purpose. Application of mosquito repellent finish on textile fabrics makes the surface characteristics such that it will repel the mosquitoes away. The contents of chemical which are extracted from plant materials can be used as repellents, ovipositor attractants, larvicides, deterrent agents and also insect growth hormone regulators. Plant products have been used almost everywhere in the world for killing or repelling mosquitoes. Certain natural products have been investigated for repellent activity against mosquitoes are Citronella oil, Clove, Babul, Eucalyptus, Cedar wood, Peppermint, Cinnamon oil, Lemon grass oil, etc..

Some of these work as excellent repellent against mosquitoes. And DEET (Di-Ethyl MetaToluamide) is the most widely used synthetic mosquito repellent chemical to get rid of mosquitoes, but because of its toxicity in nature, natural mosquito repellent extracts have own the market. So, This study is mainly focused on natural based mosquito repellent finish used in Textile applications as well as effectiveness of their uses.

## 1.2

Usawadee Sakulku, Onanong Nuchuchua, Napaporn Uawongyart, Satit Puttipipatkachorn, Apinan Soottitawat, Uracha Ruktanonchai have studied the "Characterization and mosquito repellent activity of citronella oil nano-emulsion" and concluded that, the high pressure homogenization process, surfactant and glycerol concentration demonstrates their influence on release kinetics and mosquito protection time in addition to the nano emulsion droplet size and the stability. High pressure homogenizer process reduces droplet size and polydispersity of oil droplet. The emulsion composition also affects the stability of encapsulated oil over storage time. The release of essential oil could be effectively controlled by changing the amount of surfactant and glycerol. An increase in surfactant concentration led to decreasing droplet size, increasing of homogeneity and extension of release and protection time. Citronella oil moves a bit slower from high glycerol than the low glycerol amount, that results sustained mosquito protection time. Therefore, according to Usawadee Sakulku, et.al. The optimal size of oil droplets and viscosity of medium in nano-emulsion should be recommended for stability during storage and ability to control the release of essential oil as well as the in vivo activity.

After encapsulation and homogenization of citronella oil tests, transparent nano-emulsion obtained at optimal concentration of 2.5% surfactant and 100% glycerol. They improved Physical appearance and the stability of the emulsion through an addition of glycerol, owing to its co-solvent and highly viscous property.

The increasing emulsion droplet increased the oil retention. The release behavior could be attributed to the effect of droplet size and concentrations of surfactant and glycerol. The release rate related well to the protection time where a decrease in release rate can prolong mosquito protection time.

## 1.3.

According to Eliningaya J Kweka, et.al. the protective effects in terms of feeding inhibition, knockdown effect and mortality by *O. suave* and *O. kili-mandscharicum* plant extracts is significant particularly against mosquito biting. The community-wide use of such repellent plants has potential to complement existing control measures, such as treating mosquito nets once a month in areas where affordability of the ITNs is restricted. Eliningaya J Kweka, et.al. stated that, the duration of effect of Osmium essential oils is compromised due to its high volatility and hence further investigation should focus on

developing formulation applicable for community application. Specifically, such formulation can be promoted for protection against early biting cycle of mosquito in the evening before going to bed and for those exposed to early morning biting cycle.

Likewise assays to quantify and determine contribution of different active ingredients of *O. suave* and *O. kilimandscharicum*, investigation of protective effect of extracted oils should be done, because this may result discovery of novel compound(s) with required insecticidal activities.

He said natural repellents used to prevent tropical diseases caused by nuisance biting insects is common now a days but its strength for malaria vector control requires more improvement with different level of malaria endemicity. The naturally extracted essential oils were valuated against malaria vectors.

#### 1.4

According to Luz Stella Nerio, et.al. Plant extracted oils and their individual strength have shown potential for repellent activity against several species (insects and other kinds of arthropods). However, its high volatility decreases the times of protection. Therefore, these natural products have a considerable potential as commercial repellent products when they are mixed with fixative materials, improving the efficiency and obtaining even greater activities than those found for DEET, known as the most effective mosquito repellent. Among all metabolites extracted from essential oils, oxygenated are the best repellent active, because of the presence of hydroxyl group. The study of the synergistic effects among constituents of EO and mixtures of oils, as well as the search of new additives that could make longer the protection times, represents an important tool to replace the synthetic products used today.

Synthetic chemicals used against insects and arthropods raises concerns related to environment and human health. So, natural products are alternatives to be used which give good efficacy and are environmentally friendly. Naturally extracted oils of different species have been tested repeatedly to assure their repellent properties as a valuable natural resource. These natural oils are volatile mixtures of hydrocarbons with a large no. of functional groups and are highly activated in nature.

In some cases, these chemicals work effectively. Vanillin is used to increase the protection time and potential repellent effect of some essential oils. Among the plant families *Cymbopogon* spp., *Ocimum* spp. And *Eucalyptus* spp. are the mostly used repellents, cited.

The presence of compounds in these mixtures are alpha-pinene, limonene, citronellol, citronellal, camphor and thymol have high repellent activity. From cost point of view synthetic chemicals are still more used; but, these natural products are safer repellents for humans and the environment.

## 2. Materials & Methodology

### 2.1 Materials Used

Both naturals and synthetic textiles have been used for mosquito repellent fabrics. Scoured and bleached cotton fabric is to be use as mosquito repellent textile, because of its cellulosic & eco-friendly in nature and it possesses a lot of excellent properties/characteristics such as breathability, absorbency, comfortable, soft, good strength and good drape.

A mixture of lemon grass oil (*Citronella* oil) and *neem* oil (*Azadirachta Indica*) are to be used as mosquito repellent finish on textile. Lemongrass and *neem* oil were taken because of their insect(mosquito) repellent properties in addition, lemongrass oil has many beneficial medicinal properties including analgesic, anti-inflammatory, antidepressant, antipyretic, antiseptic, antibacterial, antifungal, astringent, carminative, diuretic, insecticidal, sedative, and anti-cancer properties. And *neem* oil also has many medicinal properties as for skin, mouth, bones, etc.

### 2.2 Methods of application

There are some methods to be used for the application of the mosquito repellent finish on the textile materials are given below :

#### a) DIRECT APPLICATION METHOD:

In this method, the extract is directly applied on the fabric using pad-dry-cure method.

#### b) Encapsulation Method: (Review)

In this method the extracts are enclosed in microcapsules. The fabric is to be immersed in the microcapsule solution, then removed, squeezed, dried and cured.

According to the convenience and availability of the instruments and machine will be preferred.

2.3 There are various testing methods for evaluation of mosquito-repellent textiles which are given below (Ijesmr Journal source): (Review)

#### 2.3.1. THE FIELD TEST:

It is the most meaningful evidence for the efficacy of treated textile. The field test is especially performed in locations where numerous of floodwater mosquitoes are present. In this method solution of 0.5ml of repellent is applied on forearms and forearms are exposed to mosquitoes. No. of mosquito bite is recorded.



Field Test[Figure.1]

### 2.3.2 WHO CONE TEST:

In WHO cone test a standard WHO plastic cone is attached to the treated test surface. Afterwards, 5 mosquitoes are transferred into the cone with an aspirator and exposed to the treated surface for 3 minutes. At the end of the exposition, test mosquitoes are removed from the cones, placed in small cages for further observation and kept in insecticide-free air. The number of paralyzed, knocked-down test mosquitoes is noted one hour after the exposition; the mortality rate is calculated using the following formula:

$$\text{Mortality\%} = (\text{No. of dead specimen} / \text{total no. of exposed specimen}) \times 100$$



Cone Test [Figure.2]

The natural mortality rate is determined with an untreated textile. It is found that mosquito might spend more time resting on the cone than on the treated surface.

### 3. Discussion

The synthetic mosquito repellent chemicals work more effectively than naturally extracted oils. But its toxicity in nature harms human health; it causes skin irritations, vomiting, nausea, breathing problem, etc. That is why the traditionally used mosquito repellent extracts attract people more. Which Asian countries people have been used it since a long time ago by smoking the leaves or stem parts of the plants.

As compared to synthetic mosquito repellent finish, natural mosquito repellent finishes are less reactive and economical. In that aspect the experiment to be proceed.

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