

# Synthesis of Herbal Substitute to Synthetically Developed Mosquito Repellents using Natural Products as Active Ingredients

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*Abstract*— The herbal mosquito repellent formulations from major repellents of natural origin like lemongrass oil, rosemary oil, lavender oil, ginger, neem oil, saw dust, coconut husk, vitamin E oil, and other chemical were synthesized. The mosquito bites and synthesis of herbal repellents to minimize human mosquito contact have always been a dealing issue for the scientists and researchers. The mosquitoes are counted among the insects causing deadly diseases like malaria, yellow fever, filariasis, dengue etc. The scientists from various developed as well as developing countries keep on synthesizing better repellents that could work more efficiently than the available products. Keeping same in mind we too replaced some ingredients with our selected ingredients to synthesize an efficient repellent which is eco-friendly and nonirritant to humans and babies too. The following research project aimed at synthesizing herbal substitute of mosquito repellent using natural active and inert ingredients. Herbal mosquito repellent cream sprays and coils were synthesized of significant protection time up to 30 minutes confirmed after the test on adult *Aedes Aegypti* Mosquitoes. Each product was tested for 30 minutes and observations were recorded at time interval of 10 minutes each. The research project successfully yielded satisfactory product which were found to be safe and significantly active.

**Keywords:** Herbal, Mosquito Repellents, Eco Friendly, Oils

## I. INTRODUCTION

As the mortality rate due to mosquito bite is increasing now a day it becomes a need to develop mosquito with long-lasting effects and that cause no irritation to the human beings and children. Keeping all of these facts in mind we tried to synthesize better repellents that could be used with ease. The arthropod (mosquitoes) ejects their saliva into the blood of the host that creates an immune response due to the binding of the antibodies IgG and IgE to the antigens. The reactions result in irritations, itching, redness and sometime it develops into the bumps. They are known to carry diseases like Malaria and yellow fever. It is the saliva of the mosquito that often causes an irritating rash that is a serious nuisance. However, it has been reported that among all the breed of mosquitoes only the female species bite animals and humans and transmits the virus that is responsible for the deadly diseases. Mosquitoes bite the infected person and carry the same virus with it and when it bites the other uninfected person it insert that saliva causing the disease. Not only can mosquito carry diseases that afflict humans, they also transmit several diseases and parasites that dogs and horses are very susceptible to. In addition, mosquito bites can cause severe skin irritation through an allergic reaction to the mosquito's saliva by human mosquito contact. Mosquito vectored diseases include, malaria, filarial diseases such as dog heartworm, and viruses such as dengue, encephalitis and yellow fever. Mosquitoes detect our presence since they bears set of sensors that have the capability to track their preys presence, these includes:

### A. Chemical Sensors:

The studies have proved that the mosquitoes have the tendency to sense the lactic acid, carbon dioxide and the propen-3-ol upto many yards away. The humans and the animals release these compounds when they breathe or perspire. This is the reason that a person that sweats more becomes the target of the species and the one who sweats less don't get as many bites.

### B. Heat Sensors:

The mosquitoes also have the ability to detect heat and hence can target the warm blooded animals very fast once they get close enough.

### C. Visual Sensors:

It's been recorded that the mosquitoes are the intelligent insects as they can easily detect you by looking at your clothing if it contrasts to the background as when you move wearing such clothing you are easily detected by them as it's very obvious that anything that moves is alive and hence full of blood.

## II. MOSQUITO REPELLENTS AND THEIR MODE OF ACTION

A mosquito repellent is a substance that is synthesized in such a manner so that it makes the surface unpleasant and unattractive to mosquitoes so as to reduce the human mosquito contact. They contain active ingredient which is the only reason to repel mosquitoes by blocking their olfactory senses which detects the Carbon Dioxide and lactic acid that gets released when the human perspires. These products also contain some more ingredients which aids them with cosmetic finishing. They are available in various forms from coils to aerosols to lotions to creams to oil. But the major sold products are coils, aerosols and creams.

### III. MATERIALS AND METHODS

#### A. Herbal Mosquito Repellent Coil:

Herbs used: Tulsi, rosemary oil, ajowan, raal, guggal, rice husk, lavender oil, vegetable ghee, lemon grass oil, maida, rice, ghee, neem oil, neem sawdust, cowdung.

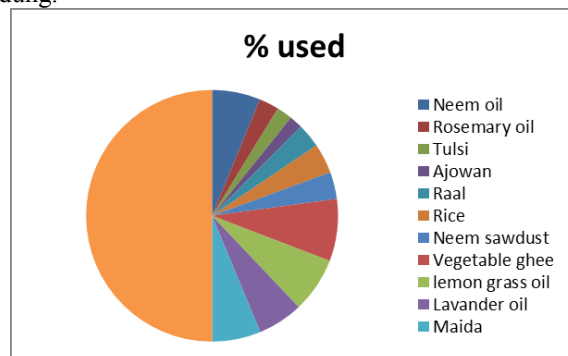


Fig. 1: (Composition of herbal mosquito repellent coil)

##### 1) Preparation:

Tulsi, Ajowan, Raal, guggal, neem sawdust, maida, rice, rice husk, vegetable ghee, sodium benzoate was firstly ground into powder form so that it could be mixed with our other ingredients evenly and then the above mix were added to the cow dung also the mix of essential oil was sprayed w/w over the coil.

The so synthesized coil was then dried in sunlight for few hours & then in oven at (70–75) degree Celsius for next few more hours. The synthesized product was then Left undisturbed for a day at room temperature and the mix of oils sprayed (w/w) again to ensure that it must get distributed evenly on the surface of the coil. The essential oil mix was prepared by mixing Neem oil (w/w), lavender oil (w/w), Rosemary oil (w/w) lemongrass oil (w/w) and finally we Stored our synthesized herbal repellent coil for 2 weeks.

We even tried to prepare a better coil by adding and replacing few other ingredients to the above by adding some known easily available and effective repellents such as camphor and camphor oil, vitamin E oil, rice as a binder and wax to prevent breakages caused in the coils.

##### 2) Mosquito Culture:

The progress of the coil was checked. The herbal mosquito repellents were tested against the male breed of mosquitoes i.e. *Aedes Aegypti*. The test for checking the repellence activity of the synthesized herbal mosquito repellent coil was done by exposing the hands of the volunteer to the so prepared mosquito trapped in which almost 50 adult male mosquito of *Aedes Aegypti*.

##### 3) Time of Protection:

The time of protection was observed and calculated by exposing the volunteer hands into the mosquito trap at time interval of 10 minutes and observing for 2 minutes. The time between the use of repellent and the attracting of at least two mosquitoes of male *Aedes Aegypti*, entertained by a confirm bite, was considered as the final time of protection.

#### B. Herbal Mosquito Repellent Spray (Aerosol):

##### 1) Herb/ Natural Ingredients Used:

- Witch hazel or vodka
- Glycerine
- Lemon grass oil:- lemongrass Known for its good repelling property and perfect aroma
- lavender oil :- known to be the best mosquito repellent
- rosemary oil:-antidepressant property
- acetone: as vaporiser

The standard procedure were followed to prepare the following herbal mosquito repellents and then they were taken for testing their activity against *Aedes Aegypti* breed of mosquitoes in the self prepares mosquito trap.

The individual repellent formulations gave positive results composed of selected active essential oil combination.

##### 2) Preparation:

First, Half of the beaker was filled with the distilled water and then to it ~ 10 ml vodka, (2-15) drops of each of the essential oil and ~ (1-2) of glycerin was added with vigorous shaking. It was then kept on magnetic stirrer to mix the oil and water completely for nearly 10 hours with half an hour of interval at 40 degree C and finally we kept and stored it for a week to check if the aq. & oil layer separated. We again stirred the solution on magnetic stirrer for several hours to make sure that in case if the two layers separated by even small proportion then it must get compensated. The product was stored for final analysis.

#### C. Herbal Mosquito Repellent Cream:-

##### 1) Herbs Used:

Since odomos composition included 12% N, N-dimethyl benzamide (DEB) again a toxic ingredient. We thought of to replace the same with the essential oil that could work as effective as this product. Any cream is generally synthesized using mostly the emulsification method. So, going throughout various searches we came to a final decision of replacing N,N-dimethyl

benzamide (DEB) with a mixture of essential oil that was prepared by mixing lemon grass oil, vitamin E oil, neem oil that have wonderful aroma, antiseptic properties, anti-depressant properties, anti-biotic properties and Nontoxic effects.

## 2) Preparation:

- Preparation of 30 gm of herbal mosquito repellent cream:
- Preparation of a lipid phase:

Weighed the chemicals required, essential oil, and preservatives. i.e. Stearic acid 6 g, stearyl alcohol 4.5 g, cetyl alcohol 4.5 g, citric acid 3-4 pinch. The above mix was then properly heated at a temperature of 70 degree to 75 degree Celsius in oven.

- Preparation of an aqueous phase:

Weighed and mixed the ingredients as follows: Milk of magnesia (preparation):



Fig. 2: (Synthesized Herbal Repellent Cream)

Milk of magnesia also called magnesium hydroxide was first prepared by burning the magnesium ribbon and then mixing the ash of magnesium oxide so formed in distilled water. 1.5 g of milk of magnesia or magnesium hydroxide was weighed and to it added glycerin (1.5 g) 10 ml of 0.2 % of disodium salt of EDTA (Ethylene Diamine Tetra-acidic Acid) was self-prepared by adding 0.2 g of the salt in 10 ml of distilled water. The mix was then heated at the same temperature of (70–75) degree in oven for one hour. Both the phases were added to the active ingredient mix at room temp. with constant stirring. It was then kept on the magnetic stirrer at interval 10 min. for one hour. Refrigerated the cream thus formed for a day. Again (2–3) g of glycerin was added to it and kept on magnetic stirrer at interval of 10 min. for an hour. The cream was then stored for (2–3) days. The standard procedure were followed to prepare the following herbal mosquito repellents and then they were taken for testing their activity against *Aedes Aegypti* breed of mosquitoes in the self prepares mosquito trap. The individual repellent formulations gave positive results composed of selected active essential oil combination.

## D. Time of Protection:

The time of protection was observed and calculated by exposing the volunteer hands into the mosquito trap at time interval of 10 minutes and observing for 2 minutes. The time between the use of repellent and the attracting of at least two mosquitoes of male *Aedes Aegypti*, entertained by a confirm bite, was considered as the final time of protection.

## IV. RESULT AND DISCUSSION

In the case of herbal mosquito repellent coil the burning and the essence is the important criterion in the wide scale of a mosquito repellent coil. The protection time was our basis of working of the synthesized herbal repellent which was almost an hour. The use of herbal ingredients ensures that they are safer to be used as repellents. The so prepared coil evolved enough fumes which was nonirritant and non-suffocating with wonderful essence of lemongrass. It can be concluded that the most active component found to be present in our herbs used as ingredients for repelling the pests and other insects used in our repellents was Azadirachtin in neem that decreases the feeding of an insect and it usually makes the surface rough for the insects to lay eggs and the best thing about it is that it is suitable to people of all ages, Lemongrass has antifungal properties and are used as pesticides and as well as preservatives as they contains citrus flavour, Rosemary oil is found to be a plant of the family mint and the presence of rosmarinic acid, camphor (known to be poisonous to the insects and possesses anaesthetic and anti-microbial) and carnosic acid & carnosol ( known to be an antioxidant) are found to be responsible for the aroma and the repellence activity of the oil in our repellents; also it has anti-depressing property, Lavender has been used since many decades due to their anti-depressant analgesic, antifungal properties as they contains mixtures of camphor, esters, limonene, linalool, caproic acid that contributed them the ability to act as an insect repellent, Tulsi is known to have rosmarinic acid, oleanolic acid linalool, ursolic acid as the active components in it that contributed to its repellence activity in our formulations. Similarly, cream too was found non-irritating and no side effects were seen on volunteer's hand. However, the spray showed less repellence activity as compared to coil and cream.

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