IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 11, May 2025
Impact Factor: 7.67

Formulation and Evaluation of Herbal Mosquito Repellent Incense Coil

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Abstract: *One of the most upsetting bloodsucking insects that humans have to deal with is the mosquito. Everywhere that the environment is not maintained, clean, and orderly, mosquitoes proliferate. In the current situation, mosquito control or prevention is crucial. Mosquito repellents can be a useful tool for protecting individuals from mosquito bites that pose a danger of spreading diseases including chikungunya virus, dengue virus, and plasmodia. In addition to being widely utilized, mosquito repellent coils are quite effective. Numerous viruses and parasites that cause disease are spread by mosquitoes. halting the spread of numerous infectious diseases via mosquitoes. Nowadays, more people are using plant-based mosquito repellents because synthetic repellents include a lot of harmful chemicals that can be toxic and cause swelling, redness, itching, and other symptoms. Orange peel powder, turmeric, limonene oil, lemongrass oil, and charcoal were used to make the herbal insect repellent coils. There are insecticidal properties in lemongrass.*

Keywords: mosquitoes

I. INTRODUCTION

One of the most upsetting bloodsucking insects that humans have to deal with is the mosquito. Everywhere that the environment is not maintained, clean, and orderly, mosquitoes proliferate. In the current situation, mosquito control or prevention is crucial. Mosquito repellents can be a useful tool for protecting individuals from mosquito bites that pose a danger of spreading diseases including chikungunya virus, dengue virus, and plasmodia. In addition to being widely utilized, mosquito repellent coils are quite effective. Numerous viruses and parasites that cause disease are spread by mosquitoes. halting the spread of numerous infectious diseases via mosquitoes. Nowadays, more people are using plant-based mosquito repellents because synthetic repellents include a lot of harmful chemicals that can be toxic and cause swelling, redness, itching, and other symptoms. Orange peel powder, turmeric, limonene oil, lemongrass oil, and charcoal were used to make the herbal insect repellent coils. There are insecticidal properties in lemongrass.

Lemon grass oil, which comes from Cymbopogon flexuosus, and limonene oil, which is found in orange peel, both have deadly or fatal effects on mosquitoes and other insects. Lemon grass exhibits the highest level of activity and efficacy in lowering mosquito populations. Within smoking restrictions, it can be used as an active element to make mosquito coils that, when ignited, will repel insects or mosquitoes. Given the long history of usage of plant-based insect repellents due to their low toxicity, natural products serve as a good substitute. Essential oils have become more popular as insect repellents because of their many useful bioactive components. The objective of the present study is to develop effective plant-based mosquito repellent products.[1,2,3] In poor nations, mosquitoes are the cause of numerous ailments in specific areas. All around the world, mosquito bites are a widespread problem, and in some places, insects can spread dangerous diseases. One of the most upsetting bloodsucking insects that humans have to deal with is the mosquito. Numerous mosquito species are responsible for a number of illnesses, including Japanese encephalitis, dengue fever, malaria, and yellow fever. Over 700 million people are infected by mosquitoes alone, and over a million deaths are reported worldwide each year. Humans contract the Japanese encephalitis virus from infected Culex mosquitoes. In endemic areas, malaria, which is brought on by Plasmodium parasites and spread by female Anopheles mosquito bites, continues to pose a serious threat to newborns and young children.

The Aedes aegypti mosquito is the cause of dengue disease, which infects about 100 million people annually globally. Around the world, mosquito control is a major public health concern. One strategy for controlling these diseases spread

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by mosquitoes is to stop the spread of the disease by either eliminating the mosquitoes or stopping them from biting people. By taking a virus or parasite with them when they bite an infected person or animal, these mosquitoes typically spread diseases from one people to another or from one animal to another. Applying a material to skin, clothing, or other surfaces that prevents mosquitoes from leading or climbing on them is known as a mosquito repellent. Repellants for mosquitoes are used to shield the body from bites that may have systemic or localized consequences. mosquito-repelling coil with lemongrass oil as the primary ingredient. Polyherbal formulations were methodical attempts to demonstrate the effectiveness of herbal extracts using experimental methods. Many people are aware of the plant's ethnobotanical and therapeutic benefits. Its oil and extracts have been claimed to have antibacterial, insecticidal, and medicinal qualities. [4,5,6]

Fig.1 Ingredient

Classification of Mosquito Repellents:

The mosquito repellents currently available can be widely divided into the following categories:

1. Physical methods of Mosquito Repellents
2. Chemical methods of Mosquito Repellents

a) Natural mosquito repellents

b) Synthetic mosquito repellents

3. Mechanical methods of Mosquito Repellents

1. Physical Method

It means to keep mosquitoes from biting. This technique serves as a barrier to prevent mosquito bites.Using this technique, the stagnant water is emptied into buckets, old tires, rain gutters, plastic coverings, etc. Additionally, it is advised that you dress in long sleeves, particularly at dawn and dusk. To further keep mosquitoes out of the house, windows and door screens need to be repaired. Changing the water in bird baths, fountains, pools, rain barrels, etc. is quite desirable. Regularly, at least once a week, to prevent mosquitoes from locating the ideal spot to lay their eggs.

2. Chemical Method

This approach uses repellents with a chemical foundation. The best way to protect yourself from insects is to use chemical repellents, which also help prevent and manage diseases that are spread by insects. This can be further divided into two groups according to the source:

a) Natural repellents:

Repellants are made from natural materials in this manner. Since ancient times, these herbal insect repellents have been created and marketed, which has resulted in the development of personal defense techniques. Herbal insect repellents have less negative effects and are safe. Natural resources that have the ability to repel have been crucial in reducing the spread of vector-borne diseases in both humans and animals. Essential oils are among the natural repellents: Citronella, eucalyptus, lavender, lemongrass, peppermint, and other essential oils can be used topically or diffused. Garlic and Neem: It has been observed that the scent of garlic and neem oil deters mosquitoes. Herbs and Plants: Place mosquito-repelling plants throughout your house, such as catnip, marigold, and basil. Burning camphor in a space produces smoke that is

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b) Synthetic repellents:

Due to the limitations and disadvantages of natural herbal repellents, certain synthetic repellents were employed. In contrast, the effectiveness of these natural repellents seems to last less time and diminish more quickly. Due to the drawbacks of using natural plant resources as mosquito repellents, including their short repellent time and expensive cost, extensive research was conducted to create a synthetic alternative. Although chemicals produced from plants have long been used to repel mosquitoes, the same drawbacks have been noted.Plant-based mosquito repellents are different from synthetic ones.

3. Mechanical Method

This technique uses a few mechanical devices to keep mosquitoes away.A mechanical mosquito repellent system can be made using the well- known fact that yellow light attracts fewer insects than white light. In order to kill mosquitoes when they come into touch with their deadly electric charge dose, an electric mosquito zapper uses ultraviolet light to trap them. Other strategies that are classified as mechanical mosquito repellents include mosquito magnets and the Electric Mosquito Zapper. [6,7,8,9,10]

4. Behavioral Methods

Appropriate Clothes: When in mosquito-prone locations, wear light-colored, long-sleeved clothing and trousers.
Time management: Refrain from going outside between dawn and nightfall, when mosquito activity is at its highest.
Chemistry of mosquito repellent :

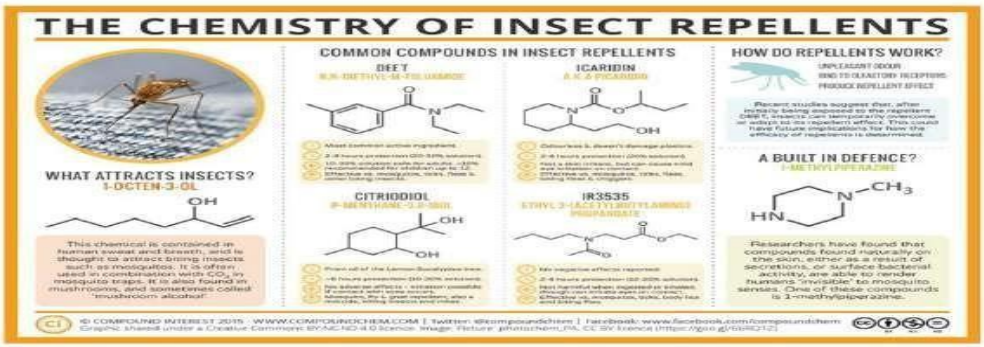

Fig.2 Chemistry

Types of mosquito repellents:

There are several categories into which mosquito repellents fall. They are classified as either chemical or herbal repellents, depending on where they come from. They can also be divided into groups based on their behavior.

1. On the basis of source

a) Natural / Herbal repellents

o Citronella oil
o Castor oil
o Clove oil
o Rosemary oil
o Lemongrass oil
o Neem
o Eucalyptus oil
o Limonene
o Peppermint oil

b) Chemical repellents

o DEET (Di-ethyl Meta Toluamide)

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o Allethrin & Permethrin
o Picaridin
o Bog Myrtle
2. On the basis of haw they act
a) Repellent Insecticides
b) Contact Insecticides
 Mode of action of mosquito repellent :
Five potential ways that insect and mosquito repellents work were examined:
1. Preventing host attractant sensory neurons from responding.
2. Turning on the receptor system that controls an improper or competitive behavior.
3. Behaving as a repellent at high concentrations yet as an attractant at low concentrations.
4. Increasing the noise signal ratio by activating receptors connected to many behavioral programs in order to "jam" the appropriate sensory circuit.
5. Turning on the distinct aversive/avoidance receptors. [11,12,13,14]
Plants Description:
Pharmacognosy:
1) Lemongrass:

Fig.3 Lemongrass

Synonyms: East India Lemongrass, Malabar or cochin lemongrass.
Biological Source: Lemongrass oil is obtained from Cymbopogon Flexuosus Stapf. Belonging to family Poaceae
Chemical constituents:
Lemongrass oil is the principal source of Citral(68-85%)
from which ionone is derived. The oil also contains methyl heptanone, decyl aldehyde, and geraniol.
Uses:
The Lemongrass oil is used in perfume, soaps, cosmetics, and mosquito repellent.
2). Orange peel:

Fig.4 Orange peel

Synonyms:
Orange cortex, Bigarade orange, Seville orange, China orange, Bitter orange peel
Biological Source:

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Orange peel is consisting of fresh and dried outer part of the pericarp of citrus aurantium linn.
Belonging to the family Rutaceae.
Chemical constituent:
Limonene (90%) Citral(4%) Vitamin C Pectin
Hesperidin
Aurantimarin and Aurantimaric acid (both are glycosides and responsible for bitterness)
Uses:
Stomachic Aromatic Carminative
Flavoring agent in oral liquid preparation Use for Bitter tonic[2]
3). Turmeric:

Fig.no 5 Turmeric

Synonyms: Saffron Indian, haldi (Hindi), Curcuma Rhizoma.
Biological Source: Turmeric is the dried rhizome of Curcuma longa Linn. belonging to the family Zingiberaceae.
Chemical constituents: Curcuminoids, curcumin, desmethoxy curcumin, bides methoxy curcumin volatile oil (5%) sugars, bitter substances, fixed oils, and acids.
Uses:
1)Turmeric use as aromatic 2)anti-inflammatory
3) stomachic
4) blood purifier 5)alternative
6)spice, coloring agent [3]
4. Camphor:

Fig.6 Camphor

Synonyms: Gum camphor, Japan camphor Biological Source:
Camphor is a solid ketone, obtained from the volatile oil of Cinnamomum camphora.
Belonging to the family Lauraceae.
Chemical Constituents:
Camphor oil, contains camphor cineole, pinene Camphene, phellandrene,limonene, diterpenes, and Camphor is entirely a monoterpenic ketone.

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Uses:

Camphor is a white, crystalline substance with a strong odor and a pungent taste.

It is derived from the camphor tree and has been used for centuries in various cultures for its medicinal and aromatic properties.

Pain Relief.

It is used externally as a rubefacient, counterirritant. Internally used as a stimulant, carminative and antiseptic.[3,4]

5. Gum Acacia:

Fig.7 Gum Acacia

Synonyms: Gum Arabic, Acacia

Biological source:

The dried sticky substance known as "Indian gum" is extracted from the stem and branches of the Acacia arabica plant.

A member of the Leguminosae family

Chemical Constituents:

The main component of acacia is Arabin, a complex mixture of potassium, magnesium, and calcium salts of Arabic acid.

Uses:

Gum acacia, also known as gum Arabic, is a natural gum derived from the sap of Acacia trees. It has a wide range of applications across various industries As a thickening, emulsifier, or food stabilizer, gum acacia enhances the texture of food products without compromising other aspects like flavor. It is employed as a demulcent in pharmaceuticals. [16,17,18,19]

Need of Herbal Mosquito Repellents: Numerous artificial mosquito repellents contain ingredients that are harmful to people's health. Herbal mosquito repellents must be used because those chemicals have a number of negative impacts on people. Because they are created from a variety of herbal ingredients and essential oils, herbal mosquito repellents are safe for human health. Only a small number of cases of dermatitis, allergic reactions, and neurologic and cardiovascular toxicities, including seizures, have been reported and discovered in relation to the extensive use of DEET-containing products, researchers like Tenenbein, and records from poison control center telephone data (13,14,15). There have been reports of further detrimental health effects, such as encephalopathy, tremors, slurred speech, aberrant behavior, coma, and even death [20,] Herbal mosquito repellents have gained significant popularity due to several advantages over their chemical counterparts:

Health Benefits

• Decreased Chemical Exposure: Chemical repellents may contain ingredients that irritate skin or create breathing issues. In general, natural substances used to make herbal repellents are safer for human health.

• Minimal Side Effects: Herbal repellents are less likely to irritate skin or trigger allergic reactions than chemical repellents.

Environmental Benefits

• Eco-Friendly: Herbal repellents have little effect on the environment and are biodegradable. They do not damage pollinating plants or beneficial insects.

• Sustainable: Herbal repellents frequently contain substances that come from renewable and sustainable sources.

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II. AIM AND OBJECTIVE:

Aim:

Formulation and Evaluation of Herbal Mosquito Repellent incence coil.

Objective: Creating a safe, efficient, and eco- friendly substitute for chemical-based repellents is the main goal of developing and testing herbal mosquito repellent coils. This entails a number of particular goals:

1. To research the several herbs that have the ability to repel mosquitoes.
2. To research the different pharmacological effects of plants.
3. To investigate the ability of different herbal essential oils to repel mosquitoes.
4. To evaluate the candle's ability to repel insects.
5. To research the formulation's effectiveness and safety.
6. Formulation evaluation.

III. LITERATURE REVIEW

1. Imeda C, Katani S, Kitu A, Kitufe N, Magesa S, Magogo F, Malebo H, Malecela M, Malima R Journal of Medicinal Plants Research 2013; 7: 653-660.

Abstract:

Controlling mosquitoes and taking precautions against mosquito bites are two of the most crucial ways to prevent the spread of infectious diseases. Using natural ingredients to create a mosquito repellent coil was the main objective of this study. In this composition, lemongrass oil and lemonene oil were used as pesticides. Following the extraction of these oils, the proper proportions of gum acacia, water, camphor, turmeric, and activated charcoal were added to serve as a binder. Over time, the coil base material's many chemicals might burn slowly, decreasing or releasing insects. An effective and safe method of mosquito repellent is the use of naturally occurring compounds. Its formulation, evaluation, and characterization were finished for safe and effective use

2. Makhaik M, Naik SN, Tewary DK: Evaluation of anti-mosquito properties of essential oils. Journal of Scientific and Industrial Research 2005; 64:129-133.

Abstract:

Essential oils from Cedrus deodara, Eucalyptus citriodora, Cymbopogon flexuous, C. winterianus, Pinus roxburghii, Syzygium aromaticum and Tagetes minuta were evaluated for bioactivity against the adults of Culex quinquefasciatus and Aedes aegypti. Serial dilutions of the oils were made in deodorized kerosene to obtain a range of concentrations (0.5- 10%) and the adults were exposed to the vapour of the different oils for 1h in WHO kits for sensitivity testing. C. winterianus and S. aromaticum oils were equi effective and found most effective with LC50 and LC95 values respectively at 0.5 and 0.9 % for C. quinquefasciatus and 1.0 and 2.0 % for A. aegypti. Activity was found in the order. S. aromaticum > C. flexuous > E. citriodora > C. winterianus > C. deodara > T. minuta

3. Ranasinghe MS, Arambewela L, Samarasinghe S. Development of herbal mosquito repellent formulations. Int J Pharm Sci Res. 2016 Sep 1;7(9):3643-48.

Abstract:

The present study reports the studies directed towards the development of safe and efficient herbal mosquito repellent formulations obtained by mixing hexane extract of Azadirachta indica seeds, hexane/ethanol extract of Vitex negundo leaves, essential oils from Ocimum sanctum leaves, Curcuma longa rhizomes and Citrus sinensis peels and essential oils of Cymbopogon nardus leaves, Eucalyptus globules leaves and Syzygium aromaticum buds purchased from the market. 1 ml of 10% (v/v%) extract / essential oil containing ethanol solutions prepared using each plant extract / essential oil was tested for mosquito repellent activity using arm-in-cage method. A volunteer's forearm rubbed with 1 ml test solution was exposed to 20 blood-seeking mosquitoes and the number of mosquitoes that aligned or biting the arm was recorded in each minute for five minutes. Analysis was carried out as a triplicate and mosquito repellent activities were found to be in the order: Cymbopogon nardus and Eucalyptus globulus (100%) > Ocimum sanctum (97.94%) > Syzygium aromaticum (95.81%) > Citrus sinensis (93.75%) > Curcuma longa (89.56%) > Vitex negundo (85.44%) > Azadirachta indica (81.25%). Outdoor and indoor field trials on mosquito repellent gel and mosquito repellent spray prepared containing 16% (v/v%) active ingredients were conducted separately on two days from 5 am to

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11 am by application on volunteers' legs. 100% mosquito repellency up to six hours was observed for the gel and the spray for outdoor and indoor field trials.

4. Hamidpour R, Hamidpour S, Hamidpour M, Shahlari M. Camphor (Cinnamomum camphora), a traditional remedy with the history of treating several diseases. Int. J. Case Rep. Images. 2013 Feb 1;4(2):86-9. Abstract:
The purpose of this literature review is to gain knowledge of the long history, wide variety and extensive applications of camphor both in traditional and modern medicine. Camphor (Cinnamomum camphora) which is obtained from the wood of camphor tree, has been used for centuries and throughout the world as a remedy for treating variety of symptoms such as inflammation, ingestion, infection, congestion, pain, irritation, etc. The studies have shown that some of the components of Cinnamomum camphora have suppressive and antimutagenic effect in number of human cancer cells without harming the healthy cells. In this paper our focus is on the use of camphor, as a remedy for daily minor problems as well as gathering some information about the new applications of this traditional medicine to treat or prevent some other serious, life threatening diseases like cancer, diabetes. We hope to get the attention of researchers for conducting more studies on the effects of camphor on patients with memory and brain disorders as well.

5. Patil[1] JR, Nalawade SM, Patil HS, Pandya[4] RY. A Review On Herbal Mosquito Repellent.
Abstract:
Nowadays Majority of the disease or infection like malaria, dengue etc. caused by the different types of mosquitoes mainly female Anopheles mosquito to prevent these infection or diseases there are multiple synthetic pesticides are used in market. The various pesticides used as a mosquito repellent containing hazardous chemicals that causes the various health problems in humans and other living creatures, that pesticides also cause the environmental pollution by considering these facts we are here with mosquito repellent without hazardous chemicals known as HERBAL MOSQUITO REPELLENT. As the herb are easily accessible in our society, it is very beneficial to use these Holly herbs in mosquito repellent formulations The herbs are the core substance in our formulations ,there are different active constituents such as alkaloids ,fixed oils, essential oil, resins flavonoids ,phenols etc. . Which is present in specific parts of herbs as it is extracted by various methods like steam distillation, pressing techniques, solvent evaporation etc. The current paper summarizes research with aimed of developing the safe and effective herbal mosquito repellents. Our study aims at the investigating the herbs which has mosquito repellent activity but they do not cause the health hazard, environmental hazard and pollution, those herbs which have Mosquito repellent activity which are used in specific proportion depending on their mosquito repellent activity in herbal mosquito repellent formulation and formulations have been developed.

6. Sanchez C, Nigen M, Tamayo VM, Doco T, Williams P, Amine C, Renard
D. Acacia gum: History of the future. Food Hydrocolloids. 2018 May 1;78:140-60.
Abstract:
On behalf of the 90th birthday of Professor Glyn O. Phillips, it is a great honor for authors of this publication to make a review on Acacia gum, one of the favorite polysaccharides extensively studied by Glyn and his collaborators all around the world during these last five decades. After remembering a synthetic historical perspective, the present critical review summarizes the main updated data of this complex polysaccharide from the chemical composition to the functional properties with a particular attention toward structure and bulk and interfacial properties. Biological properties of Acacia gums were not considered. Some of the main challenges in a near future for a better understanding of the functional properties of this polysaccharide concerns the detailed study of the gum maturation mechanism upon exudation, the structure and conformation of different molecular fractions, the role of minor components (minerals, polyphenols, lipids) on the structure and functionality of gums, the physicochemical properties of purified molecular fractions and the ways to modified them upon enzymatic modifications. In our opinion, the main challenges for a better understanding of the interfacial function of this polysaccharide (adhesion and stabilization at liquid and solid interfaces) will be to probe the interfacial induced conformational changes. This area of research seems to have been quite neglected during these last past years and fundamental questions arising from the adhesive and stabilizing properties of Acacia gum are still without answer today.

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7. Phillips GO. Acacia gum (Gum Arabic): a nutritional fibre; metabolism and calorific value. Food Additives & Contaminants. 1998 Apr 1;15(3):251-64.

Abstract:
Gum Arabic (Acacia gum, INS 414: E414) is extensively used as a food additive, but there is no regulatory or scientific consensus about its calorific value. It is a complex polysaccharide, primarily indigestible to both humans and animals, not degraded in the intestine, but fermented in the colon under the influence of microorganisms. Despite a range of animal studies, there are no usable data for humans which can quantify the utilizable energy of Gum Arabic. Estimates in the literature from animal experiments vary from 0 to 4 kcal/g. After certain allowances are made for the energy losses from volatile and gaseous fermentation products, an upper level of 2 kcal/g for rats has been set. The situation in man is demonstrably different, with greatly reduced amounts of such products, and the need to adapt for varying periods before Gum Arabic is attacked by colonic bacteria. In the absence of an agreed scientific assignment, the FDA in the USA insist upon 4 kcal/g in nutritional labelling, whereas in Europe, no value has been assigned to soluble dietary fibre, such as Gum Arabic. This review argues that based on present scientific knowledge only an arbitrary value can be used for regulatory purposes.

8. Pronobesh Chattopadhyay ,Mosquito repellents: An insight into the chronological perspectives and novel discoveries, Acta Tropica , volume 167, March 2017.

Abstract:
Mosquito being the major medically important arthropod vector; requires utmost attention to reduce the sufferings and economic consequences of those living in the endemic regions. This is only possible by minimising the human-mosquito contact by an absolute preventing measure. However, unfortunately, such absolute measures are yet to be developed despite enormous efforts and huge investments worldwide. In the absence of vaccines for number of mosquito-borne diseases, repellents could be an attractive option for both military personal and civilians to minimise the risk of contacting different mosquito-borne diseases. However, to achieve this golden goal, the detailed knowledge of a particular repellent is must, including its mode of repellency and other relevant informations. Here, in the present article, an effort has been made to convey the best and latest information on repellents in order to enhance the knowledge of scientific community. The review offers an overview on mosquito repellents, the novel discoveries, and areas in need of attention such as novel repellent formulations and their future prospective.

9. Emily Lucille Moore, Mary allice scott, Stacy Deadra Rodriguez, Soumi Mitra, Julia VulcanKristina Kay Gonzals and Immo Alex Hansen, An online survey of personal mosquito-repellent strategies, Published: on 2018 Jul 3.

Abstract:
Mosquito repellents can be an effective method for personal protection against mosquito bites that are a nuisance and carry the risk of transmission of mosquito-borne pathogens like plasmodia, dengue virus, chikungunya virus, and Zika virus. A multitude of commercially available products are currently on the market, some of them highly effective while others have low or no efficacy. Many home remedies of unknown efficacy are also widely used.

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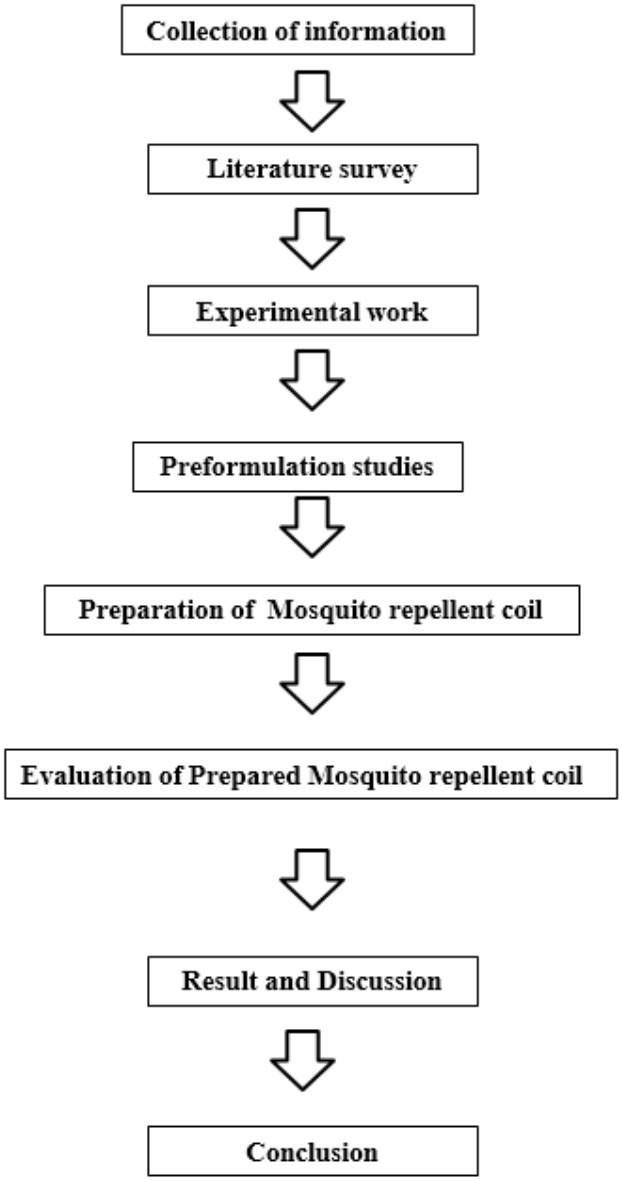
IV. PLAN OF WORK



V. PROCEDURE

Materials:

The selection of plants was based on an analysis of several publications, their availability as essential oil-based insect repellents, experimental findings, and their uses.

Herbs used in mosquito repellent formulations:

1) Lemongrass:

Natural compounds with insecticidal and repellent qualities can be found in lemongrass. One of the primary active components in lemongrass that deters mosquitoes is citronela.This volatile oil is frequently found in lotions, sprays, and coils that repel mosquitoes. Other mosquito-repelling volatile oils found in lemongrass include citral, limonene, and

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geranol.The tall, perennial grass known as lemongrass (Cymbopogon citratus) is indigenous to tropical parts of Australia, Africa, and Asia.

2) Limonene oil:

The rind of citrus fruits, including oranges, lemons, and limes, contains a substance called limonene. About 97% of the essential oils found in orange peels are contained in these peels.Its primary chemical form, d-limonene, is frequently used.Limonene is a member of the terpene family of chemicals, which are recognized for their potent scents that keep predators away from plants. One of the most prevalent terpenes in nature, it may provide a number of health advantages. Vitamin C and citric acid, which are beneficial to our skin, are found in lemon and orange peels, respectively. There are claims that both scents repel gnats and mosquitoes.

3) Activated Charcoal:

It has long been utilized as an antidote and the ideal treatment for insect bites.It has the power to remove the poisons from bites and stings.

4) Camphor:

The main way that camphor works as a mosquito repellent is by interfering with the mosquito's olfactory senses. Here's a breakdown of the mechanism:

1. Strong Odor: Camphor has a strong, pungent odor that masks the human scent that mosquitoes are attracted to, which can interfere with the mosquito's ability to detect and locate its host.
2. Sensory Disruption: The molecules of camphor can bind to the mosquito's olfactory receptors, which are in charge of detecting odors. This binding can interfere with the normal functioning of the receptors, making it harder for the mosquito to detect and locate its host.
3. Neurotoxic Effects: In rare instances, camphor can also have neurotoxic effects on mosquitoes, which can further impair the mosquito's ability to locate and bite humans.

One typical product that may be used to eradicate mosquitoes in a home is camphor. This chemical, blend of stearic acid and beeswax were used to make the candle. The formulation table mentions these ingredients derived from a tree extract, provides the longest- lasting mosquito-repelling effect when compared to other natural treatments. Burning camphor can be a very effective mosquito repellent in a restricted space.

Experimental Work:

Table no 1: Formulation Table

Sr. No.	Ingredient	Activity	Quantity
1	Lemongrass oil	Mosquito Repellent	7.5 ml
2	Limonene oil	Insect Repellent	7.5 ml
3	Orange peel powder	Mosquito Repellent	2 gm
4	Activated charcoal	Reduces Emission of toxins	2 gm
5	Camphor	Natural insecticide	2 gm
6	Turmeric	Strong Aromatic as a Mosquito Repellent	2 gm
7	Gum acacia	Binding agent	1 gm
8	Distilled water	Vehicle	10 ml

Preparation of coil:

A blend of several herbs and essential oils was used to make this coil. The hydrocarbon bases of a blend of stearic acid and beeswax were used to make the candle. The formulation table mentions these ingredients

The following is how to make a mosquito repellant coil:

1. Weigh all powdered components (charcoal, turmeric, camphor, and orange peel powder) precisely.
2. Add in beaker one by one and mix well then adding the Lemongrass oil,Limonene oil and water stir it, then add suitable quantity of Gum acacia.
3. Heat for five minutes.

DOI: 10.48175/IJARSCT-27277

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International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 11, May 2025
Impact Factor: 7.67

4. Thoroughly mix the ingredients, form the mixture into dough, Made a coil.

Fig no.1 Lemongrass oil and Limonene oil

Fig no.2 Charcoal

Fig no.3 Camphor

Fig no.4 Potato starch

Fig no.5 Turmeric

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Volume 5, Issue 11, May 2025
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Fig no 6 Orange peel powder

VI. EVALUATION OF MOSQUITO REPELLENT COIL

Table no.2: Organoleptic Test

Sr.no.	Parameters	Result
1	Colour	Light Green
2	Odour	Lemon like
3	Tecture	Solid

The prepared candles were observed while burning. It was noticed they burned with a yellow, long, and steady flame suggesting a complete combustion. Each formulated candle was tested in the laboratory at normal room conditions in areas where the mosquito population is more. By lightning and compared compare with the same size formulated herbal coil and time noted for flammability, burning efficiency and burning time and also repellent activity. The mixture of various essential oils like lemongrass, and limonene oil. These essential oils are more effective for mosquito repellency.

Table no 3: Flammability Test

Flammability	Application time	Burning time	Mosquito repellency
Polyherbal mosquito repellent coil	F1-7pm	30pm	There were no mosquitoes around coil for 1hr
	F2-7pm	30pm	There were no mosquitoes around coil for 1hr
	F3-7pm	30pm	There were no mosquitoes around 1hr

Field Evaluations:

Three groups of three formulations each were randomly selected from the nine mosquito oil formulations. Five treatments—that is, three formulations, a blank coil, and a control (no coil)—were used in each field evaluation. Five human participants were required for each study. As a result, all nine formulas underwent three field trials, while blank coil and control were used in each study. Before each examination began, the sticks were burnt for five minutes. The five volunteers sat in a row, ten meters apart, and around 0.5 meters from the burning sticks for evaluation. By-catches of mosquitoes that landed on or bit the participants' exposed legs from knee to foot were used for assessments.

A total of 15 collections were made between 1830 and 2130 hours in each evaluation, and the three commercial mosquito coil products were also evaluated for field repellency along with a blank stick and control using the same procedure as previously described. Each mosquito stick formulation (i.e., 9 formulations derived from plant powder, and 3 commercial products) was evaluated in the field on 3 different nights in order to account for variation in mosquito attractiveness. This was done by rotating each catcher clockwise for the position at each mosquito collection, while the test formulations, the blank stick, and the control were fixed at the same position throughout the evaluation. As a result, 12 nights in total were dedicated to field evaluations for this study—9 nights for the plant-based formulations and 3 nights for the commercial items. The gathered mosquitoes were returned to the lab, where they were counted and given a confirmed identification.

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Efficacy Testing

Method:

• 1) Control Group: Provide a mosquito- infested room without a coil.

• 2) Test Group: Prepare a comparable space and light the mosquito coil.

• 3) Release a predetermined quantity of mosquitoes into every room, such as 50–100. 40At regular intervals (e.g., every 15 minutes for 4 hours), count the number of mosquitoes that are active, knocked down, or dead. Results: Metric:

• Knockdown rate (temporary incapacitation of mosquitoes).

• rate of mortality (dead mosquitoes).

• Rate of repellency (mosquitoes staying away from the area)

Toxicological and Health Impact Testing

• Examine the stick smoke for harmful substances such as formaldehyde, carbon monoxide, and particle matter.

• Human Testing: Put participants in a room with ventilation and the coil.

• Keep an eye out for respiratory problems, allergies, or discomfort.

• Assure informed consent and ethical approval.

Duration and Burn Rate

• Note the sticks overall burn time under typical circumstances.

As the stick burns, observe the physical integrity of the coil and the consistency of the smoke.

Data Analysis

• Compile information from field and controlled experiments.

• Utilize statistical techniques (such as ANOVA and t-tests) to assess the safety and efficacy in comparison to controls.

VII. RESULT AND DISCUSSION

The goal of the current study was to create and assess a polyherbal insect repellent coil. This study uses various plant essential oils to build a polyherbal insect repellent coil. We found that plant essential oils outperform plant extracts in terms of repellency when used in this mixture. The flammability test, color, texture, aroma, and mosquito repellency of the created candle were all assessed. Since the essential oils in this coil are made from herbal plants, it is safe to use and has no negative side effects.

VIII. CONCLUSION

This study successfully developed a mosquito repellent using a natural base. The coil formulation in this investigation produces impressive results. Significant repellent effect against a variety of mosquito species is provided by plant essential oil. Based on the study's findings, we can say that it is safe for human usage and a useful tool for preventing diseases spread by mosquitoes. The coil formulation may offer a practical, cost- effective, and convenient means of preventing diseases spread by mosquitoes, including dengue and malaria.

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