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Research Article

# Formulation and Evaluation of an Innovative Dual-Action Herbal Mosquito Repellent Perfume

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## A B S T R A C T

Herbal insect repellents shield users from insects that transmit illnesses and dangerous mosquitoes. Since effective protection frequently necessitates insect repellent with harsh chemicals and disagreeable scents, which deter regular usage, the ongoing danger of mosquito-borne diseases worldwide is troublesome.This work introduces a new approach in insect protection to overcome the tension between consumer demand and public health necessity. We suggest a brand-new, multifunctional personal scent that completely rethinks. By developing a wearable fragrance that not only satisfies the senses but also offers strong protection from mosquitoes, our research pioneersadditive method. The composition creates a plant-based, non-toxic substitute for traditional solutions by utilizing the inherent repelling and fragrant qualities of specific essential oils. By designing a product that serves as both an individual aroma and a mosquito repellent, this study presents a fresh, bio-rational strategy for personal protection. We speculate that volatile molecules included in essential oils generated from plants have two inherent qualities: they have a pleasant scent and can interfere with mosquitosensory circuits.

**Keywords:** Herbal Mosquito repellent, Essential oils, DEET free, Dual action perfume, Eco- friendly formulation.

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## INTRODUCTION:

The mosquito is one of the most annoying insects for sucking blood that people have to live withvarious mosquito species from the species of Anopheles, Culex, and Aedes genera are transmitters of pathogens that cause a number of illnesses, include Japanese encephalitis, dengue fever, malaria, yellow fever, and other infections. Mosquitoes alone infect about 700 million people, and more than a million people die from the disease every year worldwide. Malaria, which is carried by female Anopheles mosquito bites and is caused by Plasmodium parasites, continues to be a major hazard to young children and infants in endemic areas.Two of the most significant vectors of human malaria, Anopheles gambiae and Anophelesarabiensis, exhibit the widest global range.

Through the bites of female Anopheles mosquitoes carrying the parasite, humans are susceptible to malaria, a preventable and treatable disease that can be fatal. Anopheles mosquitoes are found in over 400 species, five of which are known to infect people with malaria.Regular trash removal, sanitary cleanliness, and the removal of breeding habitats are some treatments to lessen the disease load. Using insecticides, installing wire mesh on windows and doors, wearing suitable clothing, installing mosquito nets, and using insect repellent creams, coils, plug-in devices, and incense sticks are all ways to stay safe indoors.

The WHO recommends long-term insecticide nets (LLINs) because they provide chemical and physical protection. Sub-Saharan Africa accounts for over 90% of all malaria cases globally, and the use of LLINs reduced incidence by 50% there. To lay their eggs, female mosquitoes need

blood meals (from humans or animals), but male mosquitoes choose honey from flowers. Sleep can be disturbed by the characteristic high-pitched stinging of flying insects. Female mosquitoes inject anticoagulants and saliva.Vectors are living things that can spread infectious diseases from animals to people or between people. Several associated with these vectors are insects that consume blood that inject disease-causing microorganisms into a new host, either human or animal, after ingesting them throughout a bite of blood from an infected host.

The most well-known vector of disease is the mosquito. Triatomine bugs, fleas, flies, sandflies, ticks, and certain freshwater aquatic snails are among the others.The World Health Organisation (WHO) reports that over 3 million people die each year from widespread mosquito transmitted diseases such dengue haemorrhagic fever, yellow fever, encephalitis, epidemic polyarthritis, and malaria.In the world, mosquitoes are found everywhere except in Antarctica and France. Mosquitoes are responsible for 1 in 17 fatalities and spread disease to over 700 million people annually. Insects that cause all of these issues are present throughout Asia. Rural as well as urban residents must work together to implement effective mosquito control measures in order to address this issue. searching for ways to use non-toxic insecticides to stop the spread of this illness.

While some people become hypersensitive to bites, resulting in blistering, bruising, and severe inflammatory reactions, the immune system of the human body produces antibodies, which cause a bite to become irritated and itchy within minutes.An immunological response, or hypersensitivity, is the cause of noticeable, bothersome bites. IgG and Immunoglobulin E antibodies' response to antigen in this mosquito's saliva causes this hypersensitivity. The necessity for effective repellents against insects is highlighted by the morbidity and fatality rates.Another term for mosquito repellent is " bug spray." To prevent mosquito bites on the skin, repelling agents are applied to the skin's surface. Diseases including fever, dengue, and malaria are prevented and controlled by mosquito repellent.It is preferable to utilise natural synthetic repellents, like essential oils including lemongrass, neem, tea tree, lavender, and clove oils, as synthetic repellents can cause respiratory problems and other health problems. Methrin, permethrin, dimethyl carbamate, and DEET (N, N-diethyl-m-toluamide) are some examples of chemical-based insect repellents. To keep mosquitoes away, you can also wear clothing that covers your entire body and use a mosquito net.

Light-coloured clothes and an appliance with more air will help keep mosquito. Early detection and comprehensive treatment of many diseases are extremely challenging because of people's lack of understanding. As a result, a number of chemical techniques are available to stop their spread, albeit their use has been restricted by logistical issues, resistance development, expense, etc. Delivering larvicides that to the vectors' breeding grounds will disrupt their life cycle, making this the most efficient and straightforward method of controlling these diseases. Furthermore, it is widely recognized and seen that synthesized pesticides are hazardous to non-target species and the environment. A safer, more palatable way of vector control via natural, less expensive means of employing plants as pesticides gained popularity in order to prevent the tendency of bioaccumulation and the emergence of malignancies in non-target animals.

Despite their frequent use of masking agents to cover up human scent, it is hard to ignore the possible harm that commercially accessible repellents could do to human health. In order to solve this problem, the research will create a synthetic-free mosquito repellent that prioritises both human safety and environmental sustainability. Even while commercial repellents are widely used, they frequently contain chemicals that might cause allergic reactions, respiratory irritations, or environmental damage. In order to lessen reliance on synthetic repellents, this natural alternative makes use of common household items and botanical compounds.Commercial repellents often contain Conventional synthetic repellents that are used for mosquitoes include DEET (N, N diethyl-m-toluamide), a registered pesticide with potential adverse reactions and warnings include irritation of the skin and eyes, sleeplessness, etc. In mosquito control operations, other synthetic pyrethroids like sumithrinand permethrin are also frequently employed to kill adult mosquitoes.

An increasing number of studies over the past decade has shown that plant-based mosquito repellents, such as citronella oil and neem oil, are equally as powerful as DEET, if not further as well. Numerous herbal extracts have been found to have insect-repelling properties. Essential oils are one type of plant product that is particularly interesting as a possible mosquito control method because they have repellent or insecticidal properties. Essential oils are complex, naturally occurring, volatile substances with a powerful smell that are produced by plants with aromatic compounds as secondary metabolites.In order to demonstrate the effectiveness of herbal extracts, polyherbal formulations were methodical attempts to employ experimental procedures. Indeed, conventional pharmaceuticals are experiencing a resurgence in both academic and industry circles.

As medical knowledge of herbal remedies has advanced, there have been increasing efforts to combat mosquito-borne illnesses. Polyherbal formulation has made significant efforts to prevent diseases spread by mosquitoes in the past. Natural repellents: Although the majority of repellents on the market today are effective at rapidly keeping mosquitoes away, they are not the best for safety because they contain the hazardous chemical DEET. The ideal repellent is a substance that might make you appear unappealing to mosquitoes.Usingthe arm-in-cage method, the repellent effectiveness of ten essential oils against all three mosquito species was evaluated in order to ascertain the length of protection. The entire protection duration of all essential oils against Culexquinquefasciatus ranged from 120 to 360 minutes.For many years, the insect vector biology community has focused a lot of attention on understanding how repellents for mosquitoeswork, although many active chemicals have only been partially explained. In general, repellents for mosquitoestarget chemoreceptors linked to gustatory and/or olfactory organs, as well as additional appendages including wings and tarsi

which possess chemoreceptive sensilla.Notwithstanding these natural materials' potential, a methodical assessment and creation of mosquito repellent compositions are still required.

## MATERIALS:-

- Essential oils: Lemongrass oil, Neem oil, Tea tree oil, Lavender oil, Clove oil
- Base: Rose water (pharmaceutical/cosmetic grade)
- Optional excipients:- Emulsifier (Tween 20& Tween 80)

**Equipment's :**

- Volumetric flasks, beakers, and graduated cylinder.
- Micropipettes (for accurate measurement of essential oils).
- Magnetic stirrerwith stir bar (or overhead stirrer)
- Glass rod (for manual mixing)
- Homogenizer (optional, for improved dispersion)
- Filter paper or 0.45µm membrane filter
- pH meter
- Amber glass spray bottles (for storage and packaging)

**Herbal Ingredients Used:-**

| Sr. No. | Ingredients | Scientific Name | Family | Chemical Constituents | Medicinal uses | Image |
|---|---|---|---|---|---|---|
| 1. | Lemongrass oil | Cymbopogon citratus, Stapf | Gramineae | Citral α,Citral β, Citronellal | Anti-malarial, Anti-inflammatory, Repellent and Pesticidal |  |
| 2. | Neem oil | Azadirachta indica | Meliaceae | Nimbin ,Nimbidin, Nimbolide, Salannin | Repellent and Pesticidal, Anti-inflammatory, Anti- Microbial |  |
| 3. | Tea tree oil | Melaleuca alternifolia | Myrtaceae | Monocyclic terpene alcohol, α Terpinene | Antimicrobial, Antifungal, Anti-inflammatory |  |
| 4. | Clove oil | Syzygium aromaticum L. | Myrtaceae | Eugenol, β-caryophyllene | Anti-inflammatory, Analgesic, Antioxidant |  |
| 5. | Lavender oil | Lavandula dentata L. | Lamiacae | Monoterpenes, Borneol, α Terpineol, Thymol | Insecticidal and repellent activity, Antifungal |  |

## Method of Preparation:-

Take a sterile glass beaker, the oils that were used were precisely metered and mixed to create a consistent oil phase. Then, using a mechanical stirrer to make sure adequate dispersion, this combined oil phase was gradually introduced drop by drop into rose water, which served as the aqueous base. When necessary, Add the Tween 20 & Tween 80 to improve miscibility and clarity, and the resulting solution was further homogenized to attain consistency. A 0.45 µm filter paper was then used

to filter the resultant solution in order to eliminate any particles or undissolved substances. Prior to being sealed and properly labelled, the produced formulation was finally moved into amber spray bottles that had already been sterilized. Amber spray bottles that had already been sterilized were filled with the formulation, sealed, and properly labelled.

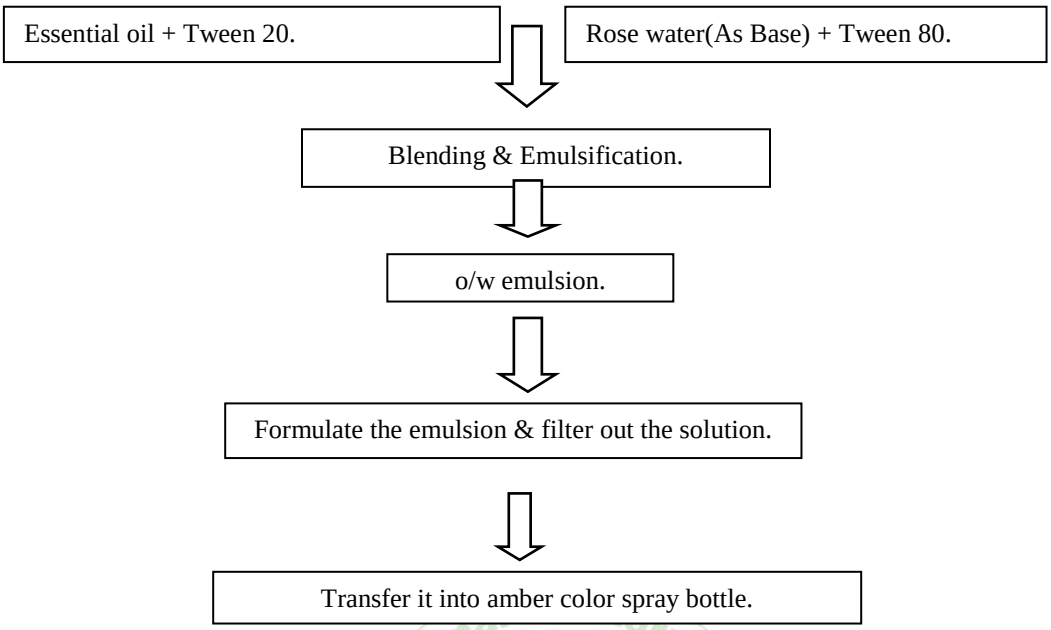


**Figure 1:** Schematic representation of procedure of formulation ofperfume.

**Quantity of constituents of Herbal Repellent Perfume:-**

| Sr No. | Constituents. | F1(ml) | F2(ml) | F3(ml) | Role of ingredient. |
|---|---|---|---|---|---|
| 1. | Lemongrass essential oil (*Cymbopogon citratus*) | 5.0 | 6.0 | 6.2 | Strong scent and mosquito repellent. |
| 2. | Neem oil (*Azadirachta indica*) | 5.0 | 5.2 | 5.0 | Natural insect repellent and antibacterial. |
| 3. | Tea tree oil (*Melaleuca alternifolia*) | 4.5 | 5.0 | 5.5 | Antimicrobial and insect deterrent. |
| 4. | Clove bud essential oil (*Syzygium aromaticum) (L.)* | 6.0 | 5.5 | 4.8 | Strong scent and repellent property. |
| 5. | Lavender essential oil (*Lavandula angustifolia*) | 5.0 | 5.0 | 5.2 | Fragrance and skin-soothing agent |
| 6. | Tween 80 | 20.0 | 20.0 | 20.0 | Emulsifier to stabilize the oil-water mixture. |
| 7. | Rose water | q.s. to 100 ml | q.s.to 100 ml | q.s. to 100 ml | Aqueous base and natural fragrance enhancer. |

## Evaluation of Perfume:-

1. **pH:-**The perfume's pH was determined to be 5.6, meaning it's slightly acidic and ensures that the perfume is mild on the skin.
2. **Skin Irritancy test:-** After spraying the perfume to a patch and leaving it on the forearm for 48 hrs. A reaction was noted. The skin's surface showed no signs of irritation after a day.
3. **Mosquito Repellencyactivity:-**

   Initially, the volunteers' forearms were washed with soap and allowed to completely dry. The left arm served as the control within the mosquito cage. Over the course of 30 seconds, the frequency of the vector touched the forearm. If there was more than ten mosquitoes, the testing began. The arm was carefully removed from the mosquito cage after a 30-second break. The investigation was carried out at 30, 60, 120, 240, and 480 minutes afterwards after the right arm had been spray with a herbal mosquito repellent perfume composition. The overall number of mosquitoes which landed & the positive control were compared. In triplicate, the study was conducted.

4. **Public Survey:-**

   To investigate the formulation's safety and effectiveness, a survey of the public of the finished product was conducted with 20 volunteers. Feedback was gathered after all volunteers received the perfume.

**Observation Table of Public Survey:-**

| Sr.no | Rating | Quality and Usefulness (No. of Volunteers) | Ease of Handling (No. of Volunteers) |
|---|---|---|---|
| 1. | Excellent | 11 | 14 |
| 2. | Very Good | 8 | 5 |
| 3. | Good | 2 | 1 |
| 4. | Average | 1 | 0 |
| 5. | Poor | 0 | 0 |

## CONCLUSION:

A novel herbal repelling mosquito scent that blends potent bio-repellent qualities with a pleasing aroma was successfully developed and tested in the current investigation. The essential oils Cymbopogon citratus (lemongrass),Azadirachta indica (neem), Melaleuca alternifolia (tea tree),Syzygium aromaticum (clove), and Lavandula angustifolia (lavender)that were used have been mixed in a rose water base, and the improved formulation, which maintained the requisite physicochemical stability and skin compatibility, demonstrated substantial repelling activity. The composition was found to be mildly acidic and skin-friendly, while skin irritancy testing confirmed that it did not cause irritation. Responses to surveys conducted among volunteers showed good appeal in terms of fragrance, usability, and sensory appeal. Longer-lasting protection was offered by the mosquito repellency experiments in comparison to conventional repellents, confirming the reciprocal benefit.

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