IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, June 2024

Formulation of Herbal Mosquito Repellent From Essential Oil Extracted Form Citrus Sinensis (Orange)

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Abstract: *One of the infectious diseases that still poses a health risk to the society is malaria. Malaria is spread by insects called Anopheles sp. brought on by parasitic plasmodium sp. Owing to their high citric acid concentration, oranges have a sour flavor and a crisp scent. Orange peel essential oils are generally suitable for use as deodorizers with anti-mosquito spray. Due to their dislike of perfumes, mosquitoes can be sent away by orange peels. Oil-soluble (lipophilic) gologan organic molecules called terpenes and terpenoids are found in essential oils. With changes in active components infusion of orange peel F1 (20%), F2 (40%), this study intends to determine the usage of citrus peel waste into mosquito repellent spray compositions as an alternative to malaria prophylaxis.*

Keywords: Citrus sinensis, anti-malaria, peppermint, Soxhlet extraction

I. INTRODUCTION

The goal of the current study was to ascertain the mosquito-repelling properties of a few chosen plant materials in order to combine those components to create herbal formulations that are both safe and effective. Traditionally, people have used plant-based repellents to protect themselves from various Anopheles species for decades. The creation of novel natural products as an alternative to chemical repellents can be greatly aided by knowledge of conventional repellent plants. Numerous research have demonstrated the ability of plant extracts or essential oils to repel malaria vectors across the globe. To determine how well plant-based repellents work against Anopheles mosquitoes was the goal of this systematic review. PubMed/Medline, Scopus, and Google were used to conduct a thorough search for all relevant research on plants' ability to repel Anopheles mosquitoes that were published up until 2020.were thoroughly searched using the databases of PubMed/Medline, Scopus, and Google Scholar. Protection time and % repellency were the outcome measurements Combining essential oils and plant extracts could result in the development of environmentally friendly repellents against anopheles species. In the future, plant oils could be a good substitute for synthetic repellents because they are widely accessible, reasonably priced, and safe.

1.1. Mosquito repellents (Synthetic)

A chemical that is applied to skin, clothing, or other surfaces to deter mosquitoes from landing there is known as a mosquito repellent. It is a material that is created in a way that deters mosquitoes from biting humans by making the surface disagreeable and unappealing to them. Insects are repelled by mosquito repellents, not killed.As a result, they aren't strictly speaking pesticides or insecticides. They aid in the prevention and management of mosquito-borne illnesses such malaria, dengue fever, yellow fever, Japanese encephalitis, and others. Because of its active substance, which blocks mosquitoes' ability to smell carbon dioxide and lactic acid created during perspiration, they are the only thing that can repel mosquitoes. Additionally, these goods include a few more Ideas, Research, and Technological Innovations, Volume 4, Issuee4, Issue 1) Mosquito repellents often function by disguising the chemical that attracts mosquitoes. Among the oldest repellents available is also one of the most effective. DEET was initially created in 1946 and made available to the public by the U.S. Army. Though many additional products have been released since then, only few are as effective as DEET. Actually, the CDC recommends using this chemical in mosquito repellent as one of

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the two ways to prevent diseases spread by mosquitoes. The other is picaridin, and according to the CDC, these two components work better than other repellents for mosquitoes (Mosquito Repellents: Choosing the BestRepellant, n.d.).

1.2. DEET(N,N-Diethyl-meta-toluamide)

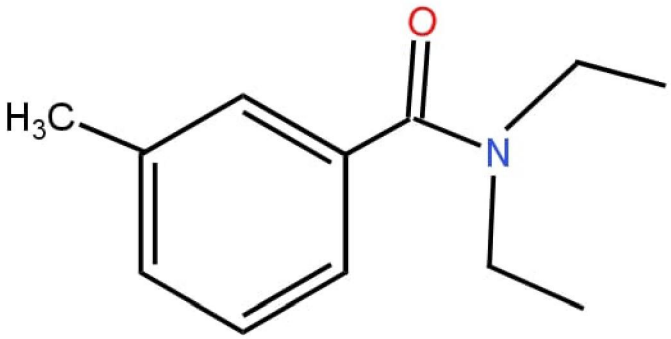

Fig. 1.2. Structure of DEET

In use by the public since 1957.

One of the best repellents for bugs and ticks is DEET, an acronym for N, N-Diethyl-meta-toluamide (Chemicals of Concern in Bug Repellents).(Repellent, n.d.).

Negative consequences

DEET and Well-being

Excessive amounts of DEET have been connected to memory loss, seizures, and skin blisters.

DEET has also been connected to neurotoxicity, which can cause behavioral and physiological issues, particularly with motor skills, as well as issues with learning and memory.

One study found that 48% of the applied amount of DEET is fully absorbed in six hours due to the substance's rapid skin absorption. It was discovered that absorption increased much further when combined with the sunscreen ingredient oxybenzone.

DEET and Ecosystem

Research on animals has demonstrated that DEET can pass the placenta; it was discovered in the

1.3. Allethrin

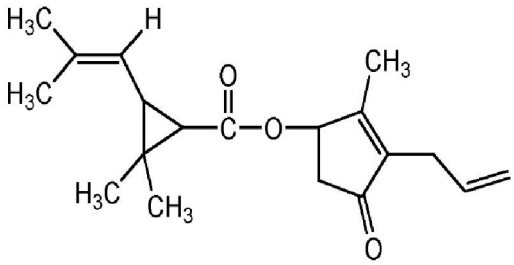

Fig. 1.3. Structure of Allethrin

Strong insecticide allethrin is frequently used to keep mosquitoes away.

When exposed to allethrin, insects experience a nervous system reaction that causes paralysis before they eventually die.

Negative consequences

Allethrin directly on the skin produces a burning, tingling, and itchy sensation. When inhaled, it aggravates asthma in those who have the condition.

Others may experience dizziness, nausea, vomiting, and trouble coordinating.

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Pregnant women, small children, and babies are particularly at risk. The environment of India renders the country more susceptible to the harmful effects of these pollutants.
These carpets are less dangerous if burned outside.
Nonetheless, as mosquito mats are typically used indoors, the effects are exacerbated in rooms with multiple users.
A young person or An infant or youngster is exposed to these toxins for ten hours out of the night on average.
Despite claims that mosquito mats pose health risks, their usage is nevertheless permitted in India (Allethrin in Mosquito Repellents Is Toxic, n.d.).

1.4 .Dimethylphthalat

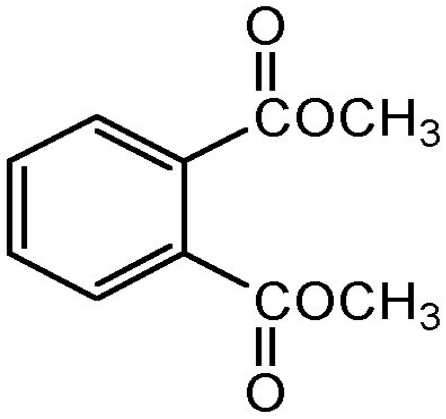

Fig 1.4. Structure of Dimethyl phthalat

When applied topically, dimethyl phthalate repellents primarily work by evaporating to keep insects away.
In both humans and animals, acute (short-term) exposure to dimethyl phthalate by inhalation causes irritation of the throat, nose, and eyes.

II. AIM AND OBJECTIVES

2.1.Aim: To formulate herbal mosquito repellent from essential oil extracted by various extraction methods From Citrus sinensis (Orange)

2.2. Objective

The majority of plants have substances that they employ to fend off attacks by phytophagous (plant-eating) insects. These substances can be classified as growth regulators, repellents, feeding deterrents, or poisons.
Plant-based repellents are readily biodegradable and do not provide any toxicity risks to humans or domestic animals.
When it comes to human safety, natural products are safer than manufactured ones.
Thus, now is the perfect time to begin a thorough investigation into environmentally safe biological materials for insect pest control.
Different researchers have noticed that phytochemicals generated from plant resources have deterrent properties, such as acting as larvicidal, insect development regulators, repellents, and ovipositional attractants.

III. ORANGE (CITRICSINESIS)

3.1.The composition of chemicals

C. sinensis is a rich source of secondary metabolites, which support the plant's claimed pharmacological properties. Numerous kinds of chemical substances
Have been found in the C. sinesis fruits, peel, leaves, juice, and roots, and they belong to the following groups: flavonoids 1 through 54. The following substances are listed in chronological order: hydroxyamides (55, 56), alkanes and fatty acids (57–60), coumarins (61–67), peptides (68–70), carbohydrates (71–74), carbamates and alkylamines (75–78), carotenoids (79–82), volatile compounds (83–148), and nutritional elements (Kavela-Hernández et al., 2016).

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3.2.Pharmacological Activities:

Protective of UV Activity
Relaxant, Sedative, and Anxiolytic Activities
Insecticidal Activity
Hypocholesterolemic Activity
Anti-Obesity Activity
Hypocholesterolemic Activity
Anti-Obesity Activity
Cardiovascular System Activity

I) Limonene

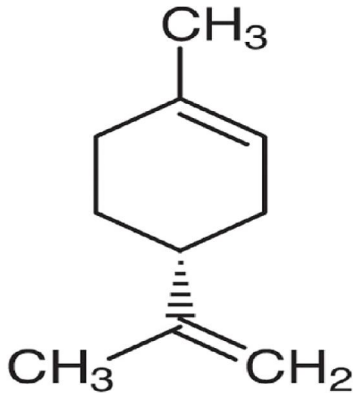

Fig. I. Structure of Limonene

When applied directly to insects, the essential oil's active component, d-limonene, destroys the wax covering protecting their respiratory systems, causing them to suffocate.

d-limonene possesses antimicrobial and insecticidal properties, and is used as a pesticide to manage domestic animal ectoparasites. The potential allure of limonene to invertebrate natural enemies could present innovative uses for natural substances in the control of beneficial species in organic farming.

The volatile oil exhibited four distinct properties that may be used to repel insects: resistance, fumigant, antifeedant, and attraction.

Because d-limonene degrades naturally, it is a more environmentally friendly option for contact and fumigation applications than synthetic pesticides. This study examines the d-limonene activity of peels from sweet oranges.

II) α-Pinene

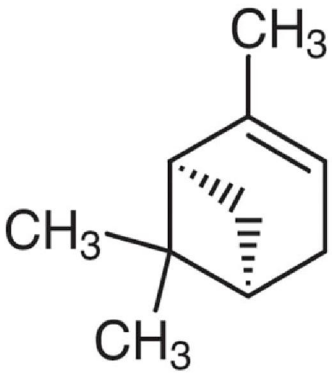

Fig .II Structure of α Pinene

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α Pinenehas a 60% pulmonary absorption rate in humans and is rapidly metabolized or redistributed, making it highly accessible. Through PGE1, α-pinene has anti-inflammatory and maybe antibacterial properties.
Antiseptic
Anti-inflammatory
Anticipating

III) Beta-Pinene(β-pinned)

Plants include monoterpenes, such as beta-pinene (β-pinene), which are organic compounds. It is one of pinene's two isomers; the other is α-pinene.

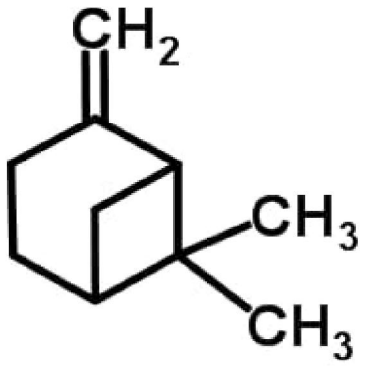

Fig.III. Structure of beta-Pinene (β-pinene)

IV) Myrcene

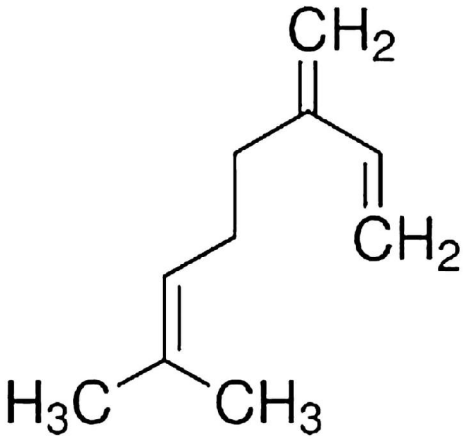

Fig .IV Structure of myrcene

An intermediary utilized in the perfumery sector is myrcene.. It has a pleasant odor
But is rarely used directly.
Anti-inflammatory
Analgesic
Antibiotic
Sedative

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V) Octanol

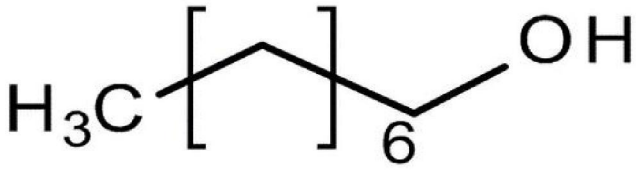

Fig. V. Structure of octanol

It is a naturally occurring colorless, aromatic liquid that smells like fruit and is found in citrus oils.
It finds commercial application as an ingredient in perfumes and in food sector flavorings.

VI) Linalool

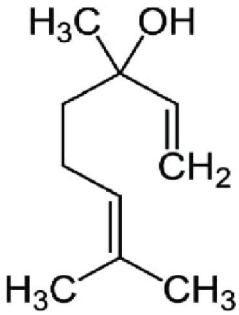

Fig.VI. Structure of 3-Carene

Sixty to eighty percent of scented cleaning products and hygiene products, such as lotions, soaps, detergents, and shampoos, contain linalool as an ingredient. It has antifungal and antibacterial qualities.
As an insecticide, linalool works against cockroaches, fruit flies, and fleas. It can also be applied as a codling moth pest management strategy.
Certain products that repel mosquitoes contain linalool.
Sedative
Anti-depressant
Anti-anxiety
Anti-epileptic
Analgesic

VII) 3-Carene

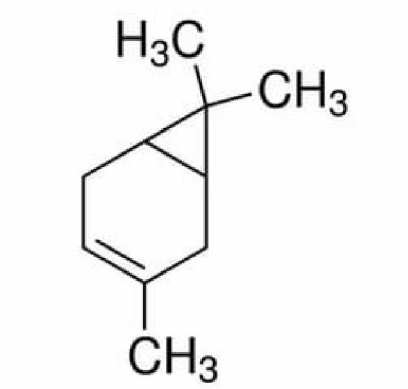

Fig. VII. Structure of 3-Carene

DOI: 10.48175/IJARSCT-18883

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3,4-Caranediol is produced by treating 3-Carene with peracetic acid. Over ferric oxide, pyrolysis
Causes a rearrangement that results in p-cymene. Carene is employed as a chemical intermediate and in the perfume business.

VIII) Decanal

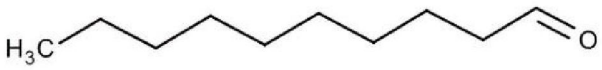

Fig. VIII. Decanal Structure

Decanal is an aldehyde-class chemical molecule (Asadollahi et al., 2019).

4. Peppermint

Fig 4. Pepppermint oil

The therapeutic properties of the mint family were undoubtedly known to the ancients. But even modern scientific research has demonstrated the peppermint plant's plethora of possible health benefits.
For many years, peppermint has been utilized for its medicinal properties; it was used to cure cholera, colds, cramps, bloating, nausea, and digestive issues.
Peppermint leaves were crushed and applied to the chest in the nineteenth century to treat whooping cough. Menthone (23.4%) and menthol (40.7%) were the primary ingredients. Additional components were limonene, beta-pinene, (+/-)-methyl acetate, 1,8-cineole, and beta-caryophyllene.Benefits of Peppermint

V. MATERIAL AND METHOD

5.1.Material

Purchased orange fruit from the market Next we turned orange peels into power for.

5.2 Chemicals

Methanol, peppermint essential oil, distillated water

5.3 Material/Instruments

Every pieces of glassware used to extract essential oil was clenedAne rinsed with distilled water that has been dried before extraction. The tools and glasses use in this work were round with flask with a round bottom, funnel for separation, and condensr ,heater basket, thermometer, and measuring cylinder, seperating funnel, electric balance grinding , knife.

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5.3.1. Soxhlet Extraction / Solvent Extraction:

Fig 5.3.1. Soxhlet Extraction

10 g of powdered orange peel was dried, and its weight was noted.
As illustrated in Figure 1.24, the weighted sample was inserted into the Soxhlet extractor device.
Methanol was used as the extraction solvent during the process. The Soxhlet apparatus produced a mixture of oil and solvent that was subsequently separated using a rotary evaporator. After being heated by the heating mantle, the solvent in the round-bottom flask evaporated and condensed through the sample, extracting the oil along.

5.3.2.Rotary Evaporator:

Fig.5.3.2.Rotary Evaporator

As illustrated in Fig. 5.3.2, the oil and solvent (methanol) mixture were separated using a rotary evaporator, and the separation was accomplished utilizing the rotary evaporator principle. Evaporator

5.3.3. Hydro Distillation

Fig. 5.3.3: Hydro distillation

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Using an electronic weighing balance, approximately 100g of orange peel was weighed. The peels were then transferred into a round-bottom flask and a substantial amount of distilled water was poured until the peels were covered with water.

As illustrated in Figure 1.26, the flask was attached to a still column, which was subsequently linked to a condenser.

A temperature of 80°C was maintained when heat was given to the assembly through the use of a basket heater.

The distillate was then gathered into a conical flask. There are two levels in this distillate: a dense layer and a less dense one. After that, a separating funnel is used to separate this.

5.3.4. Essential oil separation:

The mixture separates into two distinct layers when it is placed into a separatory funnel.

Water gathers in the bottom of the funnel because it is denser than oil. The liquid at the bottom of the funnel is then poured into a container once the funnel tap has been opened.

5.3.5. Clevenger Hydro distillation

According to Clevenger Using an electronic weighing balance, about 100g of orange peel was weighed. The peels were then transferred into a round-bottom flask and a substantial amount of distilled water was poured until the peels were completely covered in water.

Subsequently, as illustrated in Fig. 1.28, the flask was attached to the apparatus tube of the clevengr and connected to the condenser. Currently, the assembly is heated using a basket.

VI. EVALUATION TEST

1. Compute the oil yield.

Equation was used to determine the yield of oil produced by each of the two extraction techniques.Weight of oil extracted divided by weight of sample utilized times 100 equals yield.

2. Essential Oil Characterization

By figuring out its physicochemical characteristics, the essential oil that was extracted from orange peels under ideal processing circumstances (the maximum yield) was identified. The tests done on the oil are listed below.

3. Examining the essential oil by sensory analysis

The physical qualities of the oil were ascertained through sensory analysis. This involved the senses of touch, smell, and vision.

4. Identifying the essential oil's water solubility

A test tube with a small amount of water in it was filled with a few drops of the oil.

Using a stirring rod, the test tube was thoroughly mixed. There were two distinct phases that were noted. Two separate phases were observed. From that procedure, it was deduced that the oil was water insoluble.

5. Finding the essential oil extracted from orange peel's specific gravity

Every experiment was conducted in triplicate, with average values recorded. A weighing balance was used to weigh a dry, clean bottle. The water was distilled.

Filled the bottle, then measured. The same amount of oil was weighed after being put into the same bottle in the same way. The ratio was used to compute the specific gravity.

Weight of a certain volume of oil extract divided by the weight of an identical volume of water is the oil specific gravity. (Av &Oke, 2017)

6. Oodine examination

The characterisation test for any unsaturated chemical found in a test sample was the iodine test. Upon the addition of iodine, the color changed to brown. It was verified that the sample contained limonene and other aromatic chemicals.The hue of brown

7. pH Examination

After distillation, an oil sample was taken and put through a pH meter examination. It was discovered that C. sinesis had a pH of 4.67, or orange oil. Extracted has an acidic composition.

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8. Microbiological test

Using the disk diffusion process, the extracted orange oil underwent an antimicrobial test. After preparing the agar nutrition media, the petri plate was autoclaved for 30 minutes at 100°C. Alcohol was employed to make the area under usage aseptic. Next, the media for the bacterial culture was made by adding nutritional agar to a petri plate and evenly streaking the microorganism suspension of Staphylococcus aureus and Escherichia coli. The plates had labels and names on them. The 5 mm-diameter wells

VII. RESULT

The table below displays the results of the mosquitoes' behavioral response to the formulation used; the formulation including orange peel extracts and essential oils demonstrated a substantially higher level of repellent activity. During the initial test, out Out of the ten mosquitoes that were introduced, only one had an 80% repellent activity percentage and was present in the treatment tube. Similar to the first test, there was just one mosquito in the treatment tube. Nonetheless, the 50% repellent action percentage was significantly different. In the third trial, when there were no mosquitoes in the treatment tube, the greatest percentage of repellent activity was demonstrated. The formulation had a higher overall repellent activity with a mean of 76.66%, as determined by the percentage of repellent activity attained.

A material or active ingredient with desired qualities that is extracted from plant tissue—typically by subjecting it to a solvent treatment—is known as a plant extract. The perfect solvent to utilize should be very selective for the compound to be extracted, totally volatile, inexpensive, and safe for humans and the environment. It should also not react with the extracted compound or with any other compound in the plant material.

Common extraction solvents include ether, chloroform, methanol, alcohol, and water. Many techniques, including maceration, decoction, infusion, percolation, Clevenger's device hot continuous extraction (soxhlet), counter-current extraction, and others, were used to extract the plants.

% repellant activity is equal to the number of mosquitoes in the control tune minus the number of mosquitoes in the treatment and divided by the number of mosquitoes in the control tune x 100.

Sr.no	Extraction method	Peels use (gm) (powder) (peels)	Solvent	Solvent used (ML)	Oil Obtion (ml)	Percentage Yield (%)
1	Solvent extraction	150	Methanol	250	0.9	0.5
		150	Water	250	1	0.9
2	Hydro distillation	150	Water	500	2	1.12
		150	Water	500	4	2.24
3	Clevenger"s app	100	Water	250	3	1.68
		100	Water	250	4	3.36
		200	Water	350	5	2.1

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