JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A Review On Allopathic Mosquito Repellent

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Abstract

Mosquito-borne diseases such as malaria, dengue, chikungunya, and Zika virus pose significant public health challenges worldwide. Effective mosquito repellents are essential in preventing mosquito bites and reducing the transmission of these diseases. This study focuses on the development of an allopathic mosquito repellent formulated with synthetic active ingredients that provide long-lasting protection against various mosquito species. The formulation includes proven chemical agents such as N,N-Diethyl-meta-toluamide (DEET), picaridin, or IR3535, known for their high efficacy and safety. The repellent's effectiveness was evaluated through laboratory and field studies, assessing factors such as duration of action, toxicity, skin compatibility, and resistance development. Results indicate that the formulated repellent exhibits superior mosquito deterrence, prolonged action, and minimal dermal irritation, making it a viable option for widespread use. The study underscores the importance of allopathic formulations in vector control and highlights their role in public health protection. Further research is recommended to optimize the formulation for enhanced efficacy and safety.

Keywords: Mosquito repellent, allopathic formulation, DEET, picaridin, vector control, mosquito-borne diseases.

I. INTRODUCTION

Control of mosquitoes is something most important in the present day with Rising number of mosquitoes borne illnesses. Mosquitoes need to be exterminated using the right tools and with a little bit of effort. These blood thirsty beasts don't care about Boundaries and they can bite you if your Neighborhoods are allowing its breeding. So, the mosquito control measures can be Successful only if public mosquito programs Are designed. First and the most thing is to Destroy the breeding areas of these Mosquitoes. The mosquitoes are horrific They're highly aggressive, you can be bitten hundreds of times without protection, its torture, impossible to bear. Deforestation and industrialized farming are also two of the factors causing an alarming increase in the range mosquitoes[1]

Along with a mosquito bite comes the discomfort of an allergic reaction with skin Rashes, edema, and pruritus, and the risk of disease transmission. Recently, mosquitoes Such as Culex sp., Anopheles sp., Aedes albopictus, and Aedes aegypti have expanded their Range due to the global warming: they can travel between nations, have adapted to the urban environment, and increased the incidence of diseases caused by mosquito bites around the world. In order to prevent insects landing and biting, insect repellent formulations and

window screens in buildings and open environments are useful as effective preventive measures. The most widely used synthetic repellents are N, N-diethyl-3-toluamide[3].

(DEET), N, N-diethyl phenylacetamide (DEPA), permethrin (synthetic pyrethroid), ethylUtylacetylaminopropionate (IR3535, EB), 1-(1-ethylpropoxycarbonyl)-2-(2-hydroxyethyl) (Picaridin or Icaridin), and lemon eucalyptus essential oil.

Definition

"Allopathic Mosquito Repellents are synthetic chemicals-based products which are used to prevent, repel or kills the mosquitoes' bites that can transmit the diseases".

II. SYNTHETIC ACTIVE INGREDIENTS

1. DEET (N, N-diethyl-m -toluamide
2. Picaridine (Icaridine)
3. Permethrin
4. IR3535
5. Metofluthrin

1. DEET (N,N-Diethyl-meta-toluamide):

One of the most widely used and effective mosquito repellents.

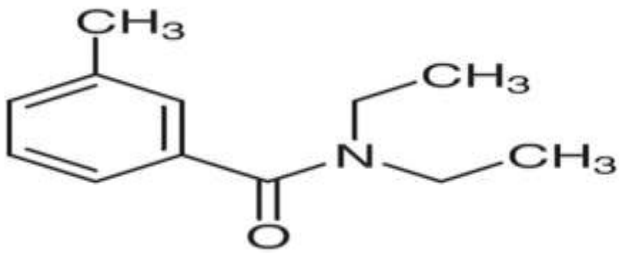
Available in concentrations ranging from 5% to 100%.

Repels mosquitoes by interfering with their ability to detect humans through smell.

Drug Profile :

Chemical Formula : $C_{12}H_{17}NO$

Molecular Weight : 191.27 g/mol



Appearance : Colourless to slightly yellow liquid.

Odour : Mild, characteristic odour.

Boiling Point: 288°C (550°F).

Solubility: Soluble in organic solvents like ethanol, isopropanol, and acetone.

Slightly soluble in water.

2. Picaridin (Icaridin):

A synthetic compound that is as effective as DEET but less irritating to the skin.

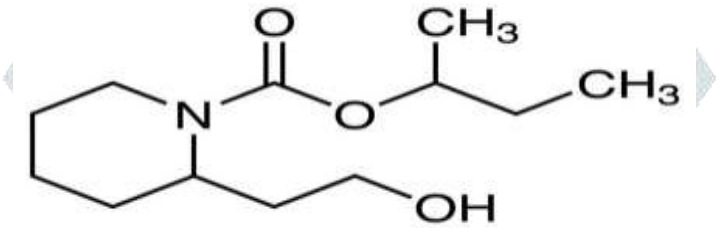
Used in concentrations ranging from 5% to 20%.

Effective against a wide range of insects, including mosquitoes.

Drug Profile:

Chemical Formula: $C_{12}H_{23}NO_3$

Molecular Weight: 229.32 g/mol



Appearance: Colourless to pale yellow liquid.

Odour: Mild, almost odourless.

Boiling Point: 296°C (565°F).

Solubility: Soluble in most organic solvents, including ethanol and isopropanol.

Slightly soluble in water.

3. Permethrin:

An insecticide used to treat clothing, tents, and other gear.

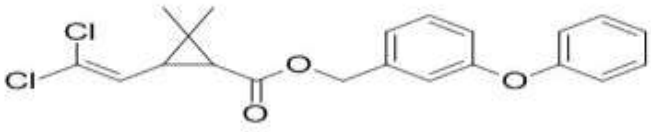
Repels and kills mosquitoes on contact.

Often used in combination with DEET or Picaridine for enhanced protection.

Drug Profile:

Chemical Formula: $C_{21}H_{20}Cl_2O_3$

Molecular Weight: 391.29 g/mol



Appearance: Colourless to pale yellow liquid or crystalline solid.

Odour: Slightly characteristic odour.

Melting Point: 34–39°C (solid form).

Boiling Point: Decomposes at high temperatures (>200°C).

Solubility: Insoluble in water but highly soluble in organic solvents like acetone, ethanol.

4. IR3535 (Ethyl butylacetylaminopropionate):

A synthetic repellent considered as effective as DEET.

It has a low toxicity profile and is safe for use on children and pregnant women.

Drug Profile:

Chemical Formula: $C_{11}H_{21}NO_3$

Molecular Weight: 215.29 g/mol

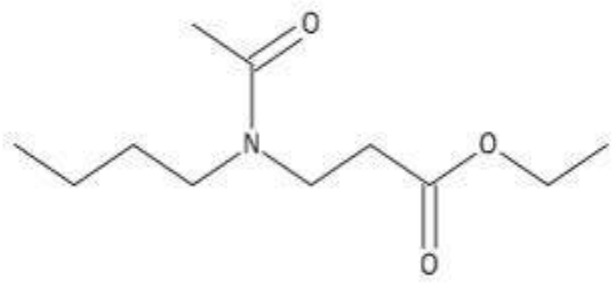
Appearance: Colourless to pale yellow liquid.

Odour: Mild, characteristic odour.

Boiling Point: Approximately 294°C (561°F).

Solubility: Soluble in organic solvents (e.g., ethanol, isopropanol).

Moderately soluble in water.



5. Metofluthrin:

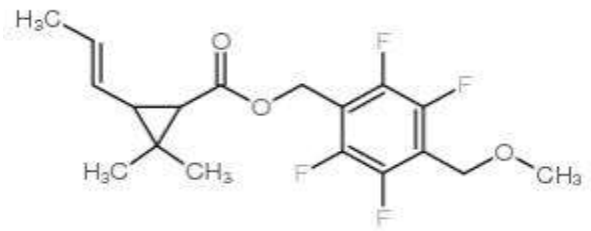
A relatively new compound, highly effective in vaporizing repellents.

Used in indoor products like plug-in devices and coils.

Drug Profile:

Chemical Formula: $C_{16}H_{15}F_4O_3$

Molecular Weight: 336.29 g/mol



Appearance: Pale yellow liquid.

Odour: Mild and slightly aromatic.

Boiling Point: Decomposes at high temperatures (not distilled under normal conditions).

Solubility: Low solubility in water.

Soluble in organic solvents like acetone.

III. TYPES OF REPELLENTS

1. Lotions, Creams, and Sprays:

Applied directly to the skin to protect against mosquito bites.

Most commonly contain DEET, Picaridin, or IR3535 as the active ingredient.

Active Ingredients: DEET, Picaridin (Icaridin), IR3535.

Form: Applied directly to the skin as a lotion, cream, or spray.

Use: Provides protection for the skin by repelling mosquitoes and other insects.

Examples:

DEET-based lotions: Offers protection ranging from 2-10 hours depending on concentration.

Picaridin-based creams: Gentle on skin, odourless, and effective against mosquitoes and ticks.

Popular Brands: OFF!, Cutter, Repel.

Figure 2 (Lotion Repellent)

2. Aerosols:

Contain chemicals like permethrin, which can be sprayed on clothing or surfaces to repel or kill mosquitoes.

Active Ingredients: DEET, Picaridin, Pyrethroids (Permethrin, Allethrin).

Form: Aerosol cans that create a fine mist to repel mosquitoes when sprayed on skin, clothing, or exposed surfaces.

Use: For both skin application and spraying on clothing or surroundings.

Examples: OFF! Deep Woods Spray, Raid Aerosol Repellent.

3. Liquid Vaporizers:

Devices like All Out and Good Knight that use heat to vaporize chemicals (e.g., Prallethrin or Metofluthrin).

Provides continuous mosquito protection indoors.

Active Ingredients: Prallethrin, Transfluthrin, Allethrin.

Form: Electric plug-in device that heats a liquid repellent, releasing vapours for repel mosquitoes.

Use: Indoor use, ideal for continuous mosquito protection in rooms.

Examples: Good Knight Liquid Vaporizers, All Out Liquid Vaporizers.

Figure 4 (Liquid Vaporizers Repellent)

4. Mosquito Coils:

Burn slowly, releasing insecticidal smoke containing compounds like allethrin or d-trans allethrin.

Used in outdoor spaces for short-term protection.

Active Ingredients: Pyrethroids (Allethrin, D-trans allethrin).

Form: A slow-burning coil that releases insecticide in smoke form.

Use: Typically used outdoors, these coils burn for several hours, providing protection in an open area.

Examples: Good Knight Mosquito Coils, Mortein Mosquito Coils.

Figure 5 (Mosquito Coils Repellent)

5. Impregnated Fabrics:

Clothing or bed nets treated with permethrin or other insecticides.

Repel mosquitoes and prevent bites while sleeping or outdoors.

Active Ingredients: Permethrin.

Form: Sprays or pre-treated clothing, which repels mosquitoes when they come in contact with treated fabric.

Use: For application on clothing, bed nets, or other fabrics (not for direct skin use).

Examples: Sawyer Permethrin Spray, Insect Shield Clothing.

Figure 6 (Impregnated Fabric

6. Mats and Refills:

Active Ingredients: Pyrethroids (Allethrin, Translations).

Form: Electric plug-in devices that heat insecticide-treated mats. The mat releases vapours to repel mosquitoes when heated.

Use: Indoor use, similar to vaporizers but with replaceable mats.

Examples: Mortain Mosquito Mats, Good Knight Mats.

Figure 7 (Mats Mosquito Repellent)

7. Candles and Incense Sticks:

Active Ingredients: Pyrethroids, essential oils like citronella are sometimes added.

Form: Mosquito repellent candles and incense sticks release smoke that contains insecticide or repellent when burned.

Use: Typically used in outdoor settings for temporary mosquito protection.

Examples: Citronella Candles, Mortain Incense Sticks.

Figure 8 (Candles and Incense Sticks Repellent)

8. Ultrasonic Devices (Questionable effectiveness):

Active Mechanism: Devices that claim to repel mosquitoes by emitting high-frequency sound waves.

Use: Worn as portable devices or used indoors.

Effectiveness: Scientific evidence of their effectiveness is limited, and they are generally not recommended by health organizations.

Examples: Various portable ultrasonic mosquito repellents.

Figure 9 (Ultrasonic Devices Repellent)

9. Mosquito Repellent Patches and Bands:

Active Ingredients: DEET, Picaridin, or essential oils (sometimes combined with synthetic chemicals).

Form: Worn on the skin as patches or bands that slowly release repellent.

Use: Provides localized protection, particularly for children or those who do not want to apply creams or lotions.

Examples: Buggy Bands, Mosquito Repellent Patches.

Figure 10 (Mosquito Repellent Patches and Bands)

10. Mosquito Nets Treated with Insecticide:

Active Ingredients: Permethrin, Deltamethrin.

Form: Bed nets that are treated with long-lasting insecticides.

Use: Provides physical and chemical protection while sleeping, commonly used in malaria-prone regions.

Examples: LLIN (Long-Lasting Insecticidal Nets).

Figure 11 (Mosquito Nets Repellent)

IV. ADVANTAGES OF ALLOPATHIC MOSQUITO REPELLENTS

1. **Effective Protection:** These repellents, particularly those containing DEET, picaridin, or permethrin, are highly effective at repelling mosquitoes and preventing bites for extended periods.

2. **Quick Action:** Allopathic repellents provide rapid protection and begin working almost immediately after application.

3. **Long-Lasting:** Many chemical repellents can offer long-lasting protection, often for several hours, making them suitable for outdoor activities or areas with high mosquito populations.

4. **Widespread Availability:** Allopathic repellents are widely available in various forms, such as sprays, lotions, and wipes, making them convenient for use.

5. Proven Safety: When used as directed, allopathic repellents have been studied extensively and are considered safe for most people, including children and pregnant women.

6. **Prevention of Vector-borne Diseases:** By effectively repelling mosquitoes, they help reduce the risk of mosquito-borne diseases like malaria, dengue, and Zika virus.

7. **Stable Formulations:** Chemical repellents are more stable in extreme environments (heat, humidity) than many natural alternatives, maintaining their effectiveness over time.

V. DISADVANTAGES OF ALLOPATHIC MOSQUITO REPELLENTS

1.Health Risks with Overuse: Prolonged or excessive use of chemicals like DEET may cause skin irritation, allergic reactions, or, in rare cases, systemic toxicity.

•**Skin Irritation –** DEET, Picaridin and Permethrin can cause skin irritation such as redness, itching and rashes.

•**Neurotoxicity –** High concentration of DEET can cause neurotoxic effects, such as seizures, tremors and respiratory problems.

Some people may experience respiratory issues if inhaling aerosol sprays.

2. Environmental Concerns: Certain chemical repellents, such as permethrin, can harm beneficial insects (e.g., bees) and aquatic ecosystems if not used responsibly.

Residual chemicals from improper disposal can contribute to environmental pollution.

3. Limited Suitability for Sensitive Groups: Some repellents may not be suitable for infants, pregnant women, or individuals with sensitive skin or pre-existing allergies.

4. Strong Odors: Many allopathic repellents have a chemical odour that some people find unpleasant.

5. Short-Term Protection: While effective, some formulations provide limited protection and require frequent reapplication, which can be inconvenient.

6. Potential for Misuse: Incorrect application (e.g., applying high concentrations to sensitive areas like the face) may increase the risk of adverse effects.

Over-reliance on repellents might lead to ignoring complementary preventive measures like mosquito nets or proper clothing.

7. Cost : High-quality allopathic repellents may be expensive, especially for regular use over extended periods.

8. Resistance Development: Repeated and widespread use of certain chemicals (like permethrin) can contribute to mosquitoes developing resistance, reducing long-term effectiveness.

VI. METHOD OF PREPARATION

1. Selection of Active Ingredient (Commonly used active ingredients include):

DEET (N, N-Diethyl-meta-toluamide) : Effective and widely used.

Picaridin (Icaridin) : Low odour and less irritating.

Permethrin : Often used for fabric treatment.

IR3535 (Ethyl butylacetylaminopropionate) : A biodegradable option.

2. Formulation Design (Determine the type of repellent to be prepared) :

Spray/Liquid : Dissolve active ingredients in a suitable solvent (e.g., alcohol, water).

Cream/Lotion : Blend with emollients and stabilizers to ensure skin compatibility.

Aerosol : Combine with propellants for sprayable applications.

Candles or Coils : Embed the active ingredient into wax or combustible bases.

3. Preparation Process

A. Base Preparation

Spray : Prepare a mixture of alcohol (ethanol/isopropanol) and water as the solvent.

Cream/Lotion : Prepare an emulsion by blending oil (e.g., mineral oil) and water phases with emulsifiers.

Candles/Coils : Melt the wax or prepare a combustible base for the product.

B. Incorporation of Active Ingredient

Add the active ingredient at the recommended concentration (usually 5-30% depending on the ingredient and application method).

Ensure thorough mixing to evenly distribute the active compound.

C. Addition of Additives

Stabilizers : Prevent degradation of active ingredients.

Fragrance : Mask unpleasant odours.

Skin Conditioners : Reduce skin irritation for lotions/creams.

D. Quality Control

Test for stability, efficacy, and safety.

Check for proper mixing, consistency, and effectiveness in repelling mosquitoes.

4. Packaging : Pour into appropriate containers such as bottles, tubes, or aerosol cans.

Label with ingredient details, instructions for use, and safety precautions.

5. Testing and Regulatory Compliance : Ensure the formulation meets safety standards and regulations of the region (e.g., EPA in the U.S., WHO guidelines).

Conduct efficacy testing to verify mosquito repellence

Step-by-Step Preparation For Lotion :

1. Measure the Active Ingredient (DEET):

For a 20% DEET solution: If preparing 100 ml of repellent, measure 20 ml of DEET.

The concentration can be adjusted based on the formulation to be. For lighter formulations, use 10-15% DEET.

2. Prepare the Solvent : Measure 50 ml of Ethanol or Isopropyl Alcohol. The alcohol helps dissolve the DEET and ensures quick drying when applied to the skin.

3. Add Water : Measure and add 20 ml of water. This helps dilute the alcohol and makes the formulation milder for the skin.

4. Optional: Add Fragrance or Essential Oils : to improve the scent of the repellent, add a few drops (5-10) of an essential oil like citronella, lavender, or eucalyptus oil, which also has mosquito-repellent properties.

5.Mix Thoroughly : Stir the mixture thoroughly using a stirring rod or a magnetic stirrer until the active ingredient, solvent, and water are well blended.

Ensure the solution is uniform and free of any visible separation.

6. Optional: Add Emollients (for lotions) : Add glycerine (around 5-10%) to make the product skin – friendly .

This will ensure the formulation moisturizes the skin while repelling mosquitoes.

7. Transfer to Packaging : Using a funnel, carefully pour the mixture into a clean into lotion tubes making a lotion.

Ensure the packaging is airtight to prevent evaporation.

8. Label the Product : Clearly label the container with the concentration of the active ingredient (e.g., 20% DEET).

Include instructions for use, such as:

"Apply to exposed skin and reapply after 4-6 hours."

"Avoid contact with eyes and mouth."

"Not recommended for use on children under 2 years of age."

9. Storage : Store the mosquito repellent in a cool, dry place, away from direct sunlight to maintain its effectiveness over time.

VII. STANDARDIZATION METHODS FOR ALLOPATHIC MOSQUITO REPELLENTS

1. Physical and Chemical Standardization

Appearance: Assess the lotion's color, texture, and homogeneity.

pH : Measure the pH to ensure it is within a skin-safe range (usually 4.5–7).

Viscosity : Use a viscometer to determine the lotion's flow properties.

Specific Gravity : Analyse using a hydrometer or pycnometer.

Active Ingredient Quantification : Use chromatography (e.g., HPLC or GC-MS) to quantify the concentration of the active ingredient (e.g., DEET, picaridin, or permethrin).

2. Microbiological Standardization

Microbial Contamination Testing : Check for total viable aerobic count, yeast, and mold contamination per pharmacopeial guidelines.

Pathogen Testing : Test for specific pathogens like E. coli, Pseudomonas aeruginosa, and Staphylococcus aureus.

3. Efficacy Testing

Mosquito Repellency : Conduct laboratory and field tests to evaluate efficacy:

Arm-in-Cage Test : A controlled laboratory setup where volunteers expose treated skin to mosquitoes.

Field Studies : Monitor mosquito bites in natural environments.

Duration of Protection : Measure how long the lotion effectively repels mosquitoes.

4. Stability Testing

Conduct under various conditions (accelerated and real-time) to determine shelf life and stability of active ingredients:

Temperature and Humidity : Expose to 40°C ± 2°C with 75% ± 5% RH for accelerated testing.

Light Exposure : Test under UV and visible light to assess photostability.

Packaging Interaction : Evaluate compatibility between lotion and its packaging material.

5. Dermatological Safety Testing

Patch Test : Evaluate for skin irritation and allergic reactions.

SensitizationTest : Confirm that repeated application does not cause sensitization.

Toxicological Testing : Ensure the formulation meets safety standards (e.g., non-toxic, non-carcinogenic)

6. Regulatory Compliance : Follow guidelines from relevant authorities like the U.S. EPA (Environmental Protection Agency), FDA, or WHO, depending on jurisdiction.

Labelling requirements : Ensure proper indication of active ingredients, usage instructions, and warnings.

7. Packaging and Labelling Standardization : Test for material durability, leakage, and resistance to environmental conditions.

Ensure tamper-proof packaging and legible labels.

VIII. FUTURE PERSPECTIVE

The future of allopathic mosquito repellents holds much promise, with a focus on safety, sustainability, and innovation. As technology advances and concerns about mosquito-borne diseases continue to grow, we can expect to see significant improvements in the development and delivery of allopathic mosquito repellents.

IX. CONCLUSION

allopathic mosquito repellents are an effective tool in preventing mosquito bites and controlling vector-borne diseases. Allopathic mosquito repellents are widely used to prevent mosquito-borne diseases. These repellents contain chemicals such as DEET, Picaridin, and Permethrin, which provide effective protection against mosquitoes. While allopathic mosquito repellents have several advantages, including high efficacy and long-lasting protection, they also have some disadvantages. These include skin irritation, neurotoxicity, and environmental concerns. Despite these limitations, allopathic mosquito repellents remain a popular choice for mosquito control. However, it is essential to use these products responsibly and follow the manufacturer's instructions to minimize potential risks. Choosing the right repellent , applying it correctly and taking safety precautions can help you enjoy the outdoors. In the future, research and development of new allopathic mosquito repellents will focus on creating safer, more effective, and environmentally friendly products. Additionally, the development of novel delivery systems, such as nanoparticles and microneedles, may improve the efficacy and safety of these repellents. Overall, allopathic mosquito repellents are an essential tool in the fight against mosquito-borne diseases. While they have their limitations, ongoing research and development will continue to improve their safety, efficacy, and environmental sustainability.

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