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Sustainable Protection: Innovative Dual-Form Herbal Mosquito Repellent Formulation from Traditional Knowledge

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Abstract: *Mosquito borne diseases including malaria, dengue, filariasis, and chikungunya cause serious health hazards across the world. Several mosquito repellents are currently in the market; however, most of these are not efficacious and eco-friendly. Recently, considerable research progress has been made to develop more pleasant, effective, and non-toxic to other species using herbal oils and formulations.Also, these herbal compositions are easily available and economic. Although, this existing herbal composition has been demonstrated to be effective and non-toxic to humans, they are more volatile and short lifespan of these compounds has necessitated further development of plant originated pesticides as alternative to chemical pesticides. In the current study, we have developed the various herbal formulations and showed that these formulations are effective mosquito repellents. The survey further showed that these repellents are pleasant with minimum allergic reactions.*

Nowadays, people widely use chemical-based products like room fresheners and disinfectants to clean their surroundings, which may cause harmful effects on health and the environment. To reduce the use of such chemicals, an effort was made to prepare an herbal dhoop using natural ingredients such as tulsi, bael, cow dung, cow milk, clove, and camphor — all known for their purifying and medicinal properties. The prepared dhoop was tested for its antimicrobial activity and was found to be effective in disinfecting the environment. Along with purifying the air, it also showed good mosquito repellent action. Regular use of this herbal dhoop may help prevent various airborne diseases and can be especially beneficial in remote areas, where it can be easily made and used for air sterilization. This research mainly focuses on the preparation and evaluation of this natural and herbal dhoop as a safe and eco-friendly way to cleanse the environment.

Keywords: Dhoopbatti, Mosquito, Disease, eco-friendly, Safe

I. INTRODUCTION

Mosquito-borne diseases such as malaria, dengue, chikungunya, and Zika virus continue to be major public health challenges worldwide, particularly in tropical and subtropical regions[1]. According to the World Health Organization (WHO), these diseases account for millions of infections and deaths annually. Mosquito control, therefore, remains a crucial aspect of disease prevention[2]. Chemical-based mosquito repellents and insecticides are commonly used; however, prolonged use of these synthetic products has raised concerns about adverse effects on human health, environmental pollution, and the development of insect resistance[3]. These challenges have led to a growing interest in alternative, eco-friendly, and safe solutions derived from natural sources[3]. Herbal mosquito repellents, rooted in traditional and folklore practices, offer an effective and sustainable alternative[4]. Folklore knowledge has long relied on the use of plant-based products known for their insect-repelling properties[5]. Plants such as *Azadirachta indica* (neem), *Cymbopogon citratus* (lemongrass), and *Ocimum sanctum* (tulsi) are widely recognized in traditional medicine for their strong aroma and insect-repelling phytochemicals [6]. These natural agents are not only biodegradable but also safe for

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human use and pose minimal environmental risk [6]. In rural and traditional communities, various forms of herbal mosquito repellents have been utilized, such as topical applications, smoke-based repellents, and plant extracts sprinkled around living areas[6]. However, scientific validation of these practices and standardization of formulations are essential to ensure their effectiveness and safety[7].The present study aims to formulate and evaluate herbal mosquito repellents in two forms commonly used in folklore practice a topical herbal cream and a mosquito coil[8]. The cream provides a user-friendly method of direct skin application, ensuring prolonged protection, while the herbal coil releases plant-based vapors into the surrounding air, repelling mosquitoes in enclosed spaces[9]. The selected plant ingredients were chosen based on their traditional usage, documented insect-repelling activity, and safety profile[6].The prepared formulations were subjected to thorough evaluation, including mosquito repellency tests against common species such as Aedes aegypti and Anopheles mosquitoes, stability studies, safety assessments on human skin, and user acceptability analysis[2]. Through this work, we aim to bridge traditional wisdom with scientific validation and offer safe, cost-effective, and eco-friendly alternatives to synthetic mosquito repellents, contributing to public health and environmental protection [3].

In today's world, where chemical exposure has become routine and environmental sustainability is a global concern, rediscovering and scientifically validating these ancient methods is not just relevant it's necessary[10]. This research takes inspiration from folklore practices and transforms them into modern, user-friendly solutions by formulating herbal mosquito repellents in two forms: a topical cream and a herbal mosquito coil [11]. The cream provides convenient, safe skin application, offering prolonged protection, while the coil replicates the traditional use of plant-based smoke for spatial repellency in living areas[12].

By combining tradition with innovation, this study aims to not only create effective herbal repellents but also contribute to cleaner environments, healthier communities, and accessible solutions for both urban and rural populations[13]. The results of this research have the potential to reduce chemical dependency, prevent vector-borne diseases, and revive nature-based living in harmony with our environment[14]

II. MATERIALS AND METHODS

List of Chemicals:

Sr.No	Chemicals	Quantity For 100%	Uses Of Ingredient
1	Activated charcoal	15%	Adsorptive Material
2	Cowdung Powder	15%	Repelling Properties
3	Starch	5%	Binding agent
4	Neem Powder	7%	Repellant Properties
5	Tulsi Powder	5%	Aromatic/Repellant
6	Nirgundi	4%	Insecticidal Properties
7	Lobhan	8%	Aromatic Properties
8	Ghee	22%	Flavour Enhancer/lamp lightening
9	Camphor	5%	Mosquito Repellant
10	Waste dry Flower	10%	Repellant Properties
8	Rose Oil	4%	Fragrance

Table No -1

III. METHODS OF PREPARATION

All the plant powders and cowdung powder were taken in tray and dried under sunlight for 3-4 days.
Then Cowdung,starch and ghee were added to make mixture of wet mass and Rose oil was added.
The different types of plastic moulds was taken for filling wet mass to get dhoopbatti
After moulding these dhoopbatti were dried at 400c to get completely dry
At last completely dried dhoopbatti was used for evaluation of various activity[15].

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Figure No: 1 Formulated Dhoopbatti for mosquitoes repellent

Evaluation of Herbal Dhoop:

Result and Discussion

1. Physical evaluation
2. Chemical evaluation
3. Sensory analysis
4. Anti-microbial analysis
5. Mosquitos repellent activity

1. Physical Evaluation:

Table No: 2[16]

Sr.No	Parameter	Observation
1	Colour	Brownish
2	Odour	Resinous

2. Chemical Evaluation:

Table No: 3 Physicochemical Tests[17]

Sr.No	Test	Observation
1	Carbohydrates	+
2	Alkaloids	+
3	Glycosides	-
4	Triterpenoids and phytosteros	+
5	Phenolic compounds and tannins	+
6	. Flavonoids	-
7	. Amino acids	-

Figure No: 2

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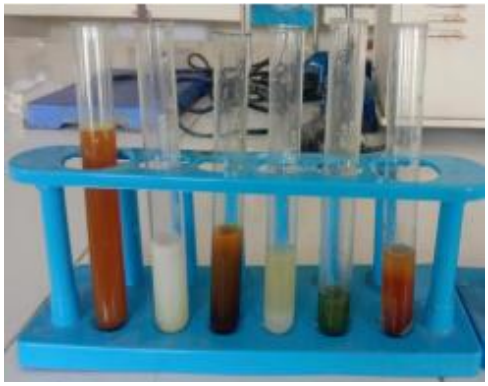

Figure No :3 Phytochemical test of Herbal Dhoop

3. Sensory Analysis:

Additionally, a survey was conducted to gauge 15 students' acceptance of herbal dhoop. Numerous factors, including appearance, smoke, and smell, were assessed.

Table No: 4[18]

Sr.No	Questions	Yes	No
1	Is the smell apprecialble?	12	03
2	Smoke is irritating?	10	05
3	Use of product at home?	15	00
4	Will you recommend the product?	12	03
5	Resionous product?	8	7

4. Mosquitoes Repellent:

To evaluate the dhoop stick against mosquitos repellent activity. The repellency activity by the stick or dhoop to the mosquitoes shown successful result when burning in a corner of home having mosquitoes and it explain that natural insecticidal preparation are always effective than synthetic repellent. During the burning of dhoop it was shown that up to 80% of the mosquitoes number was reduced. The Tulsi camphor, clove show the maximum mosquito repellent activity[18].

5. Microbiological Study:

The evaluation of antimicrobial activity was carried out by preparing Nutrient Agar plates in duplicates set of plates exposed in same area. For performing this activity we take 2.8 gm of nutrient broath and 3gm of agar then pour into the 50 ml distilled water in conical flask. Then place the conical flask in autoclave After sterilization the sample pour into petri plate and cover the sample and make them solidify, After 10 minutes after opening the petri plate in the test area, place it in the incubator for a full day. Next, open the second petri plate in the same spot where the dhoop is burned, and put it in the incubator. After a day, compare the two plates [18].

Figure: 5 Microbial Examination of Dhoopbatti

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5. Result And Discussion

Research has demonstrated the superior mosquito cidal and repellent qualities of herbal cone and liquid repellents. In addition to having no adverse side effects, these herbal repellents have demonstrated a strong favourable impact on human health and an ability to effectively keep mosquitoes away. Chemical mosquito repellents, on the other hand, can have negative side effects and endanger human health. In addition to providing protection against diseases spread by mosquitoes, using herbal repellents is a safe and healthy substitute for conventional chemical repellent .Thus, it can be said that using herbal insect repellents is a good and practical choice for people looking for safe and efficient mosquitoes form.

Figure: 6 Plant kept for shadow drying

Fine powder of dried drug Repellant Cone kept for Drying Burning Cone

VI. CONCLUSION

In place of chemical repellents, herbal repellents are safe, natural, and effective. With strong mosquito-repelling and mosquito-killing properties, they provide reliable protection against mosquito-borne diseases without the harmful side effects associated with chemical options. Their positive impact on human health and environmental safety makes herbal repellents a highly viable and beneficial choice for individuals seeking safe mosquito control solutions.

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