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FORMULATION AND EVALUATION OF SAFE HERBAL MOSQUITO REPELLENT DHOOP STICKS

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ABSTRACT

Mosquitoes are wide spread in the world. Mosquitoes are major cause to various diseases such as malaria, dengue, yellow fever. Many chemical based mosquito repellents are present in the market which is harmful to the human and environment. This is an attempt to prepare mosquito repellents by natural ingredients. Plants showing property of mosquito repellency were selected and the formulation was designed according to it. The neem, tulsi and marigold plant were considered as the main ingredients. Neem plants have the ability to keep insects away. Marigold and tulsi are also thought to keep insects away. Dhoop sticks were made using these plants and sandalwood powder for fragrance. Dhoop sticks were made using various essential oils. The dhoop sticks were compared to the commercial formulation and evaluated for their ability to burn, flammability, and repel mosquitoes. The evaluation and findings led to the conclusion that using dhoop sticks was safe.

Keywords: Mosquitoes, Mosquito repellents, Neem plant,Tulsi plant, Dhoop stick, Essential oils

INTRODUCTION-

The global threat posed by prevalent mosquito-transmitted diseases such malaria, which the World Health Organization (WHO) estimates accounts for more than 3 million fatalities annually **[1]**, epidemic polyarthritis, yellow fever, dengue hemorrhagic fever, and encephalitis. There is currently no effective vaccine for the prevention or treatment of these diseases, which are solely spread to humans by mosquito bites. One of the key methods to stop or reduce the occurrence of these diseases is to avoid mosquito bites **[2]**. Malaria and other diseases spread by mosquitoes have a variety of treatments, but it is always preferable to avoid getting sick in the first place. As a result, the term "mosquito repellent" came in existence. Mosquito repellents are compounds that make surfaces unpleasant for mosquitoes. It can be used to apply to skin or other surfaces to deter mosquitoes from settling on them **[3]**. Chemicals like N, N-diethyl-metatoluamide (DEET), allethrin, N, N-diethyl mendelic acid amide, and dimethyl phthalate are used to make the majority of commercial repellents. Chemical repellents have been shown to cause hazardous reactions, such as allergic reactions, dermatitis, and cardiovascular and neurological side effects, which have typically been documented after incorrect application **[4]**. Natural habitats have been harmed by the widespread use of manufactured insect repellents with chemical origins to control mosquitoes **[5]**. This has made it necessary to do research and produce environmentally safe, biodegradable, affordable, indigenous approaches for vector management that people and communities can utilise with the least amount of caution. The use of insect repellents can be a useful and affordable method of preventing infections spread by mosquitoes. To reduce the negative impacts on the environment and human health, the notion of employing natural mosquito repellent products as an alternative to create new eco-friendly repellents has been proposed **[4]**. Numerous medicinal herbs and essential oils have been shown to have a variety of pharmacological effects, one of which is their ability to deter insects and mosquitoes. Because natural medicines are seen to be safer and have fewer adverse effects than synthetic ones, they are more widely accepted **[7-17]**.

Figure 1

Herbal mosquito repellent dhoop sticks:

Dhoop sticks' calming scents assist to soothe the mind and foster a tranquil environment around them. Many plants

have mosquito-repelling properties, which is necessary for disease protection. Since they are made of plants, they are environmentally friendly and frequently have no adverse effects. By doing this, they provide mosquito protection without any negative side effects. Natural coil is efficient and useful, however synthetic coil can be dangerous due to its adverse effects. To prevent the harmful effects of the chemicals added to commercial mosquito repellents, which have an impact on both humans and the environment, herbal dhoop sticks can be a perfect substitute.

Figure 2

MATERIALS AND METHOD:

List of chemicals:

Table I

Chemicals	Supplier
Activated charcoal	Merck limited Mumbai
Starch	Ozone International India
Neem powder	Yogesh Pharmacy, Nanded
Tulsi powder	Yogesh Pharmacy, Nanded
Sandalwood powder	Yogesh Pharmacy, Nanded
Peppermint essential oil	Spice Herbals and Amenities Pvt. Ltd.
Eucalyptus oil	Medizen Labs Pvt. Ltd.
Rose essential oil	Natural biotech solutions
Lavender essential oil	ASG Mantra

List of equipments:

Table 2

Equipments	Manufacturer
Electronic weighing balance	Dolphin Mumbai

METHODOLOGY

A. Formula for dhoop sticks

Table 3

Sr. no.	Ingredients	Quantity taken
1	Neem powder	1.5 gm
2	Tulsi powder	1.5gm
3	Marigold powder	1 gm
4	Sandalwood powder	1 gm
5	Activated charcoal	1 gm
6	Starch	2 gm
7	Camphor	0.5 gm
8	Peppermint essential oil	0.4 ml
9	Eucalyptus essential oil	0.5 ml
10	Lavender essential oil	0.25 ml
11	Rose essential oil	0.25 ml
12	Distilled Water	10 ml

a) Procedure:

1. All the powders were weighed according to the formula and were mixed in a morter pestle
2. Powder the shed dried. The marigold petals were shed dried and powedered by using domestic grinder and mixed to the above powder mixture.
3. The fine powder of camphor is mixed into it.
4. Starch and charcoal were mixed into water.
5. The mixture is heated and the powder mixture is mixed into it.
6. The mixture was completely cooled and made into thick paste.
7. The mixture was then moulded into the shape of dhoop sticks.

Figure 3

RESULTS

RESULTS FOR EVALUATION OF DHOOP STICKS:

a) Physical analysis-

Color: Black

Odour: Fragrant

b) Moisture content-

The initial weight of the prepared dhoop was ignited and also the final weight of the dried dhoop was noted.

Initial weight of one dhoop-2.560 gm

Final weight of dried dhoop-2.190 gm

$$\text{Moisture content} = \frac{\text{Initial weight - Final weight}}{\text{Initial weight}} \times 100$$

$$= \frac{2.560 - 2.330}{2.560} \times 100$$

$$= \mathbf{8.9\%}$$

The moisture content was found to be **8.9%**

c) Flammability and Burning Time

The flammability and the burning time of the dhoop was checked by burning the dhoop. It was observed that the dhoop was burnt completely creating low smoke and the burning time was 24 minutes.

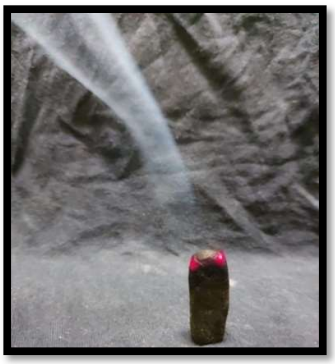

Figure 4

d) Ash value

The dhoop stick was burnt completely and the ash was collected and weighed.

The weight of ash- **0.143 gm**

e) Repellency test [6]-

Repellency test performed in a net of cuboidal shape with an opening so that the mosquitoes can escape through. The dhoop was burn inside the net. The times taken by the mosquitoes try to escape or to get number or to be killed was noted.

Table 4

	Marketed coil	Formulated dhoop
No. of mosquitoes	10	10
No. of mosquitoes escaped	9	8
Time (in minute)	20	25
Temperature	21^0 C	21^0 C
Burning time	30 minutes	24 minutes

Smoke toxicity test [6]-

Smoke toxicity experiment was conducted in a chamber. The mosquitoes were attracted by using a pair of socks and the mosquitoes were exposed to the smoke of burning incense for 45 min. and the mortality data was recorded after every 15min.

Table 5

	Marketed coil	Formulated dhoop
No. of mosquitoes	10	10
No. of mosquitoes dead	8	7
Time (in minute)	20	25
Temperature	21^0 C	21^0 C
Burning time	30 minutes	25 minutes

Evaluation of mosquito repellent activity [6]-

The dhoop was burnt in the mosquito prone areas in the evening and night period. For investigating mosquito repellent activity the prepared incense sticks are checked for causal effect such as irritation, coughing, and tears was observed and recorded.

Table 6

Sr. No.	Area	Time	Reports	Results
1.	**Bathroom**	**Morning time**	**Mosquitoes escaped, less irritation, no coughing tears, no headache**	**Mosquitoes Repelled**
2.	**Kitchen**	**Night time**	**Mosquitoes escaped, less irritation, no coughing tears, no headache**	**Mosquitoes Repelled**

CONCLUSION

The mosquitoes are the major vector that causes multiple severe diseases. Hence there is a need to formulate such kinds of mosquito repellents which are safe, cheap and convenient to use. Plant essential oils have also showed higher mosquito repellent activity. It was concluded that the formulated herbal dhoop stick is effective, cheaper and non poisonous than the presently available chemical based marketed mosquito repellents and maintains mosquito free healthy environment for the society. The formulation formulated is less toxic, eco-friendly and insects are unable to develop resistance and may be used as an alternative to other available chemical based mosquito repellents.

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REFERENCES

[1] Hindustan A. A., Kishore K. R. B., Chitta S. K., Krishna P. U., Ravindra. B.V., Chandra S. K., Anil K. G., Vamsi M. G: Formulation and Evaluation of Home Made Poly Herbal Liquid Mosquito Repellent, **JITPS** 2010, 1 (2), 98–105.

[2] Ibrahim S. I, Fakhraddeen Y. M., Hauwa U. A.: Mosquito repellent activity of leaf and seed extract of *Azadirachta indica* (neem), **Journal of Malaria Research and Phytomedicine** 2019, 3 (1), 19-23.

[3] Sharma P. B., Borthakur S. K.: Formulation of an herbal mosquito repellent, **Annals of Plant Sciences** 2016, 5 (12), 1463-1465.

[4] Amin A., Mehdi K., Alireza Z. R., Sahar A., Hussain S. M.: Effectiveness of plant-based repellents against different *Anopheles* species: a systematic review, **Malaria Journal** 2019, 1-20

[5] Mendhekar S. Y., Bodke N. N., Thorat P. B., Jadhav S.L., Gaikwad D.D.: Formulation and evaluation of polyherbal mosquito repellent creams (ointment type) with extra skin nourishing impact, **World Journal of Pharmacy and Pharmaceutical Sciences** 2017, 6(12), 1731-1742.

[6] Ponkiya N., Desai S., Mistry J., Patel S., Ingalhalli R., Development of economical mosquito repellent using marigold plant, **International Journal for Research Trends and Innovation** 2018, 3(11), 47-54.

[7] Sahu B., Dutta S., Mishra S. P., Khute S., Kumar L., Gupta A. S., Dewangan K.: A brief review on dhoop and its properties, **Journal of Preventive Medicine and Holistic Health** 2021, 7(1), 3–9.

[8] Trivedi A., Rai P. and Jitendra Kumar: Formulation of low smoke herbal mosquito repellent sticks by using different essential oils, **The Pharma Innovation Journal** 2018, 7(4) 173-175.

[9] Ruchi S. Shivhare, Manish A. Kamble, Mahapatra D. K., Ingole A. R., Baheti J. R., Bisen A.: Development of mosquito repellant gel formulations from various natural volatile oils: comparative study with the marketed formulation odomos®, **Journal of Drug Delivery & Therapeutics** 2018, 8(6), 106-110.

[10] Ponkiya N., Desai S., Mistry J., Patel S., Ingalhalli R.: Development of economical mosquito repellent using marigold plant, **International Journal for Research Trends and Innovation** 2018, 3(11), 47-54.

[11] Mendhekar S. Y., Bodke N. N., Thorat P. B., Jadhav S.L., Gaikwad D.D.: Formulation and evaluation of polyherbal mosquito repellent creams (ointment type) with extra skin nourishing impact, **World Journal of Pharmacy and Pharmaceutical Sciences** 2017, 6(12), 1731-1742.

[12] Rwang P. G., Effoim O. E., Mercy K. P., Etokakpan A. M.: Effects of

psidium guajava (guava) extracts on immature stage of mosquito, **International Journal of Complementary & Alternative Medicine** 2016, 4(5), 1-5.

[13] Ranasinghe M. S. N., Arambewela L., Samarasinghe S.: Development of herbal mosquito repellent formulations, **IJPSR** 2016, 7(9), 3643-3648.

[14] Lad N., Palekar S.: Preparation and evaluation of Herbal Dhoop for cleansing the air, **International Journal of Herbal Medicine** 2016, 4(6), 98-103.

[15] Gupta P., Vasudeva N.: Marigold: A Potential Ornamental Plant Drug, **Hamdard Medicus** 2012, 55(1), 45-59.

[16] Kamaraj C., Bagavan A., Elango G., Zahir A. A., Rajakumar G., Marimuthu S., Santhoshkumar T., Rahuman A. A: Larvicidal activity of medicinal plant extracts against *Anopheles subpictus* & *Culex tritaeniorhynchus,* **The Indian Journal of Medical Research** 2011, 134(1), 101-106.

[17] Bagavan A., Rahuman A. A.: Evaluation of larvicidal activity of medicinal plant extracts against three mosquito vectors, **Asian Pacific Journal of Tropical Medicine** 2011, 29-34.