

Fabrication and Evaluation of Herbal Mosquito Repellent Ointment

Namrata¹, Diksha Sharma², Deepak Prashar^{3*}, Lokender Singh⁴, Heena Sharma², Tanvi²

¹Rayat Bahra Institute of Pharmacy, Hoshiarpur (Pb)-India

²DDM College of Pharmacy, Una HP-India

³LR Institute of Pharmacy, Jabli-Kyar, Solan (HP)-India

⁴Shanti Niketan College of Pharmacy, Ratti Mandi (HP)-India

Email address: prashardeepak99@yahoo.in

Abstract—The occurrence of mosquito-causing diseases like dengue, chikungunya, zika, malaria, and yellow fever has been increasing in the world day by day. Mosquito repellents are one of the best methods to prevent mosquito bites. Mosquito repellent works by avoiding mosquitoes from landing on the surface by applying it on clothes, skin, and other surfaces. These are unattractive and unpleasant vexatious to mosquitoes resulting in reduced mosquito contact with the human body surface. The action of mosquito repellent is to repel mosquitoes but not kill them. Mosquito repellent contains such active ingredients that repel the mosquito by blocking mosquito olfactory senses like chemical sensors (Lactic acid, carbon dioxide, propane-3-ol), heat sensors, (warm-blooded animals), and visual sensors. Mosquito is the deadliest pest to man. Various plants contain phytochemicals are used in ancient times to prevent the attack of insects. The synthetic mosquito repellents contain Allethrin, Dimethylphthalate, DEET (N,N diethyl-3- dimethyl benzamide), Prallethrin, DEPA (N,N-diethylphenylacetamide), DEBA (N,N-diethyl benzamide), DMP (dimethyl phthalate) and other substance that are harmful for human use and not environment friendly so the current research work tries toward developing safe and effective herbal mosquito repellent formulations. In current work, Essential Oil-Based Mosquito Repellent (EO-MRC) is prepared of beeswax containing different essential oils like marigold oil, peppermint oil, tea tree oil, neem oil, deodar oil, lemongrass oil, and citronella. Quality, safety, and efficacy of herbal mosquito repellent are identified by various evaluation methods.

Keywords— Mosquito repellent, Citronella, EO-MRC, Essential Oil, Beeswax.

I. INTRODUCTION

Mosquitoes are blood-sucking insects that affect human health. Some pathogenic mosquito species like Anopheles, Culex, and Aedes are vectors that result in various diseases like Japanese Encephalitis, Malaria, Dengue, Fever, Yellow fever, and other infectious diseases. More than 700 million people are affected by mosquito-transmitted diseases. Annual report suggests that over one million deaths are reported worldwide. Therefore, public health awareness and prevent mosquitoes by using various mosquito repellent products is important [1]. 500 species of Anopheles mosquitoes are present in the world of which 50 species are the source of transmitting malaria from bites of infected Anopheles species [2]. About 100 million people are affected by *Aedes aegypti* mosquitoes that spread dengue every year worldwide. Only female mosquitoes bite human beings because they need human protein for the maturation of eggs after mating with male mosquitoes [3]. In 1946, DEET is used by US Army personnel in insect infected areas to avoid mosquitoes. In 1957, DEET is registered for use by the general public. The odor of DEET is unappealing as discovered by researchers at the University of California Davis. In United States, 78 million people and worldwide 200 million people used DEET. DEET is harmful for continuous use in human beings for longer duration of time. Records of poison control center data suggested that excess use of DEET can leads to allergic reactions, neurologic, and cardiovascular toxicities [4]. It is not eco-friendly and is restricted in children below 6 months to 2 years [5]. Herbal mosquito repellents are used now a day because of inexpensive, natural, effective, and

safe. In last two decades or so a lot of research work is being carried out globally using herbs to treat numerous ailments [6-11]. The main aim of this study is to formulate mosquito repellent having least side effects and chemical free.

II. METHODS OF PREPARATION OF HERBAL MOSQUITO REPELLENT

Material

The entire chemicals used in the formulation of mosquito repellent are of analytical grade. Essential oil of citronella, clove oil, neem oil, tea tree oil, lemongrass oil, lavender oil, Eucalyptus oil was procured from Natural Biotech Solutions, New Delhi, India. Bees wax, Liquid paraffin, Vitamin E oil was purchased from SD Fine Chem Limited, Mumbai, India. Coconut oil and baking soda was purchased from the local market.

Method of Preparation

Method

Beeswax, coconut oil, liquid paraffin and vitamin E oil was taken in a china dish and placed over the heating mantle. The mixture was stirred so as to prevent the overheating and assure proper mixing. The requisite amount of water was poured into another beaker and boiled it and after specified time beaker was removed from the heating mantle. Baking soda was poured into hot water, and mixed with a glass rod until baking soda dissolved completely. Then, transferred the beeswax, coconut oil, and Liquid paraffin and Vitamin E oil mixture in mortar. Mixture was triturated by slowly adding the water. Continuously triturate in the same direction until a clicking sound was produced. Essential oils and aromatic oil

were added in combination. Mixed all the ingredients properly so as to form an ointment of required consistency [12].

TABLE 1: Composition of Mosquito Repellent Ointment

Name of Ingredient	Quantity		
	F1	F2	F3
Bees wax	60gm	60gm	60gm
Coconut oil	168ml	168ml	168ml
Liquid paraffin	40ml	40ml	40ml
Vitamin E oil	5ml	5ml	5ml
Distilled water	170ml	170ml	170ml
Baking Soda	3.45gm	3.45gm	3.45gm
Citronella	0.25ml	0.30ml	0.35ml
Clove Oil	0.25ml	0.30ml	0.35ml
Neem Oil	0.25ml	0.30ml	0.35ml
Tea Tree Oil	0.25ml	0.30ml	0.35ml
Lemongrass Oil	0.25ml	0.30ml	0.35ml
Lavender Oil	0.25ml	0.30ml	0.35ml
Eucalyptus	0.25ml	0.30ml	0.35ml



Figure 1– Formulation of Herbal Mosquito repellent ointment

Evaluation Herbal Mosquito Repellent Formulation [13]

Physical Evaluation

The formulated ointment was visually evaluated for color and transparency. The smoothness of the gel was evaluated by simply rubbing the formulation between fingers to feel for smoothness, clumps, roughness, and homogeneity.

pH

The pH of the gel was evaluated with the digitally calibrated pH Meter. 1 G of the formulated sample was dissolved in 25 ml of distilled water. The measurement of pH was performed in triplicate and the average reading was calculated.

Spreadability

2 Gram of formulated sample was sandwiched between two similar glass slides. 200 gm weight was applied on the slides to get rid of the entrapped air to form a uniform film between the slides. The top slide was dragged and the time taken to separate the glass slides from one another was determined from the formula:

$$\text{Spreadability (S)} = \frac{M \sqrt{L}}{T}$$

Where, M = Weight placed on the upper slide (200 G)

L = Length Of A Glassslide (6 Cm)

T = Time Taken (Sec) to separate the glass slides from one another

Viscosity

The Viscosity of the formulated sample was determined using the digital brookfield viscometer using spindle no. 64 At 10 RPM and temperature of 25±1°C. The corresponding dial reading was noted.

Wash Ability

The ease of wash ability of ointment with water was observed visually after application.

Mosquito-Repellent Activity

The formulated ointment was evaluated for mosquito repellent activity and compared with the positive control (Odomos) marketed formulation.

III. RESULTS AND DISCUSSION

TABLE 1-2 Physical Evaluation and Evaluation Parameter of Ointment

Formulations	Color	Transparency	Homogeneity	Washability
F1	Off white	Not transparent	Good	Easily washable
F2	Off white	Not transparent	Good	Easily washable
F3	Off white	Not transparent	Good	Easily washable

Formulations	pH	Spreadability (g.cm/s)	Viscosity (cp)
F1	6.53	25.32	4766
F2	6.44	24.06	4730
F3	6.54	26.09	4794

The Results of the F1, F2 And F3 formulations suggested that all the three formulations are wisely prepared as per the standard value. the spreadability, viscosity and pH value of the F3 Formulation are better than the other formulations. This clearly indicates that the f3 formulation is best among the formulation under research. the physical parameters for F1, F2 and F3 formulations are almost similar but are near to the standard commercially available formulations.

Mosquito-Repellent Activity

Mosquito repellency in 4 H was determined for sample formulations F1, F2 And F3 which is observed to be 88%, 90% and 91% respectively. The standard product (Odomos) demonstrated 97% repellency. Hence, it indicates that the formulations are upto the standard and can further be modified to get the best results in future.

IV. CONCLUSION

Essential oil-based mosquito repellent ointment was developed successfully in the study. The formulations were found to be safe and very effective for human use. The plant-based essential oil has more mosquito-repellent activity as compared to those plant products. Herbal mosquito repellent with Neem oil, Clove oil, Citronella, and Tea tree oil gives 88-91% mosquito repellency indoors and outdoors for 4 hours. Herbal mosquito repellent ointment was prepared and evaluated to observe its activity and stability. From the study, it can be concluded that the ointment prepared from Citronella, Neem oil, Clove oil, and Tea tree oil is safe and effective. These preparations were affordable, efficient, and can be easily accessible to prevent mosquito-borne diseases like Dengue, and Malaria. Further, research needed to be carried out to increase the effectiveness of the present formulations.

REFERENCES

1. Ranasinghe MSN, Arambewela L, Samarasinghe S. Development Of Herbal Mosquito Repellent Formulations. International Journal Of

- Pharmaceutical Sciences And Research 2016; 7(9): 364-3648.
2. Asadollahi A, Khoobdel M, Ramazani AZ, Azarmi S H, Mosawi SH. Effectiveness Of Plant- Based Repellents Against Different Anopheles Species. A Systematic Review. *Malaria Journal* 2019; 18: 436.
3. Ranasinghe MSN, Arambewela L, Samarasinghe S. Development of herbal mosquito repellent formulations. *International Journal Of Collaborative Research On Internal Medicine & Public Health* 2016; 8(6): 341-380.
4. Salunke MR, Bandal SC, Choudhari D, Gaikwad T, Dubey M. Review Of Herbal Mosquito Repellent. *International Journal Of Scientific Development And Research* 2022; 7(3): 204-214.
5. Koren G, Matsui D, Bailey B. DEET-Based Insect Repellents: Safety Implications For Children And Pregnant And Lactating Women. *Canadian Medical Association Journal* 2003; 169(3): 209-212.
6. Wang H, Chen Y, Wang L, Liu Q, Yang S, Wang C. Advancing herbal medicine: enhancing product quality and safety through robust quality control practices. *Frontiers in Pharmacology* 2023; 14:1265178.
7. Chaughule RS, Barve RS. Role of herbal medicines in the treatment of infectious diseases. *Vegetos* 2023: 1-11.
8. Prashar D, Saklani S. Pharmaceutical and Economical Aspects of Medicinal Herbs: An Overview. *Research Journal of Pharmacognosy and Phytochemistry* 2011; 3(5): 187-190.
9. Sharma D, Prashar D, Saklani S. Bird's Eye view on herbal treatment of diabetes. *Asian Journal of Pharmaceutical Research* 2012; 2(1): 1-6.
10. Saklani S, Prashar D, Sharma D. An economical overview of herbal cosmetics. *Research Journal of Topical and Cosmetic Sciences* 2012; 3(1): 4-10.
11. Prashar D, Saklani S, Barshiliya Y, Sharma M, Mankotia S, Soni A. Pharmaco-economical world of herbal antitussive –An Overview. *Asian Journal of Research in Pharmaceutical Science* 2012; 2(2): 48-51.
12. Da Silva MRM, Ricci-Junior E. An Approach To Natural Insect Repellent Formulations: From Basic Research To Technological Development. *Acta Tropica* 2020; 212:105419.
13. Shivhare RS, Kamble MA, Mahapatra DK, Ingole AR, Baheti JR, Bisen A. Development of mosquito repellent gel formulations from various natural volatile oils: A comparative study with the marketed formulation odomos. *Journal of Drug Delivery and Therapeutics* 2018; 8: 106-110.