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**Research Article**

# Evaluation And Preparation for Repellent of Mosquito Agarbatti

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## ABSTRACT

Currently the use of synthetic mosquito repellent chemicals has several issues related to environment and human health. This project was formulated and developed to have safer mosquito repellent free from carcinogenic chemicals and are significantly cheaper and simple to develop. Dried powdered herbs like acorus, pyrethrum flower head, camphor, benzoin, neem leaves were used to make mosquito repellent formulation. The powdered blend were mixed with binders and additives like joss powder, charcoal powder. The solid formulation was rolled in the form of incense sticks. Further to add value, it was later scented with essential oil like lemongrass oil and dried. The incense sticks when ignited releases vapours with a pleasant fragrance and herbs which repels the mosquitoes. The incense sticks was tested for its potency by burning near the mosquito net cage with sufficient mosquitoes. The sticks also distributed to random peoples for feedback and were deemed to be very effective in controlling the mosquitos.

## INTRODUCTION

Mosquitoes are most irritating and blood sucking insect disturbing human beings1. Some of the mosquito species which belongs to genera *Anopheles, Aedes and Culex* are known to be vectors for the most of the disease pathogens like malaria, dengue fever, Myiasis, yellow fever, encephalitis etc. Protozoan diseases- In Malaria the female Anopheles mosquito carries the malarial parasite. The four different species of protozoa causes Malaria, namely Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale and Plasmodium malariae. It is the leading cause of premature mortality and caused more than half a million deaths according to the WHO report in 2012 and the death rate has increased to one million as of 2018, according to the American Association of Mosquito control. Symptoms are high fever and chills.2-4 Dengue fever is an acute mosquito transmitted disease which is characterized by fever, body ache, headache, joint and muscle pains, skin rash, nausea followed by

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vomiting. The causative organism of Dengue Fever is arbovirus and is spread by genus Aedes mosquitoes. Some of the infections in Dengue are Haemorrhagic Fever, Shock Syndrome which can threat the patient's life by increased vascular permeability which leads shock. Over the past twenty years, there has been global increase in the frequency of Dengue Fever incidence. Several factors which are responsible for the resurgence of dengue epidemic are: (i) Uncontrolled population growth; (ii) Urbanization; (iii) Improper waste management; (iv) Improper water supply (v) Increased mosquitoes (vi) Improper mosquito control and (vii) Public health deterioration.5-7

**Myiasis:**

Botflies are parasites which feed on human tissues, such a phenomenon is called myiasis. The Human botfly dermatobiahominis attaches its eggs to the underside of a mosquito, when the mosquito takes a blood meal the parasitic larvae is injected in the blood stream of a human being, and it hatches due to the warm temperature of human blood. This causes rapid necrosis of the tissues. This is very rare now days due to the better sanitation in our societies but it still occurs in developing or under developed countries. Viral diseases - Viral diseases like yellow fever, chikungunya, dengue, etc. is transmitted by the Aedesaegypti mosquito symptoms range from swelling, edema, high fever to coma to death. Helminthiasis - Some species of mosquito carry the filariasis worm that causes extreme swelling (hence also called Elephantitis) of the body parts. Mosquitoes are dangerous, humans over the years have tried many ways to keep them away from entering spaces and spread deadly diseases.

**Anatomy of mosquitos:**

Mosquitoes are very small insect and has three major parts namely head followed by thorax and abdomen. The head of the mosquitos consists of sensors which helps the mosquitos to find the host for feeding. Mosquitos has eyes two in number with tine lens which can feel even little movements. The mosquito antennae are feathery and are located on head and are highly specialised sensitive capacity which can detect the human carbon dioxide from breath from around 100 feet. The maxillary palp near the antennae catches the odour of ocentol and other prime chemicals released from humans sweat. In the middle nearly between antennae proboscis which is a mouth part used to pierce in the skin and suck blood out. The thorax is continuation of the head and has a pair of wings. Mosquitos has six legs with tiny claws which help to keep intact to the surface. The abdomen hangs on the thorax and has stomach and lungs.8 Both male and female mosquitos feed plant juice. Male mosquitos will not bite human beings whereas female mosquitos suck human blood only after mating because they need some proteins for their maturation of eggs.9 Therefore the mosquitos act as a vector for many deadly disorders which transmits virus or parasite from person to person or animals.10

**Prevention of Breeding and Creating Safety Nets:**

The methods to limit breeding of mosquitoes are to make sure there is no stagnant water in our respective locality as mosquito larvae grow and hatch in stagnant water. If in case there are ponds or lakes with fresh water, we should make sure that we let the fish Poecillia reticulate which is commonly known as the 'Guppy' fish grow and breed in them as they consume mosquito larvae as food. In our houses, we can attach nets to our windows and use a mosquito net while sleeping in order to limit the amount of mosquitoes that enter our houses. However, though these methods are very effective to limit the amount of mosquitoes in our environment, they are still not able totally

prevent mosquitoes from entering our homes and workspaces. There is still a change of a mosquito entering our house and biting us and even one bite is enough for the transmission of deadly diseases, which were previously discussed. It is especially difficult in India to reduce the amount of mosquitoes in our environment due to the monsoon season, when stagnant water collect in every nook and cranny. Hence, here enters the role of mosquito repellents.11-13

**Mosquito Repellents:**

Mosquito repellents are substances that prevent mosquitoes from being in an environment. There are various types of synthetic mosquito repellents used in the market; these are manufactured on a large scale by industries. They are widely used and are very popular. However, there are various drawbacks to these mosquito repellents. The ingredients used in them are harmful for the humans as well as the environment. Harmful ingredients in synthetic herbal repellents Synthetic herbal repellents have a number of harmful ingredients, which are harmful to the health of human beings when inhaled or ingested, and are harmful to the environment either during the process of manufacture or during the use of these mosquito repellents in the average Indian household. DEET (N, N Diethyl-Meta-Toluamide)-This is a standard additive in mosquito repellents; it is used as a very popular pesticide. However, it has several very bad effects on the health and environment. It is toxic for pregnant women and can cause foetal abnormalities; it has neurological effects and olfactory effects. It is also very bad for the environment, particularly fresh water fish and zooplankton. Synthetic pyrethrins- such as Allethrin, Transfluthreine are the synthetic derivatives of naturally occurring Pyrethrins derived from Chrysanthemum cinerariifolium. They are fast acting Pyrethrins which have many side effects like anxiety, tremor, convulsions and some individuals are allergic to them. Octacholrodipropylether is also used as a synergist and it is a very potent lung carcinogen. It is banned in the United States but not banned in India. It may be listed as S-2 in the ingredient list. Deodorized kerosene - It is used as the suspending agent or solvent for any mosquito repellents. It has toxic effects for the respiratory system, cardiovascular system, nervous system. It is a confirmed carcinogen for animals and has been suspected to have carcinogenic and mutagenic properties for humans as well. It is very harmful for the environment. Aerosols- many mosquito repellents are in the form of aerosols that release their content in the air when the coil of the machine of the repellent is heated. Aerosols can be toxic to the cardiovascular system and can have several nervous system side effects such as tremors and convulsions. In addition, aerosols with a pleasant fragrance can contain several harmful chemicals like xylene and formaldehyde that are carcinogens. Aerosols are also known to harm the environment. Butylated Hydroxy Toluene (B.H.T) - is used as an antioxidant, it can cause hepatic or renal toxicity if ingested or inhaled. Apart from these terrible drawbacks on our health and environment, the commercially available are also very expensive and difficult for the common person. This is what led to developing a safe herbal mosquito repellent. 14-15

**Development of safe and herbal mosquito repellent incense sticks:**

As we now that mosquitoes are very dangerous and the commercially available mosquito repellents contain certain dangerous chemical ingredients, which are potent carcinogens and are extremely harmful for the humans and environment as well. They are easily accessible only to the urban population. Considering all this, we developed a product that contains herbal

ingredients with no known side effects. The herbs are easily available and since there are no synthetic ingredients. The production and cost of these incense sticks are very economical. Several herbs that have been used in India for generations to repel insects have been used and combined, making a strong and effective product.

**Herbs and additives used in the formulation:**

Dried Pyrethrum flower head-This is the dried flower head of *Chrysanthemum cinerariifolium*. It has potent insecticidal activity and has been used for generations. It targets the nervous system of insects by blocking the voltage gated sodium ion channels that extends nerve firings; this causes paralysis in the mosquito. This is due to the compound called Pyrethrin that is present in the flower head. Neem (*Azadirachta indica*) - This is a widely available plant with many beneficial properties, neem is an effective mosquito repellent and has been used for generations. There are published studies stating that neem is a very effective mosquito repellent. This is due to the compound Azadirachthin, which irritates the mucous membranes of the mosquito and is used an anantifeedant (stops the feeding of the mosquito and it cannot consume human blood meal). Lemon grass oil- Lemon grass oil or Citronella oil is the essential oil obtained from *Cymbopogon nardus* plant. Its strong scent irritates the mosquitoes and other insects and hence the mosquito usually stays away from the scent and cannot sense the presence or scent of a human being. Thus is very effective as a mosquito repellent and has a very pleasant scent. Camphor - Camphor is originally a white and oily resin of the tree *Cinnamommum camphora*. Its crystals are also widely available in the market. It has been used for generations as an effective repellent of mosquitoes and ants. *Acorus calamus* - This herb contains the compound β-asarone which has anti-feedant and larvicidal properties which also like neem prevents the mosquito from feeding on the blood meal of humans as well as prevents the mosquito larvae from growing and maturing in the surrounding areas. Benzoin- Also known as Sambhrani in Southern India, is the resin obtained from the aromatic tree Styrax genus. Its odour also repels mosquitoes and it has been used for generations in India, China, etc. as a mosquito repellent. Joss/Jigat powder- This is the bark powder of the *Persea marcantha* tree used as an adhesive and binding agent in incense sticks. Charcoal powder- This is used as a binder obtained from partially burnt husk of coconut shell.16-19

## MATERIALS AND METHODS:

**Method of preparation of Incense sticks:**

• All the dried herbs were finely powdered in a mixer and then passed through a sieve (mesh no.80). The powder should be very fine or else there will be problems in the binding and burning. Total 100 grams of powder premix taken to prepare 20 incense sticks. The quantity of plant material taken is listed in Table 1.

• Water was gradually added to the fine powder until it attains dough like consistency. It should be well mixed and not too watery dough otherwise it creates problem in making sticks.

• The dough was divided in portions and was rolled by hand in small quantities on plain bamboo sticks. This can be done by a machine in large scale production.

• The sticks were dried for 24 hours under shade. Tray dryer can also be used to dry the sticks faster.

• The dried incense sticks were then scented with lemon grass oil.

• Finally sticks were packed in a suitable packing material preferably plastic.

**Table 1. Quantity of material taken for 20 Incense sticks**

| Sl No | Content | Quantity |
|---|---|---|
| 1 | Neem powder | 10 grams |
| 2 | Camphor | 5 grams |
| 3 | Benzoin | 5 grams |
| 4 | Pyrethrum | 5 grams |
| 5 | Acorus<br>Charcoal | 10 grams<br>50 grams |
| 6 | Joss powder | 10% |

Lemongrass oil Q.S

| | |
|---|---|
| Total | 100 grams |

**Testing mosquito repellent activity of incense sticks using mosquito net cage method:**

The mosquitos used in this experiment were caught by big plastic cover and transferred carefully in the net cage with approximately 60cm X 60cm. About 30 mosquitoes are transferred in the net cage between 7pm to 10pm since most of the mosquitos bite at that time. The three full incense stick were burned in the room with sufficient ventilation and the mosquito net cage is kept at the center of the room and duration of exposure is 3 hours. The behavior of the mosquitos was assessed. The behaviors of the mosquitos were given in Table 2 and Figure 1 mosquitos with no movement after 3 hours of exposure. Figure 2 shows the mosquito net cage.

**Figure 1: Mosquitos with no movement.**

**Figure 2: Mosquito net cage with mosquitos**

## RESULTS AND DISCUSSION:

The mosquito net cage method was used to assess the behavior of the mosquitos when the incense sticks were burned near the net cage for about 3hrs. Around 3 complete incense sticks were burned near the net cage from 7 pm to 10 pm. The results are given in Table 2. and the mosquitos with no movement lying on floor number noted every hour, the first, second and third hour result shows 6, 17, 25 respectively, whereas 4 mosquitos aligned on the net after 3 hours. The figure 1 shows that mosquitoes with no movement after 3 hours of exposure. Feedback of the mosquito repellent incense sticks taken from 20 people and asked to evaluate the formulation. The feedback results are given in table 3. The prepared mosquito repellent incense sticks and sticks ignited in the area outdoor where mosquitos crowded shown in figure 3.

**Figure 3: Final product of mosquito repellent incense sticks and ignited for testing potency**

## CONCLUSION:

A through literature survey was carried out before the development of mosquito repellent incense sticks. Plants have mosquito repellent activity like neem, camphor, acorus calamus, benzoin, pyrethrum and lemongrass oil was selected, powdered and made the incense sticks by adding binders. The incense sticks are subjected for evaluation by using mosquito net cage method and the results were very satisfactory in repelling the mosquitos. The feedbacks of the product were also satisfactory when given to 20 people and the product satisfaction rating score given was 4 out of 5. The product also tested for any allergy symptoms when used and there is no such allergic symptoms like discomfort, sneezing, wheezing were reported. Overall the product is safe to use and have significant mosquito repellent activity.

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