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Development and Evaluation of Natural Mosquito Repellent Candle.

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Abstract:

Herbal products have gained significant importance in recent years due to their safety, eco-friendliness, and therapeutic potential. Plants contain a wide variety of bioactive compounds such as alkaloids, flavonoids, terpenoids, and essential oils, which exhibit antimicrobial, antifungal, and insect-repellent properties. Mosquito-borne diseases like malaria, dengue, and chikungunya continue to be a major health concern, especially in tropical regions. Conventional chemical repellents, although effective, may cause harmful side effects on human health and the environment.

The present study focuses on the formulation and evaluation of a natural mosquito repellent candle using plant-based wax and essential oils such as lavender oil. The candle works by releasing volatile compounds into the environment when burned, creating a protective zone that repels mosquitoes. The prepared formulation was evaluated for various parameters including appearance, burning time, melting behavior, smoke production, and mosquito repellent activity.

The results showed that the herbal candle exhibited satisfactory burning characteristics and significant mosquito repellent activity. It was found to be non-toxic, cost-effective, and environmentally safe compared to synthetic repellents. Thus, herbal mosquito repellent candles can serve as an effective alternative for mosquito control and contribute to public health safety.

Keyword: Mosquito repellent, Herbal candle, Essential oils, Eco-friendly, Non-toxic, Natural wax

1. Introduction:

Mosquitoes are one of the most dangerous disease vectors affecting human health worldwide [1]. They are responsible for transmitting several life-threatening diseases such as malaria, dengue fever, chikungunya, and Zika virus infection [2]. These diseases are highly prevalent in tropical and subtropical regions, where climatic conditions favor mosquito breeding [3]. Poor sanitation, stagnant water, and rapid urbanization further increase mosquito populations, leading to higher disease transmission rates [4].

Chemical mosquito repellents are widely used to prevent mosquito bites. These repellents commonly contain synthetic compounds such as DEET, allethrin, and permethrin [5]. Although effective, these chemicals can cause various adverse effects including skin irritation, allergic reactions, respiratory problems, and environmental toxicity [6]. Long-term exposure may also pose risks to human health, especially in children and sensitive individuals [7]. Moreover, continuous use of synthetic insecticides has led to the development of resistance in mosquito species, reducing their effectiveness over time [8].

Due to these limitations, there is a growing demand for natural and eco-friendly alternatives [9]. Herbal products derived from plants are considered safe, biodegradable, and environmentally friendly [10]. Essential oils extracted from plants possess strong mosquito repellent properties due to the presence of active constituents such as citronellal, geraniol, eucalyptol, and linalool [11]. These compounds interfere with the mosquito's olfactory system, thereby preventing them from detecting human hosts [12].

Candles are an effective medium for delivering mosquito repellent agents into the surrounding environment [13]. When the candle burns, heat causes the essential oils to vaporize, releasing active compounds into the air [14]. This creates a protective zone that helps in repelling mosquitoes [15]. Compared to creams and sprays, candles provide prolonged action, require minimal effort, and reduce direct skin contact with active ingredients [16].

Natural waxes such as beeswax and soy wax are commonly used in candle preparation due to their clean burning properties and ability to hold essential oils effectively [17]. These waxes are biodegradable and produce less smoke compared to paraffin wax [18]. The combination of natural wax and essential oils results in a safe and effective mosquito repellent system [19].

Fig. No. 1: Herbal Candle

Previous research studies have demonstrated that citronella-based candles significantly reduce mosquito landing rates [20]. However, their effectiveness depends on various factors such as concentration of essential oil, environmental conditions, and burning duration [21]. Therefore, proper formulation and evaluation are necessary to achieve optimal performance [22].

The present study aims to develop a herbal mosquito repellent candle using natural ingredients and evaluate its effectiveness, safety, and stability [23].

Literature Survey:

1. Joshi A et al. (2021)

This study focused on evaluating mosquito repellent activity using herbal formulations. The authors conducted controlled experiments to test the effectiveness of plant-based repellents against mosquito species. Results showed that herbal products significantly reduce mosquito landing and biting rates, making them a safe alternative to chemical repellents.

2. Patel M et al. (2018)

The research highlighted the formulation and results of herbal candles. It was observed that candles prepared with natural wax and essential oils showed good physical stability and uniform burning characteristics. The study confirmed their potential as eco-friendly mosquito repellents.

3. Singh V et al. (2019)

This study evaluated the burning characteristics of candles prepared using different waxes. It was found that soy wax and beeswax provide better burning efficiency and longer duration compared to synthetic wax, enhancing the performance of repellent candles.

4. Das P et al. (2020)

The authors studied eco-friendly evaluation parameters of herbal products. Their findings indicated that herbal formulations produce minimal smoke and are safer for indoor use, reducing environmental and health risks.

5. Sharma D et al. (2021)

This research focused on mosquito reduction studies using natural repellents. The results demonstrated a noticeable decrease in mosquito activity in areas where herbal repellent candles were used.

6. Patel S et al. (2017)

The study explained the mechanism of action of essential oils. Active components such as linalool and citronellal interfere with the mosquito's olfactory receptors, preventing host detection and thereby reducing mosquito bites.

7. Kumar R et al. (2018)

This research compared herbal and chemical mosquito repellents. It concluded that while chemical repellents are effective, herbal alternatives are safer and suitable for long-term use without harmful side effects.

8. Meena P et al. (2020)

The authors discussed future perspectives of herbal formulations. They emphasized the importance of improving formulation techniques and increasing the shelf-life of herbal repellent products.

9. Singh N et al. (2021)

This study explored large-scale production of herbal products. It highlighted the feasibility of manufacturing herbal mosquito repellent candles on an industrial scale with cost-effectiveness.

10. Sharma A et al. (2019)

The research focused on improving herbal formulations. The authors suggested optimizing ingredient concentration and formulation techniques to enhance the effectiveness and stability of mosquito repellent candles.

2. Advantages:

1. The herbal mosquito repellent candle is made from natural ingredients, making it safe for human use and reducing the risk of skin irritation and respiratory problems[26].
2. It is eco-friendly and biodegradable, causing minimal environmental pollution compared to chemical-based repellents.[27]
3. The candle provides long-lasting mosquito repellent action by continuously releasing essential oil vapors during burning. [28]
4. It is cost-effective and easy to prepare, making it suitable for both household and commercial use. [29]

3. Need of Study:

Mosquito-borne diseases continue to be a major global health problem, affecting millions of people every year [28]. Chemical repellents, though widely used, are associated with several health risks and environmental hazards [29]. There is an urgent need to develop safer alternatives that are effective and eco-friendly [30]. Herbal mosquito repellent candles offer a promising solution as they utilize natural ingredients with minimal side effects [31].

4. Materials and Methods:

4.1 Materials

- Wax (Beeswax or Soy wax)
- Lavender oil (Essential oil)
- Rose water
- Candle wick
- Coloring agent (optional)

4.2 Method of Preparation:

Step 1: Required quantity of wax (beeswax/soy wax) was taken in a clean container.

Step 2: The wax was melted using a water bath at a controlled temperature until it became completely liquid.

Step 3: After complete melting, lavender oil (essential oil) and rose water were added slowly to the melted wax.

Step 4: The mixture was stirred continuously to ensure uniform mixing of all ingredients.

Step 5: A candle wick was placed at the center of the mold properly.

Step 6: The prepared mixture was carefully poured into the mold containing the wick.

Step 7: The filled mold was kept undisturbed at room temperature to cool and solidify.

Step 8: After complete solidification, the candle was removed from the mold.

Step 9: The prepared candle was stored in a cool and dry place for further use and evaluation.

Fig. No. 2: preparation of Natural Mosquito Repellent Candle

5. Evaluation Parameters:

5.1 Physical Appearance

The prepared candle was observed for color, texture, and uniformity.

5.2 Burning Time

The time taken for complete burning of the candle was recorded.

5.3 Smoke Test

The candle was evaluated for smoke production during burning.

5.4 Melting Point

The melting behavior of the candle was studied.

5.5 Mosquito Repellent Activity

The effectiveness of the candle in repelling mosquitoes was evaluated in a controlled environment.

6. Results and Discussion:

The prepared herbal mosquito repellent candle showed good physical appearance and uniform texture. The burning time was found to be satisfactory, indicating proper formulation of wax and essential oil. Minimal smoke production was observed, which indicates safety and eco-friendliness. The mosquito repellent activity

study showed that the candle effectively reduced mosquito presence in the surrounding area. This effect is mainly due to the presence of active constituents in lavender oil, which interfere with mosquito sensory mechanisms. The results suggest that the herbal candle is an effective and safe alternative to chemical repellents.

7. Future Perspective:

- Development of improved formulations using different essential oils.
- Large-scale production of herbal mosquito repellent candles.
- Enhancement of duration and effectiveness of repellent activity.
- Increased awareness and use of herbal products in daily life.

8. Conclusion:

The present study successfully developed and evaluated a natural mosquito repellent candle using herbal ingredients. The formulation showed good physical properties, satisfactory burning characteristics, and effective mosquito repellent activity.

The use of natural wax and essential oils makes the product safe, eco-friendly, and suitable for regular use. Herbal mosquito repellent candles can serve as a promising alternative to synthetic repellents and contribute to reducing mosquito-borne diseases.

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