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An Air Purifying Herbal Mosquito Repellent Candle with Stress Relief Activity

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A B S T R A C T

Long-term epilepsy management requires maintaining stable therapeutic plasma concentrations, which is often challenging with orally administered Levetiracetam because of its short dosing interval requirements and extensive hepatic first-pass metabolism. The present investigation aimed to formulate and evaluate a novel matrix-type transdermal drug delivery system (TDDS) employing a synergistic combination of natural Ficus carica fruit mucilage and synthetic polymers, namely HPMC K100 and Eudragit S100, to achieve sustained and controlled drug release. Five formulations (LTP1–LTP5) were prepared using the solvent casting method. The developed transdermal patches were evaluated for various physicochemical parameters, including weight variation, thickness, folding endurance, and drug content uniformity. Compatibility and possible molecular interactions between the drug and polymers were analyzed using FT-IR spectroscopy, while in vitro drug diffusion studies were performed using a Franz diffusion cell over a 24-hour period.FT-IR analysis confirmed the absence of significant drug–polymer interactions, indicating the chemical stability of Levetiracetam within the polymeric matrix. The prepared patches demonstrated satisfactory uniformity, with drug content ranging from 97.5% to 99.4% and thickness values between 138 and 148 µm. Mechanical characterization revealed good flexibility and durability, with folding endurance values reaching up to 172 folds. Among all formulations, LTP4 containing an optimized ratio of natural and synthetic polymers showed the best performance, exhibiting a cumulative drug release of 98.85% over 24 hours, following matrix diffusion-controlled release kinetics.The study concludes that the optimized LTP4 transdermal patch successfully provided sustained release of Levetiracetam and may serve as a promising non-invasive alternative to conventional oral therapy, potentially improving therapeutic efficacy, patient compliance, and long-term epilepsy management.

Keywords: Levetiracetam; *Ficus carica* mucilage; Transdermal Drug Delivery; Hybrid Polymers; Matrix-diffusion; Sustained Release; Epilepsy Management; Solvent Casting

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INTRODUCTION

The Mosquito-borne diseases like dengue, malaria, and chikungunya are major health problems worldwide. Most mosquito repellents available in the market contain synthetic chemicals that may cause skin irritation, breathing problems, and environmental pollution after long-term use. At the same time, indoor air pollution and increasing stress levels have created a demand for natural products that can provide multiple benefits together. Herbal aromatherapy candles are becoming popular because they help create a pleasant environment, provide relaxation, and release natural herbal aroma into the air.[1]

Most mosquito repellent candles available in the market only help in repelling mosquitoes and do not provide other benefits like air purification or stress relief.[2]Many candles also contain artificial fragrances and paraffin wax, which may release harmful smoke during burning. Similarly, air-freshening candles generally do not have mosquito repellent properties.[3] Therefore, there is a need to develop a natural candle that can repel mosquitoes, purify air, and reduce stress at the same time.[4]

Previous studies have shown that herbal oils such as citronella oil, eucalyptus oil, lavender oil, and neem extract are effective in repelling mosquitoes.[1] Activated charcoal is

known for removing pollutants and improving air quality [2]. Studies on aromatherapy have also reported that lavender and lemongrass oils help in reducing stress and anxiety[3]. Herbal candles made with natural ingredients are considered safer and more eco-friendly than synthetic candles [4].

Earlier studies mainly focused on either mosquito repellent candles, air purification, or stress-relief aromatherapy separately. Very few studies combined all these three benefits into one single candle product. Most formulations also lacked the use of completely natural and eco-friendly ingredients.[5]

This study introduces a new "Tri Serenity Candle," which provides three benefits together:

A. Mosquito repellency
B. Air purification
C. Stress relief through aromatherapy

The candle is prepared using herbal essential oils, activated charcoal, and natural wax, making it a unique and eco-friendly product. [6]

This research is important because it helps in developing a safer and natural alternative to chemical mosquito repellents and artificial air fresheners.[7]The product may improve indoor air quality, help people feel relaxed, and reduce the harmful effects of synthetic chemicals. It also supports the use of eco-friendly herbal products.[8]

The formulated herbal candle exhibited mosquito repellent, air-purifying, and antimicrobial activities due to the presence of essential oils and activated charcoal. During burning, volatile compounds released from the herbal oils interfered with mosquito olfactory receptors, masking human scent and preventing mosquitoes from locating their host. The candle also demonstrated air-purifying action by reducing unpleasant odors and improving indoor air quality. Additionally, the herbal ingredients showed antimicrobial properties against airborne microorganisms. Eucalyptol present in eucalyptus oil disrupted microbial cell membranes, thereby inhibiting the growth of bacteria and contributing to a cleaner and healthier environment[11]

MATERIALS AND METHODS

The herbal mosquito repellent candle was prepared by melting wax using a hot plate. Stearic acid, herbal oils, and activated charcoal were added with continuous stirring to obtain a uniform mixture. The prepared mixture was poured into molds containing cotton wicks and allowed to cool at room temperature until solidification.

The candles were then removed from the molds and stored for further evaluation.

Materials Used

The following ingredients were used for preparing the Air Serenity Candle:[12]

Table 1: Formulation Table

Sr.no.	Ingredient name	Quantity[20] (100gm)	Use
1.	Bees Wax	**55%**	Emitsthebrightestmost warm toned flame (insectrepellent)
2.	Cowdung	**5%**	Disinfectant
3.	Activated Charcoal	**5%**	Air Purification And Odur Control
4	Camphor	**3%**	Air Purification And Insect Repellent
5.	Steric Acid	**10%**	Improve Hardness And Burn Time
6	Neem extract oil	**10%**	Insecticide And Antibacterial
7	Marigold Extract Oil	**3%**	Insect Repellent And Antibacterial
8	Lavender Oil	**4%**	Insect Repellent And Antibacterial
9	Eucalyptus Oil	**3%**	Insect Repellent And Fresh And Refreshing Aroma
10	Cotton Wick	**1**	For Burning-

METHOD OF PREPARATION

Step 1:

Preparation of Wax Mixture

Soy wax and beeswax were weighed in a 70:30 ratio and melted together in a glass beaker using a hot plate at about 70–80°C.[14]

Step 2: Addition of Herbal Ingredients

Activated charcoal powder was added slowly into the melted wax with continuous stirring. After slight cooling of the wax mixture, citronella oil, eucalyptus oil, lavender oil, and neem extract were added and mixed properly. [15]

Step 3: Candle Formation

A cotton wick was fixed in the center of a glass container. The prepared liquid wax mixture was poured into the container and allowed to cool at room temperature for 24 hours until the candle became solid.[16]

Step 4: Storage of Candle

The prepared candles were stored in closed containers at room temperature and protected from direct sunlight until evaluation.[17]

Evaluation Parameters[19-23]

1. **Appearance:**

   The appearance of the candle was observed visually for smoothness, uniformity, and absence of defects.

2. **Color:**

   The color of the candle was evaluated under normal light conditions.

3. **Odor:**

   The fragrance of the candle was evaluated by smelling and noting the intensity of the aroma.

4. **Shape and Surface:**

   The candle was visually examined for uniform shape and crack-free surface.

5. **Weight Variation:**

   Individual candles were weighed using a digital weighing balance to check weight variation.

6. **Melting Point:**

   The melting point was determined by heating the sample and recording the temperature at which it melted.

7. **Burning Time:**

   The candle was ignited, and the total burning duration was recorded using a stopwatch.

8. **pH Test:**

   A sample of the candle was dissolved in water, and the pH was measured using pH paper or a pH meter.

9. **Burn Rate**:

   The burn rate was determined by measuring the weight loss of the candle after burning for one hour.

10. **Flame Stability:**

    Flame stability was evaluated by observing the size and steadiness of the flame during burning.

11. **Smoke Emission:**

    The candle was burned in a glass chamber, and smoke formation was visually observed.

12. **FragranceRetention**:

    The candle was stored for a specific period, and fragrance retention was evaluated after storage.

13. **Mosquito Repellency:**

    The candle was burned in a closed room, and reduction in mosquito activity was observed.

14. **Air Purification Efficiency:**

    Air purification efficiency was evaluated by observing the reduction of unpleasant odor in a closed room.

15. **Odor Neutralization:**

    The ability of the candle to remove unpleasant smells was evaluated.

16. **Stability Studies:**

    The candles were stored at room temperature for 30 days and observed for any physical or chemical changes.

17. **User Acceptability:**

    User acceptability was assessed by collecting feedback through a survey form.

18. **Stress Relief Activity:**

    Stress relief activity was evaluated based on user feedback regarding relaxation and calming effects after candle use.

RESULT AND DISCUSSION

The developed Air-purifying Herbal mosquitoes repellent candle produced a soothing and calming effect among users during evaluation. The herbal fragrance was found to enhance mood and promote relaxation, contributing to an overall pleasant experience. Minimal smoke production was observed during burning, indicating clean and efficient performance. Most users preferred the natural herbal fragrance over synthetic alternatives due to its refreshing and comfortable aroma. Furthermore, positive feedback from participants demonstrated good acceptance of the product, suggesting its potential as an effective air-purifying, mosquito-repellent, and stress-relieving herbal candle**.**

Table of Result:

Table 1: Evaluation Paremeter

Sr. No	Parameter	Method	Observation	Result
1	Appearance	Visual Appearance	Smooth And Uniform	Acceptable
2	Colour	Visual examination	Dark Black Due to Activated Charcoal	Uniform
3	Odor	Sensory Evaluation	Pleasant Herbal Fragrance	Satisfactory
4	Surface Texture	Visual Inspection	Free From Cracks And Air Bubble	Smooth
5	Weight Uniformity	Digital Balance	11 +_0.5 g	Within Limits
6	Hardness	Manual Assessment	Firm and Stable	Suitable
7	Melting Point	Capillary Method	62-65 C	Acceptable
8	Buring Time	Stopwatch Method	30-60 minuets	Efficient
9	Burn Rate	Weight Loss Per Hour	Approx 11-12 g/Hour	Uniform burning
10	Flame Stability	Visual Observation	Steady	Stable
11	Smoke emission	Glass Chamber Method	Minimal Smoke	Acceptable
12	Fragrance Retention	Sensory Evalution	Long Lasting Aroma	Good
13	Mosquito Repellency	Room Test	Effective Within 1-2 m Radius	Significant Repellency
14	Air Purification Efficancy	Odor Absorption Test	Reduced Unpleasant odor	Effective
15	Odor Neutralization	Sensory Test	Noticeable Improvement in Air Quality	Positive
16	Stability Studies	Storage at Room Temperature for 30 Days	No Change Observed	Stable
17	User Acceptability	Feedback Survey	Highly Acceptable	Excellent
18.	Stress Relief Activity Test	Feedback Survey	Highly Acceptable	Excellent

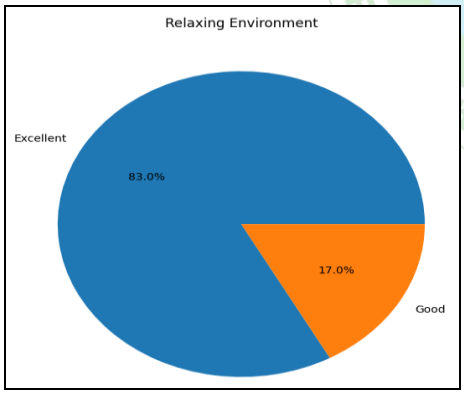


Figure 1: Graphical Representation of Relaxing

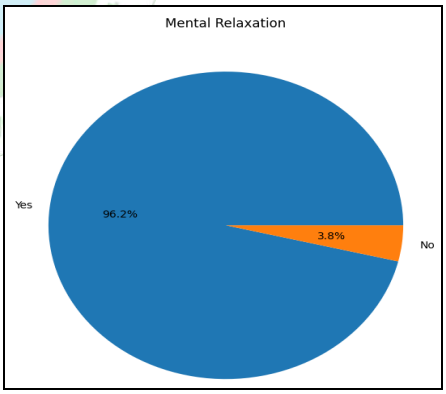
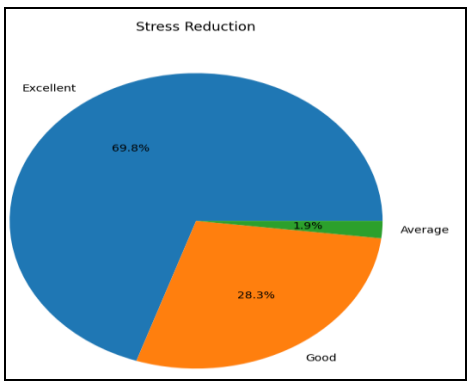


Figure 2: Graphical Representation of Mental Relaxation



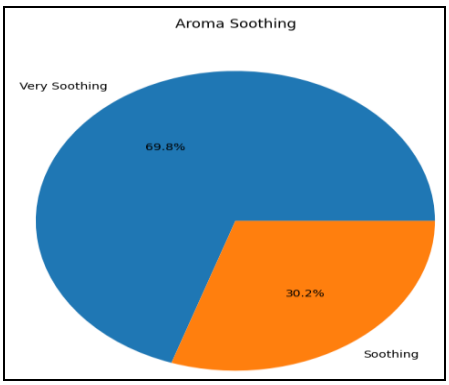


Figure 3: Graphical Representation of Stress Reduction

Figure 4: Graphical Representation of Aroma soothing

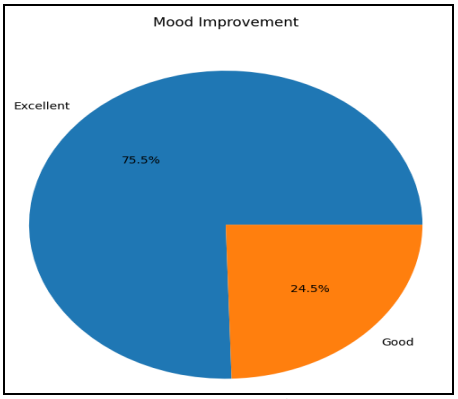


Figure 5: Graphical Representation of Mood Improvement

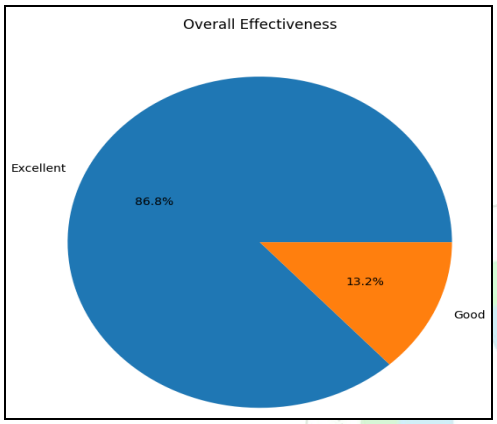


Figure 6: Graphical Representation of Regular Usage

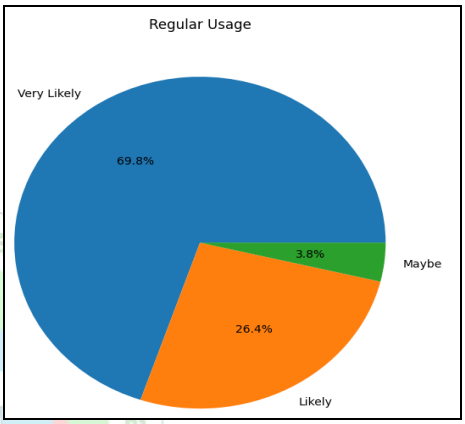


Figure 7: Graphical representation of Overall effectiveness

DISCUSSION

The main purpose of this study was to develop and evaluate the "Air Serenity Candle," a herbal candle designed to provide three benefits together: mosquito protection, air purification, and stress relief. The overall results of the study were positive. The prepared candle showed a smooth appearance, pleasant aroma, good burning performance, and satisfactory effectiveness during evaluation.

During the mosquito repellent test, a noticeable decrease in mosquito activity was observed after burning the candle. This may be due to the natural mosquito repellent properties of citronella oil and neem extract used in the formulation. These herbal ingredients are widely known for helping keep mosquitoes away naturally. Similar findings have also been reported in previous studies, where citronella oil and neem extract showed effective mosquito repellent activity.

The candle also helped improve the freshness of the surrounding environment. Activated charcoal present in the candle may have helped absorb unpleasant odor and impurities from the air, while eucalyptus oil provided a refreshing fragrance. As a result, the room atmosphere felt cleaner and more pleasant after burning the candle.

The stress-relieving effect of the candle was one of the important findings of the study. Most volunteers reported feeling calm, relaxed, and mentally refreshed after using the candle. This relaxing effect may be due to the soothing aroma of lavender oil and eucalyptus oil, which are commonly used in aromatherapy for relaxation and stress reduction. Earlier studies have also shown that lavender oil helps reduce stress and anxiety levels.

Compared to ordinary chemical-based mosquito repellents and artificial air fresheners, the Air Serenity Candle offers a more natural and eco-friendly alternative. The use of herbal ingredients and natural waxes may reduce harmful effects associated with synthetic products. In addition, combining mosquito repellency, air purification, and stress relief into a single candle makes the product more practical and convenient for daily use.

The findings of this study suggest that herbal multifunctional candles may help improve indoor comfort and wellness naturally. The product may be useful in homes, study areas, bedrooms, meditation spaces, and other indoor environments where people prefer a calm, fresh, and mosquito-free atmosphere.

However, the study had certain limitations. The mosquito repellent activity was tested only under limited laboratory conditions, and the number of volunteers involved in the feedback study was relatively small. Advanced instruments were not available to scientifically measure air purification efficiency.

Future studies can focus on improving the formulation by using different combinations of herbal oils and natural

ingredients. More detailed studies with larger sample sizes and advanced testing methods may help provide stronger scientific evidence regarding the effectiveness and long-term safety of the product.

CONCLUSION:

The present study successfully developed and evaluated the "Air Serenity Candle," a herbal candle created to provide mosquito protection, air purification, and stress relief together in a single product. The candle showed good appearance, pleasant fragrance, smooth burning performance, and satisfactory results during all evaluation tests.

The findings revealed that the candle helped reduce mosquito activity, made the surrounding environment feel fresher, and created a calm and relaxing atmosphere for users. These positive effects may be due to the natural action of ingredients such as citronella oil, neem extract, lavender oil, eucalyptus oil, and activated charcoal used in the formulation.

The Air Serenity Candle may serve as a safer and more eco-friendly alternative to synthetic mosquito repellents and chemical air fresheners. Since it combines multiple benefits in one product, it can be useful for daily indoor use in homes, study areas, bedrooms, and relaxation spaces.

Although the study produced encouraging results, further research using advanced testing methods and a larger number of participants is needed to better evaluate the long-term effectiveness and safety of the product. Overall, the Air Serenity Candle shows good potential as a natural wellness product that can help create a cleaner, fresher, and more peaceful indoor environment.

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