Medical Sains : Jurnal Ilmiah Kefarmasian
Vol. 9 No. 3, July - September 2024
https:/ojs.stfmuhammadiyahcirebon.ac.id/index.php/iojs

EVALUATION OF AROMATERAPIC LILIN AIDE FORMULATION FROM AGRICULTURAL OIL OF AURISH (*Cymbopogon citratus*) AS AROMATERAPIC RELAXANT AND INSECT REPELLENT

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Submitted: June 13, 2024 Revised: September 10, 2024 Accepted: September 23, 2024

ABSTRACT

This study aimed to evaluate the formulation of aromatherapy candles using citronella essential oil (*Cymbopogon citratus*) as the active ingredient. Lemongrass essential oil was chosen because it has two main functions: as an aromatherapeutic relaxant and as an insect repellent. In this study, several candle formulations were prepared with varying concentrations of essential oils to determine the most effective and stable formulation. An effectiveness test was conducted by measuring the intensity of the scent, burning duration of the candle, and the ability to repel insects. The results showed that candles with 25% essential oil provided the best balance between scent intensity and insect repellent effectiveness. The candles also exhibited good stability during the storage. In conclusion, kitchen lemongrass essential oil is a potential ingredient for use in aromatherapy candles that not only provides a relaxing effect, but also functions as a natural insect repellent.

Keywords: kitchen lemongrass, aromatherapy candles, relaxants, *insect repellent*

INTRODUCTION

Aromatherapy, an alternative therapy that uses plant essential oils, has gained widespread attention in an effort to improve physical and mental well-being (Gong *et al*., 2020). In this context, lemongrass (Cymbopogon citratus) has emerged as an intriguing option owing to its potential as an active ingredient in the formulation of aromatherapy candles. (Salsabila *et al*., 2023). This study aimed to evaluate the formulation of aromatherapy candles made from kitchen lemongrass essential oil, focusing on the relaxation effects and its ability as a kitchen lemongrass repellent, the ability of aromatherapy candles to influence users' perceptions of well-being and mood, and the formulation's performance at high temperatures, considering that candles can melt at certain temperatures. (Prabandari & Febriyanti, 2017).

The stability of the kitchen lemongrass aromatherapy wax formulation is a crucial aspect in the development of effective and reliable products. Several essential approaches must be considered to address the issues related to stability. First, a comprehensive product stability study must be conducted to understand the impact of changes in storage conditions such as temperature, humidity, and light on the formulation. Furthermore, the selection of raw materials with high stability is crucial, ensuring that wax, essential oils, and other supporting materials can maintain their quality throughout the shelf life of the product. Choosing the appropriate packaging is also an important factor in protecting the formulation from exposure to external elements that could affect its stability. Periodic testing of product samples, including aroma tests and other quality parameters, is a critical step in monitoring and ensuring that products continue to meet established standards. (Yuliana *et al*., 2023; Siregar, 2019). Proper product maintenance is also necessary, including providing consumers with information on optimal storage and correct usage, to ensure that the formulation

remains stable and can deliver the desired benefits during use. Considering these aspects, the formulation of aromatherapy candles can maintain their stability, making them a reliable choice as a relaxant and insect repellent (Müller *et al*., 2008).

This study presents a technological innovation in the formulation of aromatherapy candles and explores other indications of their role as insect repellents. Combining the well-known relaxing properties of lemongrass essential oil with its ability as a natural insect repellent creates a dual function in a single formulation. (Salsabila *et al*., 2023). The utilization of kitchen lemongrass in this study can provide a more natural and sustainable alternative to conventional chemical products. Furthermore, this approach offers the opportunity to explore new market potentials that may have specific needs, such as those seeking products that are effective in relieving stress, while also protecting against insects without the use of synthetic chemicals. (Awaluddin *et al*., 2023;Yenti *et al*., 2019).

This research also allows for the identification of an appropriate formulation to achieve product standardization with an optimal balance between relaxation effectiveness and insect protection. This involves comparisons and tests against similar products already on the market to assess the advantages and added value of the aromatherapy wax formulation made from citronella essential oil. (Maharianingsih & Ariasanti, 2022).

RESEARCH METHODS

The research conducted is an experimental study carried out in the pharmaceutical formulation technology laboratory at Nahdlatul Ulama Sunan Giri University.

Equipment and Materials

The research tools used included an analytical balance, scissors, stirring rod, porcelain cup, wooden stick, beaker, heating mantle, hot plate (18-one), hot plate, capillary tubes (Marienfeld), stopwatch, aromatherapy wax container, distillation equipment (distillation flask (Pyrex), boiling stones, condenser (Pyrex), condenser tubing, thermometer, receiving flask (Pyrex)), beakers (Iwaki), and an analytical balance. Distilled water, stearic acid, kitchen lemongrass (Cymbopogon citratus), candle wick, anhydrous Na2SO4, n-hexane, paraffin, and beeswax.

Research Procedure

a) Distillation

First, the distillation apparatus was assembled using a stand, clamp, and heater. (*heating mantel*), Then, set up a round-bottom flask (the first distillation flask) containing 1 liter of distilled water and boiling stones, and place it on a heater. Connect the second distillation flask containing 2 kg of jasmine flower sample, attach the condenser connector and spiral condenser, and the burette tap to collect the distillation results and then secure it with a clamp. The cooling hose was attached to the top and bottom of the condenser, the cooling water tap for the condenser was turned on, and then the heater was turned on to a temperature of 100°C, where distillation was carried out for 5-7 hours. The distillation results were placed in a separating funnel and allowed to sit for 24 hours until two layers were formed, after which separation was performed. Subsequently, 25 ml of n-hexane and approximately 20 mg of Na2SO4 were added, and the mixture was shaken for 30 minutes before separating the solvent and essential oil. (Murniningsih and Trisnawati 2022).

b) Formulation Design

The research was conducted on 3 formulations using a wax base of 100 grams. Variations in essential oil concentrations of 0, 15, 20, and 25% were used to evaluate their effects on the stability of the aromatherapy wax preparation.

Tabel I. Aromatherapy Candle Formulation

No	Material	Concentration (%)				Function
		FI	F2	F3	F4	
1.	Minyak atsiri serai	0	15 (15 g)	20 (20 g)	25 (25 g)	Active substance
2.	Stearic Acid	30	30	30	30	Density
3.	Cera Alba	20	20	20	20	Basis
4.	Paraffin wax	Add 100	Add 100	Add 100	Add 100	Basis

Description:
F1: formulation with an active substance concentration of 0%
F2: formulation with an active substance concentration of 15%
F3: formulation with an active substance concentration of 20%
F4: formulation with an active substance concentration of 25%

The process of producing scented candles begins with the preparation of the raw materials: stearic acid, white wax, and paraffin wax. Next, paraffin, stearic acid, and ceramic were weighed according to the Alba recipe. The next step is heating. Paraffin and stearic acid were mixed using a hot plate at a temperature of approximately 80–85°C. Cook until melted and then add the stearic acid. The temperature of the paraffin, white beeswax, and stearic acid mixture was maintained at approximately 55°C. Then, the essential oils of lemongrass F1 (0%), F2 (15%), F3 (20%), and F4 (25%) were added according to the formula, and stirred until well combined. Finally, the mixture was poured evenly into small pieces of glass that were ready in the center. Finally, the candle is allowed to sit at room temperature until it hardens; the scented candle is ready to be tested and used. (Herawaty, 2021).

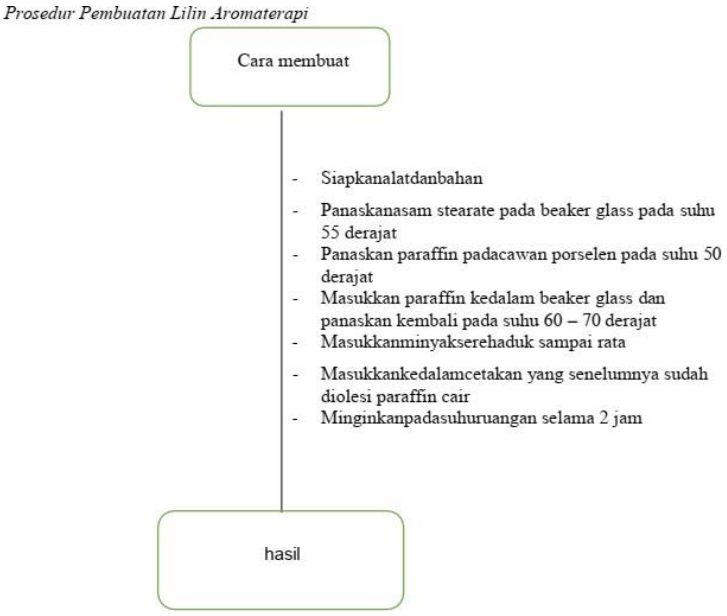

Figure 1. Procedure for Making Aromatherapy Candles

c) Evaluation of Physical Quality Testing and Stability of Preparations

1. The overall form of the wax preparation was tested.

   This test was conducted on uniformly shaped candles that were free of cracks, defects, and breaks. Testing was carried out through subjective visual observation of the

candles by each panelist. A total of 20 panelists were used in this test, and the panelists' assessments were recorded on a scale of 1 to 5, which included ratings of poor, fair, good, very good, and excellent. Melt point test. (Elya *et al*., 2022).

2. Test the Candle Color Evenly
   The composition of wax materials has a significant impact on wax color preference. This test was conducted by visually observing the color of the aromatherapy candles produced as subjectively assessed by each panelist. The observation was carried out by a panel of 20 individuals, each rating their level of preference on a scale that included options such as not good, less good, fairly good, good, and very much liked. (Elya *et a*l., 2022).
3. Aromatherapy candle test before burning.
   The aroma of the candle is produced from a combination of essential oils from lemongrass. The resulting scent provides different stimuli for panelists, each of whom is given an aromatherapy candle to smell before it is lit. This observation was conducted by using a panel of 20 participants. The results show the level of preference for the candle scent before it is burned. The assessment of the preference level for the scent of the candle before burning was presented on a scale of 1-5, which included dislike, somewhat dislike, neutral, like, and very much like. (Elya *et al*., 2022).
4. Aromatherapy candle test after burn injury
   Testing the preference for candle scents when burned would provide a more accurate assessment of the aroma produced. This test was conducted by burning an aromatherapy candle made in a room, with the panelists positioned approximately 20 to 60 cm away. Twenty panelists were prepared to observe the aroma released from the candle after it was burned, with each panelist subjectively evaluating what they experienced. The assessment of the level of preference for the scent of the candle after it has been burned is presented on a scale of to 1-5, which includes dislike, somewhat dislike, neutral, like, and very much like. (Elya *et al*., 2022).
5. Testing the effects of therapy as experienced by panelists.
   The results of the assessment of the therapeutic effects of candle aromas are based on the subjective opinions of each panelist using a 10-point scale for aroma effects, which included no effect, stuffy, fresh, dizzy, relaxed, comfortable, drowsy, fresh, somewhat fresh, drowsy, and calm. The test was conducted with 20 panelists in a closed room, with the panelists positioned approximately 30–60 cm apart. (Elya *et al*., 2022)
6. Organoleptic Test
   Organoleptic testing is based on sensory processing. Sensation is defined as a physiopsychological process, which is the awareness or recognition of sensory organs regarding the properties of objects due to the stimuli received from those objects. The organoleptic test on aromatherapy wax preparations can include the color, shape, scent, texture of the preparation, and an overall assessment of the wax product (uniformity of color, no cracks, no breaks, and no defects). (Hilmarni *et al*., 2021).
7. Candle burning time test.
   The burning time of an aromatherapy candle is the duration for which the candle burns, producing a flame and releasing the desired aromatherapy fragrance. The burning time of the candles was determined based on the differences in wick diameter to be used in product manufacturing through visual observation of the candles using a trial and error method with a stopwatch. The wick sizes are categorized by diameters of 0.15 cm, 0.25 cm, and 0.35 cm, with the same weight of wax but different formulations. (Hilmarni *et al*., 2021).
8. Test the Melting Point of Aromatherapy Wax
   Melting point testing using the drop pipette method. The candle wax was drawn into a dropper pipette and stored in a refrigerator at 4–10°C for 16 hours. The dropper pipette was attached to a thermometer and placed in a 600 ml beaker filled halfway with water. The beaker is heated. When the candle in the capillary tube first moved,

the number displayed on the thermometer was recorded as the melting point of the candle. The melting point of candles according to SNI 06-0386-1989 ranged from 50 to 58°C. (Rislianti *et al*., 2021).

RESULTS AND DISCUSSION

Distillation of kitchen lemongrass essential oil was carried out using the Stahl distillation method and steam distillation. According to Alfianur (2017), this method has the highest yield among the essential oil extraction methods that have been attempted, namely pressing. In the pressing method, the results obtained have an unpleasant aroma, and it is difficult to separate the essential oil from other mixtures. When mixed with wax, it does not blend but instead clumps at the bottom of the wax. (Alfianur, 2017). In steam distillation, liquids can produce essential oils with fresher and more distinctive aromas. Separation of water and oil can be easily achieved using the decantation method. The oil obtained through steam distillation, when mixed evenly with wax, blended. (Alfianur, 2017).

The kitchen lemongrass plant (*Cymbopogon citratus*), which is best for distillation, is a fresh plant. Fresh kitchen lemongrass produces more oil with a higher quality fresh aroma. In contrast to dried orange peel, dried leaves cause evaporation of oil, resulting in a smaller yield and less fresh aroma. (Simarmata, 2019).

Figure 2. ***Results of essential oil distillation.*** **(Sumber : Dokumentasi LaboratoriumFarmasi Unugiri)**

Based on the results of the preliminary tests conducted using steam distillation and Stahl distillation, with a distillation time of 6-7 hours, only approximately ±1 mL of oil was obtained from a material ratio of 100 grams of kitchen lemongrass and 100 mL of distilled water. The very low oil yield is due to the capacity of the distillation apparatus, which is approximately 100 grams. In Stahl distillation, the oil obtained and the steam produced are collected together, causing the essential oil, which is highly volatile, to evaporate quickly. This results in a minimal amount of oil being collected, and when the oil is mixed with a solvent, it becomes difficult to separate.

Table II. Results of Organoleptic Testing of Kitchen Lemongrass Essential Oil

Organoleptics	Lemongrass essential oil	Library	Result
Bentuk	Cair	Cair (Simarmata, 2019).	(+)
Color	Yellow	Pale yellow to brownish yellow. (Simarmata, 2019).	(+)
Aroma	Special Aromatic	Special Aromatic (Simarmata, 2019).	(+)

Note: (+) indicates the essential oil of the kitchen lemongrass used according to literature.

Table *II*The results of the organoleptic test of kitchen lemongrass essential oil show findings that align with the literature, indicating that it has a liquid form, yellow color, and distinctive aromatic scent. (Simarmata, 2019).

Table III. Organoleptic Test of Aromatherapy Wax Preparations

No	Formula	Form	Color	Aroma
1.	Formulation 1	Dense	White	Special Candle
2.	Formulation 2	Dense	Blue	Special Aromatic
3.	Formulation 3	Dense	Blue	Special Aromatic
4.	Formulation 4	Dense	Blue	Special Aromatic

Essential oils are used as additives for the production of aromatherapy candles. Aromatherapy candles are made using stearic acid, solid paraffin, and beeswax as bases for candle production. The candle was prepared in four formulations: F1, F2, F3, and F4. The addition of essential oils was in accordance with the formulae created, with varying concentrations in each formulation, where F0 served as the control for the other three formulations, which did not include the addition of essential oil. FI 1 (0), F2 (15%), F3 (20%), and F4 (25%). Before conducting the main test, the researcher conducted a preliminary test for the preparation of aromatherapy candles, and the resulting preparation met the criteria for the candles that would be used for the desired formulation and shape. After the preliminary test, the researcher conducted a main test. The first step was to weigh all raw materials, with each candle weighing 100 grams. For F1, the required materials are 30 grams of stearic acid, 50 grams of solid paraffin, and 25 grams of cera alba. For F2, 30 grams of stearic acid, 20 grams of cera alba, 35 grams of solid paraffin, and 15 grams of kitchen lemongrass essential added. For F3, 30 grams of stearic acid, 20 grams of cera alba, 30 grams of solid paraffin, and 20 grams of kitchen lemongrass essential oil were added. For F4, 30 grams of stearic acid, 20 grams of cera alba, 25 grams of solid paraffin, and 25 grams of kitchen lemongrass essential oil were added. After the tools and materials were prepared, stearic acid, cera alba, and paraffin were melted at a temperature of 80 °C, and the temperature was then lowered to 40 °C. Essential oil was added to each formulation, and the wax was hardened for approximately 2 hours. The wax preparation was then subjected to an evaluation test of the physical properties of the aromatherapy wax, which included organoleptic tests, burn time tests, and the activity test of the aromatherapy wax with kitchen lemongrass essential oil..

Results of the Candle Burning Time Test

The burn time test is the durability of the candle during the burning process. The test was conducted by burning the candle wick until a flame was formed. The burn time was obtained from the difference between the initial time of the candle burning and the time when the candle was completely burned out. The burn time was measured using a stopwatch from the start of candle burning until it was fully consumed. (Siregar,2019). The burn time testing process was conducted in a closed room free from any disturbances that could extinguish the flame. The purpose of the burn time test is to determine the duration of the candle's burn until the wick is completely consumed. (api padam). The results of the research conducted by Simarmata (2019) show that the standard burn time to provide the maximum effect is 4 hours. The longer the time required for a candle to burn, the greater is the aroma effect produced for a longer duration. The results obtained from the candle burn time tests are listed in **Table IV**.

Table IV. Data Results of the Burning Time Test of Lemongrass Essential Oil Candle (*Cymbopogon Citratus*)

Wax formulation	The color of the candle flame.	Early burn time	The candle has burned out.	Time difference	Standard
F1	Bright yellow	18.30	23.00	4 hours and 33 minutes	4 hours
F2	Bright yellow	18.30	22.55	4 hours and 26 minutes	4 hours
F3	Bright yellow	18.30	22.50	4 hours and 21 minutes	4 hours
F4	Bright yellow	18.30	22.35	4 hours and 5 minutes	4 hours

The test results indicated in **Table IV** show that the burning time of the candle was approximately 4 hours and 5 minutes. The longest burn time was for formula F1, whereas the fastest burn time was for F4. The F1 candle had a longer burn time compared to F2 and F3 because burn time is also related to the properties of essential oils, which are volatile. The higher the concentration of the essential oils, the faster the candle burns. In addition to essential oils, other factors influence the burn time of aromatherapy candles. According to Pancarani (2020), the size and position of the wick in a candle also affect the burning time of the candle; the larger the wick or the closer it is to the edge, the faster the candle will burn out. According to Turnip (2003), the burn time is the interval that indicates the endurance of a candle from the moment it is lit until it is completely burned out. The burn time was obtained from the difference between the start time of the burn and the time when the candle wick had completely burned out. From these observations, it is known that the position of the wick in each candle is centered, resulting in a burn time that meets the standard of 4 hours. The determination of the candle's burn time is based on the difference in wick diameter that will be used in the product creation process through visual candle making using a stopwatch. The candles with a 5 cm wick yielded the following burn times: formulation F1 4 hours 33 minutes, F2 4 hours 26 minutes, F3 4 hours 21 minutes, and F4 4 hours 5 minutes. Thus, the higher the concentration of the essential oil, the faster is the burning time of the candle.

Table V. Results of the Melting Point Test of Aromatherapy Wax Preparations

Formulation	Average Melting Point °C
F1	55
F2	54
F3	52
F4	47

The next physical evaluation was the melting point test of the aromatherapy wax preparations conducted on all four formulations. **Table V** shows a melting point between 47°C and 55°C, and this melting point range meets the physical evaluation criteria for melting points according to the SNI, which is 42–60°C. The highest melting point was found in formulation F1 without essential oil, whereas the lowest melting point was observed in formulation F4 with a concentration of 25% oil. The melting point is influenced by the wax base; in this case, stearic acid has a melting point of 54°C, according to the third edition of the pharmacopoeia.

Another factor that affects the melting point of the base is the concentration of the essential oils. The observation results show that the higher the essential oil content, the lower the melting point. This can be seen in the melting point test results, where all formulas have the same base concentration, but differ in their essential oil concentrations. FIII and F+ had

the lowest melting points because of their higher essential oil concentrations, while F- served as the negative control with no added essential oil, resulting in the highest melting point. FI had the highest melting point, because it had the lowest essential oil concentration. (Rusli& Rerung, 2018).

TableVI. Results of aromatherapy candle aroma test before burning.

Formulation	n	Dislike	Less Like	Just ordinary	Like	Very much like.	Amount
F1	20	13	3	4	-	-	100%
F2	20	-	3	10	7	-	100%
F3	20	-	-	5	10	5	100%
F4	20	-	-	4	12	4	100%

The next physical evaluation was a preference test in which the candle was placed in a closed room with a distance of 60 cm between the panelists and the candle. Twenty panelists were prepared along with a questionnaire containing five questions, namely, whether the panelists do not like, somewhat like, are indifferent, like, or really like the scent of the candle before it is burned. The panelists were directed to subjectively assess their feelings. The results can be seen in **TableVI** In the data before burning, 50% of the panelists gave an average rating, 44% liked it, and 6% liked it very much. In FII, 60% of the panelists liked the scent, 13% liked it very much, 24% rated it on average, and 3% did not like it. In FIII, 73% of the panelists liked it, 24% liked it very much, and 3% rated it on average. In F-, 67% of the panelists did not like the scent, because this formula only has a base without the addition of essential oils, resulting in a smell similar to regular candles. Meanwhile, formula F4, which served as a positive control using lavender aromatherapy candles, resulted in 70% of the panelists liking the fresh and calming scent. (Siregar, 2019).

Table VII. Results of aromatherapy candle aroma test after burning.

Formulation	n	Dislike	Less Like	Just ordinary	Like	Very much like.	Amount
F1	20	10	4	6	-	-	100%
F2	20	-	4	10	6	-	100%
F3	20	-	-	5	11	4	100%
F4	20	-	-	4	13	3	100%

The results of the preference test after baking are shown in **Table VII**In FI: 40% of the panelists did not like it, 40% were indifferent, 14% liked it, and 6% disliked it. In FII, 37% of the panelists were less fond, 34% were indifferent, 20% liked it, and 6% were not fond. In FIII, 24% were indifferent, 63% liked it, and 10% liked it very much, which was due to the higher concentration of essential oils compared to formulas FI and FII. For F, 57% did not like it, 26% were less fond, and 17% were indifferent because there was no aroma released when the candle was burned. F4 was used as a positive control and 100% of the panelists liked it. (Siregar, 2019).

CONCLUSION

Lemongrass essential oil (*Cymbopogon citratus*) has been proven to be an active ingredient in the formulation of aromatherapy candles as an insect repellent and as a relaxant with varying concentrations of F1, F2, F3, F4 (15%), F2 (20%), F3 (25%), and aromatherapy candle preparation has been shown to be effective as an insect repellent and as a relaxant. The optimal concentration of essential oil was determined to be 25%.

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