Pharmacy Reports

https://doi.org/10.51511/pr.49

RESEARCH ARTICLE

Open Access

Aromatherapy candle formulation from calamansi peel oil (*Citrus x microcarpa* Bunge)

Meryta, Ana Husnayanti*, Syamsul Rizal Sinulingga, Muhammad Seto Sudirman

Department of Pharmacy, Pangkalpinang Health Ministry Polytechnic, Bangka Belitung

*Corresponding author: Jl. Telaga Biru, Padang Baru, Pangkalan Baru, Bangka Tengah, Bangka Belitung.

Email: mahardhera@gmail.com

Abstract: Candles can serve a dual purpose of not only providing light but also acting as a means of aromatherapy. Aromatherapy, which involves the use of essential oils, such as calamansi peel (*Citrus x microcarpa* Bunge), is an alternative form of treatment. The objective of this study was to determine the optimal concentration of essential oil, evaluate the characteristics of aromatherapy candles, and assess their appeal. The pre-experimental technique employed a one-time case study/post-test design, with soy wax used as the candle's wax base. The preference test for aromatherapy candles involved 30 untrained individuals. The candles exhibited a uniform color, with no cracks, defects, fractures, or air bubbles. The candle with a 3% formulation demonstrated the longest burning time and quickest melting point. Furthermore, candles containing 3% essential oil were preferred both before and during burning. Additionally, this formulation displayed the fragrance promptly, with the quickest perceived effect time.

Keywords: aromatherapy, Citrus x microcarpa bunge, aromatherapy candle, soy wax

Introduction

Indonesia is a leading producer of essential oils, cultivating 40-50 of the 80 types traded globally. These oils are derived from various plant parts, including roots, stems, leaves, flowers, and fruits [1]. Among the untapped and often overlooked resources is the calamansi (*Citrus x microcarpa* Bunge), a fruit that is abundant in the Bangka Belitung region but rarely found outside Bangka Island [2]. The ethanol extract of calamansi contains flavonoids and monoterpene hydrocarbons, compounds with potential therapeutic properties [3].

Aromatherapy, which involves the use of fragrant substances for therapeutic purposes, commonly utilizes essential oils [4]. These oils are volatile liquids typically isolated from various plant parts, including roots, stems, leaves, flowers, fruits, and seeds [6]. Aromatherapy candles, which are made using essential oils, offer a popular method of delivering these therapeutic scents [5].

One method for extracting essential oil from calamansi peel is water distillation, a process that separates liquid components based on differences in boiling points and volatility [7]. Soy wax, derived from hydrogenated soybean oil, is commonly used as a safe and sustainable base material for candles [8].

Calamansi is known for its pharmacological activities, including antimicrobial, antibacterial, and antioxidant properties [9]. However, its potential as an aromatherapy agent remains unexplored. This study aims to evaluate the optimal concentration of calamansi peel essential oil for use in aromatherapy candles, assess the characteristics of these candles, and determine consumer preferences. Specifically, the study will investigate whether varying concentrations of calamansi peel essential oil—1%, 2%, and 3%—affect the candles' performance in terms of both physical properties and consumer appeal.

Method

This study utilized a one-shot case study/posttest-only design, with the concentration of calamansi peel essential oil as the independent variable and the characteristics and liking of the aromatherapy candles as the dependent variables.

Essential oil evaluation

The characteristics of calamansi peel essential oil were assessed through yield calculation, specific gravity measurement, solubility in alcohol, color evaluation, and analysis of essential oil content using Gas Chromatography-Mass Spectrometry (GC-MS).

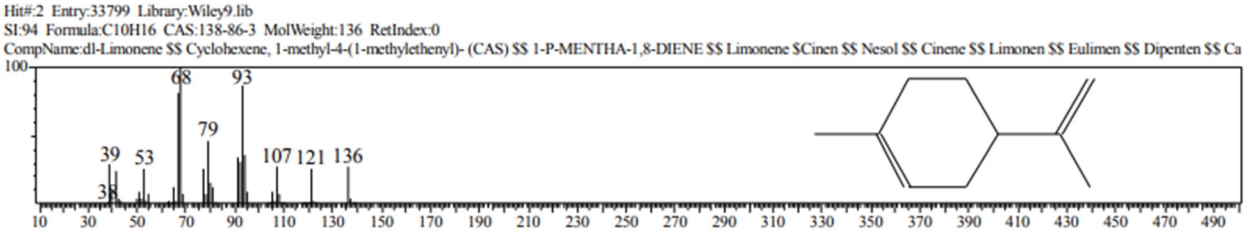

Figure 1. GC-MS peak of dl-Limonene

Candle making

A soy wax base, weighing 30 grams, was used for each aromatherapy candle. The soy wax was placed in a heat-resistant glass container and melted on an electric stove at 80°C, stirring until homogeneous. The wax was then allowed to cool to approximately 55°C. At this temperature, 0.35 mL of 1% essential oil was added to the wax and stirred until fully mixed. The mixture was then poured into a glass candle mold with a 4 cm wick attached. This procedure was repeated for candles containing 2% and 3% essential oil, using 0.71 mL and 1.07 mL of essential oil, respectively.

Candle characteristic testing

The characteristics of the candles were evaluated through several tests: overall appearance, air bubble formation, melting point, and burn time.

Liking test

The liking test evaluated the overall appearance of the candle, its color, the aroma before burning, and the aroma while burning. Thirty untrained respondents completed a subjective questionnaire, rating each aspect on a scale of 1 to 5 (1: dislike, 2: slightly dislike, 3: neutral, 4: like, 5: very like). The aroma preference test was conducted by burning the aromatherapy candle in a closed room, with respondents positioned approximately 60 cm from the candle.

Aroma detection and therapeutic effect test

Further tests were conducted to assess the first-time aroma detection, the time of perceived therapeutic effect detection, and the perceived therapeutic effects.

The first-time aroma detection test recorded the time at which the candle's aroma was first noticed by the respondent, who was positioned approximately 60 cm from the candle in a closed room. Respondents rated the detection time on a scale of 1 (0-60 seconds), 2 (61-120 seconds), 3 (21-180 seconds), 4 (181-240 seconds), 5 (241-300 seconds), and 6 (>300 seconds).

The therapeutic effect detection time test measured the time interval from the initial aroma detection to the moment the respondent perceived a therapeutic effect. This was also conducted with the respondent located approximately 60 cm from the candle in a closed room.

The perceived therapeutic effect test evaluated the respondent's experience after inhaling the candle's aroma. Respondents rated their experience on a scale from 1 to 11: 1 (no effect), 2 (tightness), 3 (dizziness), 4 (slight dizziness), 5 (relaxed), 6 (comfortable), 7 (fresh), 8 (somewhat fresh), 9 (sleepy), 10 (somewhat sleepy), and 11 (calm).

Results

Essential oil evaluation

The yield of calamansi peel essential oil was 1.021% v/b, obtained after a distillation period of 4-5 hours at 85°C. The specific gravity of the essential oil was measured at 0.84. In a solubility test with 96% alcohol, the essential oil formed a clear solution at a ratio of 1:21, indicating that 1 ml of essential oil dissolves in 21 ml of 96% alcohol.

Color evaluation revealed that calamansi peel essential oil has an absorbance value of 0.012b at a wavelength of 516 nm, corresponding to the red color spectrum. GC-MS analysis of the essential oil indicated that the highest concentration compound was dl-Limonene, constituting 29.1% of the oil's composition (Figure 1).

Candle characteristics test

The characteristics of aromatherapy candles made with calamansi peel essential oil were evaluated based on overall wax appearance, air bubble formation, burn time, and melting point.

The overall appearance of candles with 1%, 2%, and 3% essential oil concentrations was consistent across

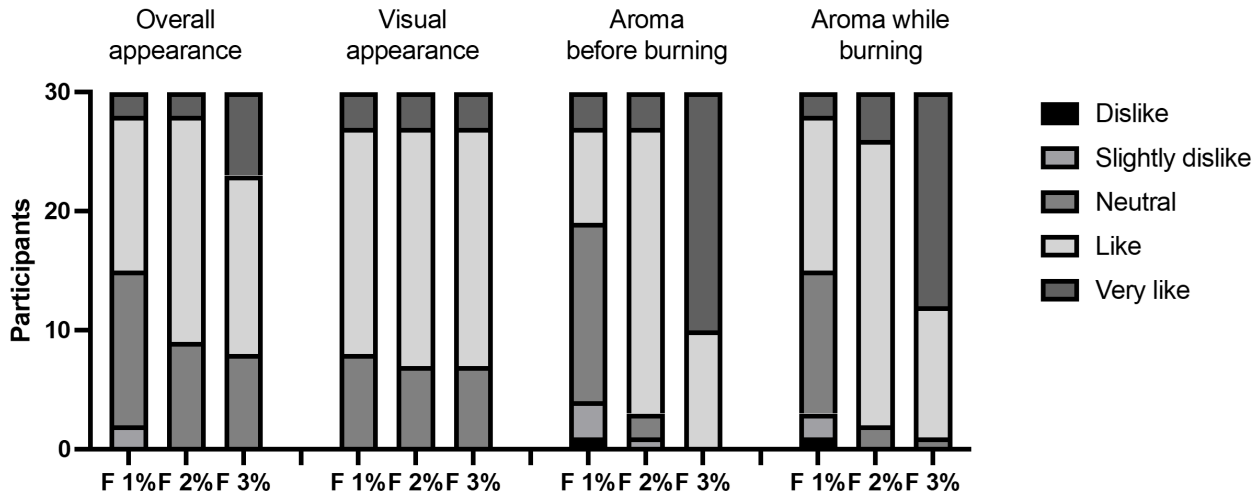

Figure 2. Aromatherapy candle liking

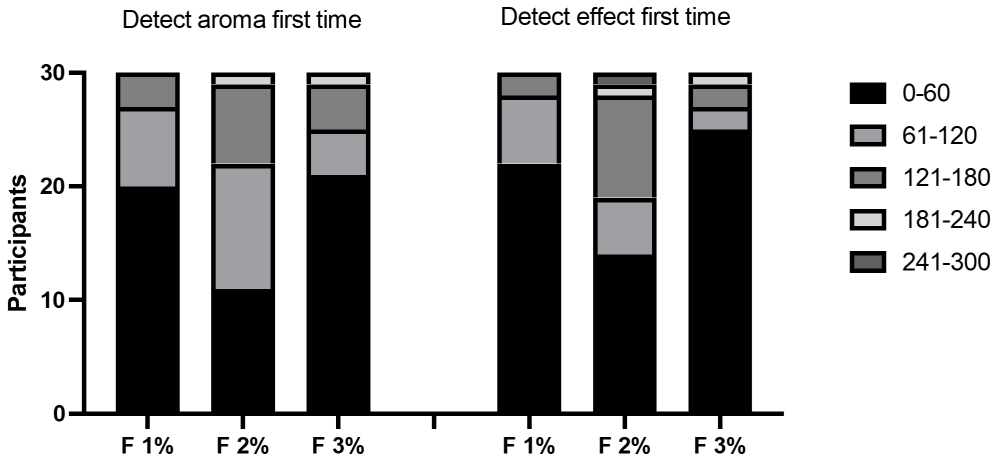

Figure 3. Aroma detection and therapeutic effects

all samples. The candles exhibited uniform color distribution, retained their shape without deformation or breakage, but did show some cracking.

No air bubbles were observed in candles containing 1%, 2%, or 3% essential oil concentrations. Among the samples, the candle with a 3% essential oil concentration had the longest burn time, lasting 8 hours and 19 minutes.

All candle formulations met the Indonesian National Standard (SNI 0386-1989-A/SII 0348-1980) for melting point, which is within the range of 50-58°C. The candle with a 3% essential oil concentration had the fastest melting point, recorded at 51.25°C.

Aromatherapy candle liking test

The overall appearance of the candles was evaluated based on physical attributes such as uniform color, absence of cracks, defects, or breaks. The candle with a 2% essential oil concentration (F 2%) was the most preferred, with 63.3% of respondents indicating a favorable impression. A similar preference was observed in the visual color liking, where 66.7% of respondents favored the candle with a 2% essential oil concentration (Figure 2).

In the aroma preference test before burning, the F 2% candle was liked by 80.0% of respondents, and 10% rating it as "very liked." For aroma during burning, the F 3% candle stood out, with 33% of respondents liking it and 66.7% highly preferring it. When the candles were burned, the F 2% candle was again the most favored, with 80.0% of respondents indicating they liked it and 10% expressing a strong preference. The F 3% candle was liked by 33.3% and highly liked by 60.0% of respondents (Figure 3).

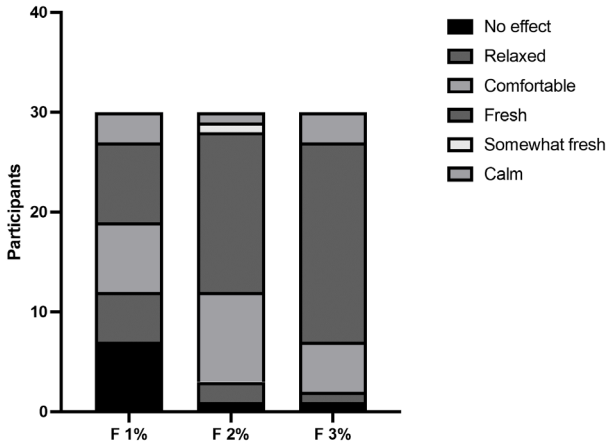

Figure 4. The perceived therapeutic effect

Aroma detection and therapeutic effects test

The aroma detection test revealed that the aroma of the F 3% candle was detected the fastest (within 0-60 seconds) by 70% of respondents. This concentration also provided the quickest perceived therapeutic effect. In terms of delivering a sense of freshness as a therapeutic effect, the F 3% candle was the most effective (Figure 4).

Discussion

The yield of essential oil obtained in this study (1.021%) was lower than that reported in previous research on Pontianak orange peel (*Citrus nobilis* var. Microcarpa), which yielded 1.652% after 7 hours of distillation at 100°C [10]. The specific gravity of the calamansi peel essential oil in this study (0.84) aligns with previous findings for Pontianak orange peel essential oil, which also had a specific gravity of 0.84 [11].

Essential oils exhibit varying solubility in alcohol, depending on their chemical composition and the specific compounds present [11]. While essential oils are typically colorless or yellowish, some may have a reddish hue. In this study, the highest component identified in calamansi peel essential oil was dl-Limonene, which is consistent with its characterization as limonene oil, commonly derived from citrus peels.

The 3% essential oil concentration (F 3%) was the most preferred by respondents and provided the greatest therapeutic effect, particularly in terms of inducing a sense of freshness. This preference can be attributed to the high concentration of dl-Limonene in the calamansi peel essential oil. Dl-Limonene is known for its strong, distinctive citrus aroma, which likely contributed to the positive response from participants [12].

Conclusion

The aromatherapy candles produced in this study met the Indonesian National Standard (SNI) requirements. Among the formulations tested, the candle with a 3% essential oil concentration was the most favored, delivering the desired therapeutic effect. Future research should explore the impact of higher concentrations of calamansi peel essential oil in aromatherapy candles, investigate the use of mixed wax bases such as soy wax and beeswax, and conduct additional tests, including the acid number, ester number, and aroma profile of the essential oil. Additionally, research on alternative extraction methods beyond distillation for essential oil extraction is recommended.

Acknowledgments

We extend our gratitude to everyone who contributed to this research, enabling the results to be documented and shared as a valuable source of information.

Declaration of interest

The authors declare no conflict of interest.

Author contributions

M, AH conceptualized the study design, M investigated the data, M, SRS wrote original draft, AH, MSS reviewed and edited final version, AH supervised all experiments. All authors have read the final manuscript.

Received: October 19, 2022
Revised: February 25, 2023
Accepted: February 25, 2023
Published online: April 23, 2023

References

1. Zuddin, R.R., H. Abadi, T.N. Khairani. Pembuatan dan Uji Hedonik Lilin Aromaterapi dari Minyak Daun Mint (Mentha piperita L.) dan Minyak Rosemary (Rosmarinus officinalis). Jurnal Dunia Farmasi. 2019;3(2):79-90. https://doi.org/10.33085/jdf.v3i2.4479
2. Pertanian.go.id. Jeruk Kunci Tanaman Khas Bangka Belitung Kaya Nutrisi. http://cybex.pertanian.go.id/mobile/

artikel/93516/Jeruk-kunci-tanaman-khas-bangka-belitung-kaya-nutrisi/.2020. Accesed on 18 November 2021(11:04).

3. Roanisca, O., Rani, Mahardika RG. Phytochemical Screening and Antibacterial Potency of Jeruk Kunci Fruit Waste (Citrus x microcarpa Bunge) Extract Against Propionibacterium acnes. J. Pijar MIPA.2021;16(3). 387-392. https://doi.org/10.29303/jpm.v16i3.2587
4. Ali, B., Al-Wabel NA, Shams S, Ahamad A, Khan SA, Anwar F. Essential Oils used in Aromatherapy: A Systemic Review. Asian Pacific Journal of Tropical Biomedicine. 2015;5(8):601-611. https://doi.org/10.1016/j.apjtb.2015.05.007
5. Yoshiko, C, Purwoko Y. Pengaruh Aromaterapi Rosemary terhadap Atensi. Jurnal Kedokteran Diponegoro. 2016;5(4). 619-630.
6. Yuliani S., Satuhu S. Panduan Lengkap Minyak Atsiri. Swadaya. 2012: Jakarta.
7. Wahyudi., Tri N, Ilham FF, Kurniawan I, Sanjaya AS. Rancangan Alat Distilasi untuk Menghasilkan Kondensat dengan Metode Distilasi Satu Tingkat. Jurnal Chemurgy. 2017;01(2):30-33. https://doi.org/10.30872/cmg.v1i2.1142
8. Surendran AN, Ajjarapu KPA, Arumugham AA, Kate K, Satyavolu J. Characterization of industry grade soybean wax for potential applications in natural fiber reinforced composite (NFRC) filaments, Industrial Crops and Products. 2022;186. https://doi.org/10.1016/j.indcrop.2022.115163
9. Husni E, Yeni F, Dachriyanus. Chemical contents profile of essential oil from calamansi (Citrus microcarpa Bunge) peels and leaves and its antibacterial activities. Advances in Health Sciences Research, volume 40.
10. Hidayati. Distilasi Minyak Atsiri dari Kulit Jeruk Pontianak dan Pemanfaatannya dalam Pembuatan Sabun Aromaterapi. Biopropal Industri. 2012; 3(2):39-49.
11. Tutuarima, T., Handayani D, Hidayat L, Atria P. Pengaruh Fermentasi Alami Limbah Industri Kalamansi terhadap Peningkatan Rendemen dan Mutu Atsiri. Agritepa. 2020; 7(2):80-87. https://doi.org/10.37676/agritepa.v7i2.1170
12. Fahlbusch., K. Georg, H.F. Josef, P. Johannes, P. Wilhelm, S. Dietmar, B. Kurt, G. Dorothea, dan S. Horst. Flavor and Fragrances. Ullmann's Encyclopedia of Industrial. 2003. https://doi.org/10.1002/14356007.a11_141