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Formulation and physical quality evaluation of aromatherapy oil combining patchouli (*Pogostemon cablin* Benth.) and peppermint (*Mentha piperita* L.) essential oils

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ABSTRACT

Background: Indonesia is a major producer of essential oils, with patchouli and peppermint oils being widely used in aromatherapy. Aromatherapy products, such as wind oil, provide therapeutic benefits but are often underused by younger consumers. Developing formulations that appeal to a broader audience may increase their use.

Objective: This study aimed to formulate an aromatherapy oil using patchouli and peppermint essential oils, evaluate its physical properties, and test consumer preferences.

Method: Four formulations (F1–F4) were prepared with varying concentrations of patchouli and peppermint oils. Physical tests, including organoleptic, homogeneity, clarity, pH, and spreadability, were conducted over four weeks. A hedonic test with 20 respondents assessed sensory preferences.

Results: Formulations remained stable in terms of homogeneity and clarity throughout the study. pH values were within the acceptable range for skin application, though they increased slightly during storage. Spreadability improved over time, with F2, F3, and F4 meeting the ideal range by the fourth week. F4, containing 6% patchouli and 15% peppermint oils, was the most preferred in the hedonic test, particularly for color, smell, and clarity.

Conclusion: Patchouli and peppermint essential oils can be effectively combined to create a stable, consumer-preferred aromatherapy oil. F4 showed the best physical and sensory qualities, making it a promising formulation for future development.

Keywords: aromatherapy oil, patchouli leaves, peppermint leaves, physical quality test

Introduction

Indonesia, as a leading agricultural country, is rich in biological and natural resources, including a wide variety of essential oil-producing plants. Of the approximately 80 types of essential oils traded globally, Indonesia is responsible for producing 40–50 varieties [1]. Essential oils are derived from various plant parts, including fruits, flowers, leaves, stems, and roots, through processes such as steam distillation [2]. These oils, known for their volatility at room temperature without decomposition, have characteristic aromas, pungent tastes, and are soluble in organic solvents but insoluble in water [3].

Aromatherapy, an alternative treatment method that uses essential oils, has gained popularity for its calming, refreshing effects and its ability to promote physical and emotional well-being. Aromatherapy products are available in many forms, including perfumes, oils, and candles [4]. One such product is aromatherapy oil, a formulation traditionally used to alleviate symptoms such as bloating, nausea, and dizziness, while also promoting relaxation [5]. Despite its benefits, aromatherapy oil is often associated with

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Table 1. Aromatherapy oil formulations [13]

Material	Formulation				Standard formula requirement (%)	Function	Reference
	F1 (%)	F2 (%)	F3 (%)	F4 (%)			
Patchouli leaf essential oil	-	2	4	6	2 – 6	Active substance	[14]
Peppermint leaf essential oil	-	5	10	15	5 – 20	Active substance	[15]
Champora	3	3	3	3	3 – 11	Warmer	[16]
Methyl salicylate	5	5	5	5	1 – 20	Warmer	[17]
Alpha-tocopherol	0.05	0.05	0.05	0.05	0.001 – 0.05	Antioxidant	[18]
VCO	Ad 100%	Ad 100%	Ad 100%	Ad 100%	-	Oil base	-

older generations, leading to its decline in popularity among younger people [6].

When inhaled, the molecules of essential oils are transformed into electrical impulses by the olfactory cilia, which then transmit signals to the brain's limbic system—an area responsible for regulating emotions and sensory processing—ultimately influencing mood [7]. Two natural ingredients commonly used in aromatherapy oil are patchouli leaves (*Pogostemon cablin* Benth.) and peppermint leaves (*Mentha piperita* L.), both of which contain essential oils with relaxing properties [8].

Patchouli oil, extracted from the leaves of the patchouli plant, is highly valued for its quality and Indonesia's dominance in the global market, controlling 80–90% of the supply [9]. This oil is widely used in cosmetics, perfumes, and antiseptic products [10]. Similarly, peppermint oil, derived from peppermint leaves, is a versatile ingredient used in medicine, food products, and cosmetics [11].

This research aims to formulate an aromatherapy oil by combining patchouli and peppermint oils. The study seeks to contribute valuable insights into the formulation process and the evaluation of the product's physical quality.

Methods

Ingredients

The ingredients used in this study included patchouli leaf essential oil (Darjeeling), peppermint leaf essential oil (Darjeeling), camphor, methyl salicylate, alpha-tocopherol (Natur-E), and virgin coconut oil (VCO).

Preparation of aromatherapy oil

Prior to packaging, the bottles were calibrated to ensure accuracy. The ingredients were then individually weighed. First, the camphor was placed in a mortar and ground into a fine powder, which was transferred to an Erlenmeyer flask. Methyl salicylate was added to the flask and mixed thoroughly until completely dissolved. Alpha-tocopherol was then gradually incorporated. Afterward, the essential oils were added according to the specified concentrations for each formula: F1, F2, F3, and F4. Finally, VCO was added until the mixture reached the designated volume. Once the preparation was complete, the liquid was transferred into calibrated oil bottles [13]. Table 1 outlines the formulations of the aromatherapy oil.

Physical evaluations

The following physical quality tests were conducted on the prepared aromatherapy oils:

Organoleptic test. Visual organoleptic testing involved observing the color, odor, and physical appearance of the formulations [12].

Homogeneity test. Homogeneity testing was performed over a four-week period to assess whether the patchouli and peppermint essential oils were evenly distributed in the formulations, with no visible separation of active ingredients [12].

Clarity test. The clarity of the aromatherapy oil was evaluated by placing the roll-on bottles under direct sunlight or artificial light to detect any cloudiness or suspended particles [12].

pH test. The acidity of the formulations was measured using a calibrated pH meter. The meter was calibrated with standard buffer solutions of pH 4 and pH 7. The pH of the samples was determined by immersing the electrode, previously rinsed with distilled water, into the aromatherapy oil, and the pH value was displayed on the meter screen [12].

Table 2. Organoleptic test results for aromatherapy oil preparations

Observation (week)	Formulation	Organoleptic parameters		
		Color	Odor	Form
1	*F1*	Clear	Typical methyl salicylate	Liquid
	F2	Turbid, slightly yellow	Mild mint scent	Liquid
	F3	Slightly yellow	Typical mint	Liquid
	F4	Deep yellow	Typical mint	Liquid
2	F1	Clear	Typical methyl salicylate	Liquid
	F2	Turbid, slightly yellow	Mild mint scent	Liquid
	F3	Slightly yellow	Typical mint	Liquid
	F4	Deep yellow	Typical mint	Liquid
3	F1	Clear, slightly cloudy	Combination of methyl salicylate and VCO	Liquid
	F2	Turbid, slightly yellow	Mild mint scent	Liquid
	F3	Slightly yellow	Mild mint scent	Liquid
	F4	Golden yellow	Strong mint scent	Liquid
4	F1	Clear, slightly cloudy	Combination of methyl salicylate and VCO	Liquid
	F2	Turbid, slightly yellow	Mild mint scent	Liquid
	F3	Slightly yellow	Mild mint scent	Liquid
	F4	Golden yellow	Strong mint scent	Liquid

Spreadability test. To evaluate spreadability, approximately 0.20 grams of the aromatherapy oil was placed at the center of a glass plate. A second glass plate of known weight was placed on top for one minute, after which the diameter of the spread was measured. The weight was progressively increased by 50 grams each minute, up to 250 grams, for five minutes. The spread's diameter was measured using a ruler [12].

Hedonic test. A hedonic test was conducted with 20 randomly selected respondents who completed a questionnaire regarding the sensory properties of the final formulations. Responses were recorded on a 5-point Likert scale, ranging from 1 (strongly dislike) to 5 (strongly like) [12].

All was carried out in 3 replications.

Aromatherapy oil was prepared in 10 ml/bottles

- F1: Aromatherapy oil formulation without patchouli and peppermint essential oils
- F2: Patchouli and peppermint essential oils in a ratio of 2:5 (0.2 mL: 0.5 mL)
- F3: Patchouli and peppermint essential oils in a ratio of 4:10 (0.4 mL: 1 mL)
- F4: Patchouli and peppermint essential oils in a ratio of 6:15 (0.6 mL: 1.5 mL)

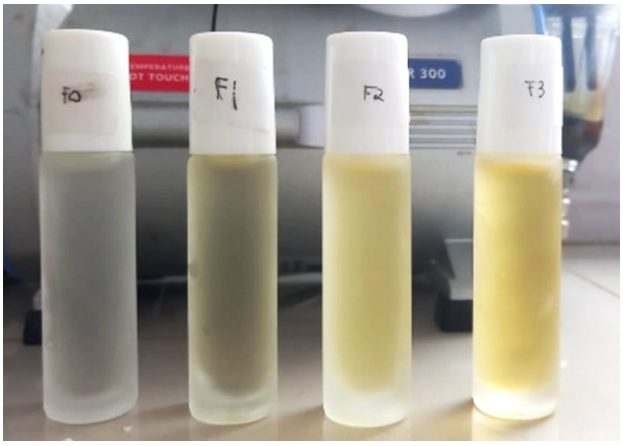

Figure 1. Appearance of manufacturing aromatherapy oil

Results

Organoleptic test

The organoleptic test assessed the sensory attributes of the aromatherapy oil formulations, including color, odor, and form. These characteristics are crucial in evaluating product quality and consumer acceptance. As the concentration of essential oils increased, the formulations became more concentrated, particularly in terms of odor and color intensity (Figure 1). The results for each formulation are shown in Table 2.

Table 3. Homogeneity test results for aromatherapy oil preparations

Formulation	Homogeneity (observation week)			
	1	2	3	4
F1	Homogeneous	Homogeneous	Homogeneous	Homogeneous
F2	Homogeneous	Homogeneous	Homogeneous	Homogeneous
F3	Homogeneous	Homogeneous	Homogeneous	Homogeneous
F4	Homogeneous	Homogeneous	Homogeneous	Homogeneous

Table 4. Clarity test results of aromatherapy oil preparations

Formulation	Clarity (observation week)			
	1	2	3	4
F1	Clear	Clear	Clear	Clear
F2	Clear	Clear	Clear	Clear
F3	Clear	Clear	Clear	Clear
F4	Clear	Clear	Clear	Clear

Table 5. pH test results for aromatherapy oil preparations

Formulation	Mean pH test result ± SD (observation week)			
	1	2	3	4
F1	6.6 ± 0.3	6.7 ± 0.2	7.0 ± 0.2	6.9 ± 0.2
F2	5.6 ± 0.3	5.7 ± 0.7	6.6 ± 0.1	6.3 ± 0.4
F3	4.9 ± 0.4	5.3 ± 0.8	6.4 ± 0.5	6.1 ± 0.1
F4	4.3 ± 0.2	4.4 ± 0.3	5.9 ± 0.1	6.0 ± 0.1

Homogeneity test

The homogeneity test evaluated the even distribution of active and additional ingredients in the formulations. All formulations were homogeneous, with no visible separation or particles observed throughout the four-week period, indicating consistent mixing. The results are presented in Table 3.

Clarity test

The clarity test assessed the transparency of the formulations. All formulations remained clear throughout the observation period, with no suspended particles or cloudiness detected. The results are shown in Table 4.

pH test

The pH test evaluated the acidity of the aromatherapy oils to ensure skin compatibility. Each formulation exhibited slight variations in pH over time, with F1 showing the most stable pH values and F4 showing the greatest variation. The average pH test results are shown in Table 5.

Spreadability test

The spreadability test measured how well the formulations spread when applied to the skin. Formulations containing higher concentrations of essential oils (F2, F3, and F4) demonstrated greater spreadability compared to F1. The results are summarized in Table 6.

Hedonic test

The hedonic test assessed the sensory preferences of 20 respondents for each formulation, including color, smell, and clarity. F4 consistently received the highest ratings for odor and color, likely due to its higher concentration of essential oils. The results are presented in Table 7.

Discussion

The organoleptic test results showed stability in color, odor, and form for all formulations during the first two weeks of observation. However, changes were observed in the third and fourth weeks, likely due

Table 6. Spreadability test result of aromatherapy oil preparations

Formulation	Average spreadability ± SD (week)			
	1	2	3	4
F1	2,6 cm ± 0,5	3,0 cm ± 0,3	2,7 cm ± 0,2	4,7 cm ± 1,1
F2	4,1 cm ± 0,3	3,1 cm ± 0,2	4,4 cm ± 0,3	5,1 cm ± 0,5
F3	3,9 cm ± 0,6	3,5 cm ± 0,3	4,5 cm ± 0,2	5,0 cm ± 0,8
F4	4,0 cm ± 0,3	3,4 cm ± 0,2	4,3 cm ± 0,5	5,3 cm ± 0,5

Table 7. Hedonic test results data for aromatherapy oil preparations

Hedonic Test Parameters	Average hedonic score ± SD (formulation)			
	F1	F2	F3	F4
Color	3,6 ± 0,7	3,8 ± 0,8	3,9 ± 1,0	4,1 ± 1,0
Smell	3,4 ± 0,8	3,7 ± 0,7	3,7 ± 0,9	4,5 ± 0,6
Clarity	4,0 ± 0,8	3,8 ± 0,8	3,6 ± 0,9	4,0 ± 0,9

to factors such as temperature fluctuations, storage conditions, and variations in essential oil concentration. These factors can significantly affect the color stability of aromatherapy oils, as supported by [19], which found that higher concentrations of essential oils tend to intensify the yellow hue of formulations [20].

The homogeneity test demonstrated that all formulations remained homogenous throughout the four-week observation period, with no visible particles or coarse grains, indicating consistent mixing of the ingredients. This aligns with previous findings by [21] and [22], which emphasize that a well-formulated aromatherapy product should exhibit uniform distribution without visible separation.

Clarity testing confirmed that all formulations were clear and free from floating particles, a key indicator of proper ingredient mixing and product suitability for skin application. This finding is consistent with research by [23] and [24], which emphasizes the importance of clarity and even distribution in topical formulations to ensure product quality and consumer satisfaction.

The pH test results indicated that the formulations maintained pH values within the range of 4.3 to 7.0 over the four-week period. While the pH of the formulations increased slightly during storage, it remained within the acceptable range for topical applications (4.2–6.5), as reported by [25]. According to [26], pH changes during storage may indicate some level of formulation instability, though the observed changes in this study were minimal and did not affect the suitability of the product for skin use.

The spreadability test revealed that during the first three weeks, none of the formulations met the ideal spreadability range of 5–7 cm. However, by the fourth week, F2, F3, and F4 exhibited improved spreadability, meeting the desired range. Spreadability is influenced by the viscosity of the formulation, as higher viscosity can hinder the product's ability to spread evenly on the skin. This aligns with research by [27], which suggests that an increase in viscosity reduces spreadability. The improvement in spreadability over time could be attributed to changes in the formulation's physical properties during storage [28].

The hedonic test results highlighted F4 as the most preferred formulation in terms of color, smell, and clarity. F4's higher concentration of patchouli and peppermint oils contributed to its sensory appeal, consistent with findings from [12], which suggest that consumer preference tends to increase with higher concentrations of essential oils.

Conclusions

This study demonstrates that aromatherapy oil formulations can be successfully prepared using a combination of patchouli and peppermint essential oils, with varying concentrations affecting the physical properties of the formulations. Among the tested formulas, F4, containing 6% patchouli oil and 15% peppermint oil, exhibited the best overall physical quality, including optimal clarity, spreadability, and sensory characteristics.

Further research is recommended to explore the manufacturing process and quality testing of aromatherapy oils with higher concentrations of

patchouli and peppermint oils, to optimize their therapeutic and sensory properties for commercial applications.

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Conflict of interest

The authors declare no conflict of interest.

Author contributions

HW: conceptualization, methodology, data curation, validation, writing – original draft; HH: formal analysis, writing – review & editing; IY: formal analysis, writing – review & editing.

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References

1. Setyowati E, Irzani EF, Luthfi CFM (2024) Tracing The Antibacterial, Antifungal and Anti-Biofilm Activities of Root Extract Bajakah Tampala (Spatholobus littoralis Hassk). JFSP 10(1): 32-41. https://doi.org/10.31603/pharmacy.v10i1.8804
2. Hilmarni H, Fauzana S, Ranova R (2021) Formulasi Sediaan Lilin Aromaterapi dari Ekstrak Kecombrang (Etlingera elatior), Sereh Wangi (Cymbopogon nardus L.), dan Cengkeh (Syzygium aromaticum). JOPS 4(2): 29-36. https://doi.org/10.36341/jops.v4i2.1877
3. Hamzah H, Tunjung Pratiwi SU, Hertiani T (2018) Efficacy of Thymol and Eugenol Against Polymicrobial Biofilm. Indonesian J Pharm 29(4): 214-221. https://doi.org/10.14499/indonesianjpharm29iss4pp214
4. Yuliana DA, Nurhidayati S, Aswan A, Febriana I (2020) Proses Pengambilan Minyak Atsiri Dari Tanaman Nilam (Pogestemon cablin Benth) Menggunakan Metode Microwave Hydodistillation. J Kinetika 11(03): 34-9.
5. Pratiwi F, Subarnas A (2020) Rewiew Artikel : Aromaterapi Sebagai Media Relaksasi. FARMAKA 18(3): 66-75.
6. Wijianto B, Hamzah H, Nurhidayah AL, Kemuning GI, Dyas RAA (2022) Characterization of Onchidiid Slug (Onchidium typhae) West Kalimantan Waters as Antibacterials and Antifungal. Borneo J Pharm 5(1): 35-41. https://doi.org/10.33084/bjop.v5i1.2936
7. Suhery WN, Wijayaningsih D, Yenny RF (2022) Formulasi Minyak Angin Aromaterapi Minyak Jeruk Kasturi (Citrofortunella microcarpa). J Penelitian Farmasi Indo 11(1): 28-31. https://doi.org/10.51887/jpfi.v11i1.1744
8. Herawaty N (2021) Formulasi Dan Uji Sifat Fisik Lilin Aromaterapi Kombinasi Minyak Atsiri Daun Kemangi (Ocimum sanctum L) Dan Sereh (Cymbopogon citratus). Politeknik Harapan Bersama.
9. Fahrul AFL, Mochtar CF, Sulistia DI, Kumara SA, Tasya SC, Hamzah H, et al (2022) Potensi Jamu Sebagai Obat Herbal Asli Indonesia Untuk Meningkatkan Daya Tahan Tubuh. J Pengab Kepada Masyarakat 3(4): 716-723.
10. Putri AS, Zamrudy W (2021) Studi Literatur Isolasi Minyak Nilam (Pogostemon cablin Benth.) Dari Beberapa Metode Distilasi. J Tek Separasi 7(2): 552-560. https://doi.org/10.33795/distilat.v7i2.285
11. Sernita, Nurhadia, Seripaica (2018) Uji Daya Hambat Ekstrak Daun Nilam (Pogostemon cablin Benth.) Terhadap Pertumbuhan Bakteri Escherichia coli. JAKK 3(1): 86-92. https://doi.org/10.46356/jakk.v3i2.109
12. Handayani T (2020) Pemanfaatan Mentha Piperita Pada Pembuatan Sabun Menggunakan Metode Cold Process. MENARA Ilmu 14(1): 130-136.
13. Fatmawati A, Zuliyati IC, Mulianingsih S (2022) Formulasi Dan Evaluasi Sediaan Aromaterapi Blended Peppermint, Lavender Dan Lemon Sebagai Antiemetika. INPHARNMED 5(2):8-16. https://doi.org/10.21927/inpharnmed.v5i2.1904
14. Febriyenti F, Putri RF, Suharti N (2019) Formulation and evaluation of patchouli oil gel for burn wound. J Sains Farm Klin 6(3): 191-194. https://doi.org/10.25077/jsfk.6.3.191-194.2019
15. Alankar S (2009) A Review On Peppermint Oil. Asian J of Pharma and Clin Research 2(2): 27-33.
16. Hamidpour R, Hamidpour S, Hamidpour M, Shahlari M (2013) Camphor (Cinnamomum camphora), a traditional remedy with the history of treating several diseases. IJCRI 4(2): 86-89. https://doi.org/10.5348/ijcri-2013-02-267-RA-1
17. European Commission. Directorate General for Health and Food Safety. Opinion on methyl salicylate (methyl 2-hydroxybenzoate. [Internet]. LU: Publications Office; 2022 [cited 2023 Nov 4]. Available from: https://data.europa.eu/doi/10.2875/47640
18. Rowe RC, Sheskey PJ, Quinn ME (2009) Handbook of pharmaceutical excipients. 6th ed. London: Pharmaceutical press. ISBN: 978-0-85369-792-3.
19. Mochtar CF, Devi RS, Hamzah H, Faradillah A, Hafidzah E, Varizza FP, et al (2023) In-Vivo Anti-Inflammatory Activity of Kelubut Leaf Ethyl Acetate Extract (Passiflora foetida L.) from Samarinda City. JFAPS 4(1): 15-22. https://doi.org/10.18196/jfaps.v4i1.18287
20. Fardan I, Harimurti S (2018) Formulasi Sediaan Gel Minyak Atsiri Daun Cengkeh ((Syzygium aromaticum (L.) Merr. & L.M.Perry) Sebagai Antiseptik Tangan dan Uji Daya Hambat Terhadap Bakteri Staphylococcus aureus. Pharm : j farm Indones 15(02): 218-230. https://doi.org/10.30595/pharmacy.v15i2.3001

21. Mochtar CF, Aisyiyah NM, Husna QA, Hamzah H, Bakhtiar MI, Devi RS, et al (2023) Antipyretic And Antiinflammatory Activities Of Bopot Leaf Extract From Kutai Kartanegara District. IJPST 1(1): 80-89. https://doi.org/10.24198/ijpst.v0i0.46188
22. Lumentut N, Edy HJ, Rumondor EM, Farmasi P (2020) Formulasi dan Uji Stabilitas Fisik Sediaan Krim Ekstrak Etanol Kulit Buah Pisang Goroho (Musa acuminafe L.) Konsentrasi 12.5% Sebagai Tabir Surya. Jurnal MIPA 9(2): 42-46. https://doi.org/10.35799/jmuo.9.2.2020.28248
23. Hamzah H, Nuryastuti T, Rahmah W, Chabib L, Syamsul ES, Lestari D, et al (2023) Molecular Docking Study of the C-10 Massoia Lactone Compound as an Antimicrobial and Antibiofilm Agent against Candida tropicalis. The Scientific World Journal 2023: 1-10. https://doi.org/10.1155/2023/6697124
24. Nuzzaibah H, Ermawati N (2023) Formulasi Dan Evaluasi Sediaan Sirup Antipiretik Ekstrak Daun Jeruk Nipis (Citrus aurantifolia L.). J Med Nusantara 1(2): 25-39. https://doi.org/10.59680/medika.v1i2.272
25. Pratasik MCM, Yamlean PVY, Wiyono WI (2019) Formulasi dan Uji Stabilitas Fisik Sediaan Krim Ekstrak Etanol Daun Sesewanua (Clerodendron squamatum Vahl.). PHA 8(2): 261-267. https://doi.org/10.35799/pha.8.2019.29289
26. Dewi DRN, Zakkia LU, Khoiruddin W (2018) Pengaruh pH Terhadap Lamanya Penyimpanan Sediaan Ekstrak Daun Seligi dan Eugenol Dari Minyak Daun Cengkeh Sebagai Obat Antinyeri. Prosiding SNST 9: 97-100.
27. Budianor B, Malahayati S, Saputri R (2022) Formulasi dan Uji Stabilitas Sediaan Krim Ekstrak Bunga Melati Putih (Jasminum sambac L.) Sebagai Anti Jerawat. JPCS 3(1): 1-13. https://doi.org/10.33859/jpcs.v3i1.204
28. Hamzah H, Rasdianah N, Nurwijayanto A, Nandini E (2021) Aktivitas Ekstrak Etanol Daun Calincing terhadap Biofilm Candida Albicans. J Farmasetis 10(1): 21-28. https://doi.org/10.32583/farmasetis.v10i1.1319