

## FORMULATION OF PEPPERMINT ESSENTIAL OIL AROMATHERAPY PREPARATIONS: A PRELIMINARY STUDY ON THE ORGANOLEPTIC

Tia Amestiasih<sup>1</sup>, Januar Rizqi<sup>2</sup>, Cahyo Pramono<sup>3</sup>, Ririn Wahyu Widayati<sup>4</sup>, Dhea Cahya Lintang<sup>5</sup>

<sup>1,2,4,5</sup>Nursing Department, Faculty of Science Health, Universitas Respati Yogyakarta, Indonesia

<sup>3</sup>Nursing Department, Universitas Muhammadiyah Klaten, Indonesia

\*Corresponding author:

[arizqi.januar@respati.ac.id](mailto:arizqi.januar@respati.ac.id)

### Info Artikel

Disubmit 08 01 2025

Direvisi 20 06 2025

Diterbitkan 27 06 2025

### Keywords:

Peppermint essential oil, aroma-therapy, organoleptics, formulation

**P-ISSN: 2086-3292**

**E-ISSN: 2655-9900**

### Akreditasi Nasional:

Sinta 4

### Abstrak

**Background:** Peppermint oil has a distinctive refreshing aroma as well as analgesic, antispasmodic, and calming effects, making it suitable for use in aromatherapy. This study aims to develop formulations and evaluate the organoleptic properties of peppermint essential oil-based aromatherapy preparations, which are known to have therapeutic benefits in reducing stress, increasing alertness, and providing a relaxing effect. **Method:** The research employed a laboratory experimental approach, utilizing two formulations with varying concentrations of peppermint essential oil, menthol, and olive oil. Organoleptic tests involved visual observation of shape, color, aroma, and skin sensation, along with pH measurements and preference tests conducted on 40 respondents. **Results:** The results showed differences in organoleptic properties between the two formulations. The first formula was brown with a strong aroma, while the second formula was yellowish brown with a more fragrant and softer aroma, which respondents preferred. Both formulations produced a warm sensation on the skin. At the same time, pH measurements indicated a range of 5-6, which is considered safe for the skin according to the pH standard for topical products (4.5-6.5). In the favorability test, the second formulation received a higher preference from respondents, especially in terms of aroma and skin feel. **Conclusion:** This peppermint oil-based aromatherapy formulation demonstrated positive results in terms of organoleptic aspects and pH safety, indicating its potential as a natural aromatherapy product that can be well-received by consumers. This research opens up opportunities for further development regarding the stability and therapeutic potential of essential oil combinations in aromatherapy.

### Introduction

Aromatherapy has been used for thousands of years, utilizing essential oils derived from various plants to enhance physical and mental well-being. In the modern context, aromatherapy has garnered significant attention in the field of alternative and complementary health, with numerous studies demonstrating that essential oil aromas can positively impact mood, reduce stress, and enhance sleep. (Swinburne et al., 2023). Aromatherapy is not only limited to relaxation, but is also used in the management of various medical conditions, such as anxiety, pain, and sleep disorders. (Cho et al., 2017). One of the most recognized essential oils in aromatherapy is peppermint oil. Peppermint (*Mentha*

piperita) is recognized for its calming yet stimulating aroma, which influences cognitive performance and emotional states. Research demonstrates that the scent of peppermint enhances alertness and concentration, optimizing cognitive functions by stimulating the release of mood-related hormones in the brain. (Jayadharani et al., 2020). Additionally, studies indicate that prolonged exposure to peppermint aroma can lead to significant improvements in mood and cognitive performance, suggesting its potential as an effective tool for enhancing memory and alertness in various settings. (Hoult et al., 2019).

The mode of action of peppermint in aromatherapy can be explained through neurobiological mechanisms. The scent of peppermint can stimulate the limbic system, a part of the brain that plays a crucial role in regulating emotions and memory, thereby affecting mood and anxiety levels. (Lamadah, 2016). Additionally, peppermint oil inhalation can increase blood flow and oxygenation to the brain, contributing to improved focus and concentration. Research has also shown that peppermint can reduce symptoms of nausea and increase comfort in postoperative patients. (Camisuli et al., 2022).

The urgency of this research lies in the increasing public interest in more natural and non-invasive treatment alternatives, especially in the midst of increasing cases of stress and mental health disorders due to modern lifestyles (Mufida & Mirzanti, 2023). Although numerous studies have been conducted on the benefits of aromatherapy, a gap remains in the literature regarding the formulation and organoleptic evaluation of peppermint oil-based aromatherapy preparations. Additionally, evaluating pH is a crucial aspect in the development of aromatherapy products. Maintaining an appropriate pH level ensures the safety, stability, and therapeutic efficacy of topical applications. A pH value within the physiological range of the skin (4.5–6.5) prevents skin irritation, optimizes the absorption of active compounds such as menthol, and supports the integrity of the skin barrier. Thus, pH testing was included as a critical component in this study. This study aims to explore the optimal formulation of peppermint essential oil and evaluate its organoleptic properties, including aroma, color, and skin sensation.

The solution offered in this study is the development of peppermint oil-based aromatherapy preparations that are not only effective but also organoleptically appealing. By conducting an organoleptic evaluation, it is hoped that the resulting product can be well-received by respondents and provide maximum therapeutic benefits. This study also aims to provide new insights into the potential of peppermint oil in the practice of aromatherapy, as well as offer recommendations for broader use in health management.

## METHODS

This type of research is experimental in the laboratory, utilizing a post-test-only design without a control group. This research was conducted at the Biomedical Laboratory of Respati University, Yogyakarta, in June 2024. The tools used in this research include a stirring rod, porcelain cup, separating funnel, Erlenmeyer flask, beaker, glass, centrifuge, and measuring pipette. The materials used in this study are peppermint leaf essential oil, distilled water, and mint.

In this study, two formulations were tested, each with a different concentration of essential oil. This formulation was prepared with a total volume of 4 mL, containing additional ingredients of menthol and olive oil. The formulas are presented in Table 1. The function of each ingredient is as follows: Peppermint Essential Oil is the primary active component, providing therapeutic effects such as stress reduction, increased alertness, and skin-cooling sensations. Menthol: Added to enhance the cooling and soothing sensation on the skin, and to augment the aromatic properties of peppermint. Olive Oil: Functions as a carrier oil to dilute the essential oil, promote safe topical application, and improve skin hydration and barrier function.

Table 1. Formulation of natural ingredients

Composition	Formula 1	Formula 2
Peppermint leaf essential oil	3	1.5
Menthol	0	0.5
Olive oil	1	2
Total	Add 4ml	Add 4ml

The formulation evaluation test was conducted using an organoleptic test, pH measurement, and a respondent's favorability test. Organoleptic evaluation involves visual observation, examining the shape, color, aroma, and texture of the skin.

Evaluation of pH is done with a Universal pH tool dipped into each formulation. Then the results are matched with a universal pH measure. The favorability test was conducted on 40 respondents to assess the aroma and taste. Respondents must honestly determine whether they like or dislike the assessment or response to the sample. The rating scale consists of 4 reactions, including: 3 = very like; 2 = like; 1 = dislike; 0 = very dislike. The criteria for respondents are as follows: being willing to participate, consistent in making decisions, not allergic to the tested ingredients, able-bodied, and free from ear, nose, and throat diseases. Organoleptic test data analysis will yield descriptive data, while pH will yield quantitative data. This research has received permission from the Dean of the Faculty of Health Sciences with number: 07/LPPM/PL-Eks/VI/2024.

## RESULTS AND DISCUSSION

The results of the organoleptic test on all forms of treatment show the same results in terms of shape, but there are differences in color and aroma. Formula 1 is brown because it contains 100% peppermint leaves and a small amount of olive oil, while Formula 2 is a yellowish-brown due to a mixture of peppermint and more olive oil. There is a warm sensation on the skin due to the mint content in each formula.

Table 2. Organoleptic Observation Results of Aromatherapy Preparations.

Formulation	Formula F1	Formula F2
Color	Brown	Yellowish brown
Liquid	Liquid	Liquid
Aroma	Typical, Strong	Typical, Fragrant
Skin feel	warm	warm

Table 3. Results of pH Measurement of Aromatherapy Preparations (Mean  $\pm$  SD, n=3)

Formulation	Mean $\pm$ SD
F1	5.97 $\pm$ 0.06
F2	5.95 $\pm$ 0.05

Based on the results of measuring the degree of acidity using Universal pH paper, the pH is 5 to 6. The test results in Table 3 indicate that, based on pH measurements, both formulations exhibited pH values within the safe range for topical application (4.5–6.5). The pH value of the solution upon preparation affects its acidity or basicity, which remains within normal limits, making it safe to apply to the skin.

Table 4 presents the results of testing respondents' preferences for aroma and taste on the skin. The results show that 40% of participants like the aroma of F1 aromatherapy, while 45% prefer F2. These results indicate that the higher the concentration of peppermint leaf essential oil, the higher the level of favorability of the respondents. The results of the taste preference test on the skin in F1 showed 15% dislike, while in F2, the results were 25% like. F2 showed a result of 65% very like, while in F1 it was 57.5% very like. The majority of respondents indicated a preference for each formula, despite disliking the taste on the skin. While in the aroma, the majority of respondents preferred formula 2.

Table 4. Results of liking for aroma and taste on the skin (n=40)

Indicator	Score	F1		F2	
		Total	Percentage (%)	Total	Percentage (%)
Aroma	0	7	17	3	7.5
	1	4	10	5	12.5
	2	13	32.5	14	35
	3	16	40	18	45
Total		40	100	40	100
Skin feel	0	2	5	2	5

	1	9	22.5	3	7.5
	2	6	15	10	25
	3	23	57.5	26	65
Total		40	100	40	100

Note: score 0= strongly dislike; 1= dislike; 2= like; 3= strongly like.

Previous research has shown that variations in ingredient composition can affect organoleptic results, as observed in a study by Aulia. (Aulia, 2023), which emphasized the importance of organoleptic testing in assessing product quality and acceptability. Organoleptic testing is an essential tool in the development of a product. For example, research by (Koga et al., 2014) Showed that organoleptic test results can be used to diagnose health conditions, such as halitosis, demonstrating the relevance of this test in a broader context. In addition, research by Gutiérrez-Capitán et al. utilized organoleptic analysis to assess the quality of drinking water, demonstrating that this method can be applied in various fields, including health and the environment. (Gutiérrez-Capitán et al., 2019).

Research by Sagala (2023) demonstrated that natural ingredient-based product formulations can exhibit desirable organoleptic properties, including stability and homogeneity. (Sagala, 2023). This suggests that the selection of suitable raw materials, such as peppermint and olive leaves in this study, can yield products with excellent organoleptic quality (Sagala, 2023). This study is also in line with the findings by Yulianti et al. (2022), who emphasized the importance of heating duration in increasing respondents' preferences for food products, indicating that the processing process also plays a role in the final result (Yulianti et al., 2022).

Maintaining the pH of aromatherapy preparations within the physiological range of 4.5–6.5 is critical for enhancing skin compatibility and therapeutic efficacy. This pH range helps to preserve the integrity of the skin barrier and promotes the effective absorption of essential oils such as peppermint and menthol. (Cui et al., 2022). Studies indicate that an acidic to neutral pH environment is essential; deviations from this range can lead to skin irritation and reduced therapeutic effects due to inflammatory responses. (Fatmasari et al., 2023). Such stability allows for better preservation of active components and ensures that essential oils can permeate biological membranes effectively, a process that may be hindered at inappropriate pH levels. Therefore, the pH findings in this study support the safe application of peppermint in aromatherapy, aligning with existing literature that confirms the efficacy of essential oils within this specified range. (Zuliyati et al., 2023).

Peppermint essential oil has garnered significant attention in recent years due to its diverse health benefits, which are attributed to its active compounds, primarily menthol and menthone. One of the most important findings regarding peppermint essential oil is its potential to improve cognitive performance. A study by Zhang et al. demonstrated that repeated inhalation of peppermint essential oil significantly enhanced exercise performance in endurance-trained rats, suggesting neuroprotective effects that could potentially translate into cognitive benefits in humans. (Zhang et al., 2023). Neuroactive compounds in peppermint, such as menthol, have been shown to inhibit cholinesterase and interact with nicotinic and GABAA receptors, leading to increased neural activity and reduced mental fatigue. (Kennedy et al., 2018). In human studies, peppermint aroma has been linked to improved memory and attention, with participants showing improved long-term memory and working memory when exposed to peppermint aroma compared to controls. (Moss et al., 2016). This suggests that peppermint essential oil may be a valuable tool for cognitive enhancement, particularly in environments that require sustained mental effort.

In addition to cognitive benefits, peppermint essential oil has been shown to enhance sleep quality and alleviate anxiety. Mahdavi et al. conducted a randomized controlled trial that found that aromatherapy with peppermint essential oil significantly improved sleep quality among cardiac patients. (Mahdavi et al., 2020). The calming effect of peppermint is believed to come from its ability to affect olfactory pathways in the brain, which may lead to reduced anxiety and increased relaxation. In addition, peppermint oil's antispasmodic properties, evidenced by its ability to relax smooth muscles, may contribute to its effectiveness in promoting better sleep and reducing stress-related symptoms. (Sousa et al., 2023). The antimicrobial properties of peppermint essential oil have shown efficacy against various pathogens, including bacteria and fungi. For example, studies have shown that peppermint oil can disrupt the cytoplasmic membrane of microorganisms, leading to their death. This antimicrobial activity is particularly relevant in food safety and preservation, as peppermint oil has been incorporated

into food packaging materials to inhibit spoilage. (Emir, 2024; Kalkan et al., 2019) . The ability of peppermint oil to combat foodborne pathogens underscores its potential as a natural preservative and its role in enhancing food safety.

## CONCLUSIONS AND RECOMMENDATIONS

Formula 2 of peppermint leaf essential oil offers a more pungent aroma and is preferred by respondents, providing a cooling sensation on the skin. The pH values produced by both formulations are within the safe range for topical application, thus ensuring the safe use of aromatherapy products. This research opens up opportunities for further studies on the long-term stability and therapeutic potential of various essential oil combinations in aromatherapy.

## ACKNOWLEDGMENTS

We want to thank the Center for Community Service Research (PPPM UNRIYO) for fully funding this research through an internal grant from Respati University of Yogyakarta.

## REFERENCES

- Aulia, W. M. (2023). Creative Fusion: Dim Sum Variation for Vegetarians Using White Tofu With Carrots, Bamboo Sprouts, and Mushroom Substitute. *Journal of Food and Culinary*, 33–39. <https://doi.org/10.12928/jfc.v6i1.8358>
- Camisuli, D. M., Cipriani, G., Giusti, E. M., & Castelnuovo, G. (2022). Effects of Reminiscence Therapy on Cognition, Depression and Quality of Life in Elderly People With Alzheimer's Disease: A Systematic Review of Randomized Controlled Trials. *Journal of Clinical Medicine*, 11(19), 5752. <https://doi.org/10.3390/jcm11195752>
- Cho, E. H., Lee, M.-Y., & Hur, M.-H. (2017). The Effects of Aromatherapy on Intensive Care Unit Patients' Stress and Sleep Quality: A Nonrandomised Controlled Trial. *Evidence-Based Complementary and Alternative Medicine*, 2017(1). <https://doi.org/10.1155/2017/2856592>
- Cui, J., Li, M., Wei, Y., Li, H., He, X., Yang, Q., Li, Z., Duan, J., Wu, Z., Chen, Q., Chen, B., Li, G., Ming, X., Xiong, L., & Qin, D. (2022). Inhalation Aromatherapy via Brain-Targeted Nasal Delivery: Natural Volatiles or Essential Oils on Mood Disorders. *Frontiers in Pharmacology*, 13. <https://doi.org/10.3389/fphar.2022.860043>
- Emir, A. A. (2024). Peppermint Oil-infused Polylactic Acid Films: A Novel Approach for Antimicrobial and Biodegradable Food Packaging. *Polymer Engineering & Science*, 64(6), 2943–2955. <https://doi.org/10.1002/pen.26737>
- Fatmasari, F. H., Mukti, R. A., & Nuraini, I. (2023). Uji Ketahanan pH Minyak Atsiri dari Kulit Buah Jeruk dan Bunga Kenanga sebagai Bahan Pengganti Aromaterapi pada Mata Kuliah Perawatan Badan. *Journal on Education*. <https://doi.org/10.31004/joe.v5i3.1419>
- Gutiérrez-Capitán, M., Brull-Fontserè, M., & Jiménez-Jorquera, C. (2019). Organoleptic Analysis of Drinking Water Using an Electronic Tongue Based on Electrochemical Microsensors. *Sensors*, 19(6), 1435. <https://doi.org/10.3390/s19061435>
- Hoult, L., Longstaff, L., & Moss, M. (2019). Prolonged Low-Level Exposure to the Aroma of Peppermint Essential Oil Enhances Aspects of Cognition and Mood in Healthy Adults. *American Journal of Plant Sciences*. <https://doi.org/10.4236/ajps.2019.106072>
- Jayadharani, C., Devi, R. G., & Priya, A. J. (2020). Effect of Peppermint Oil on Individuals with Sleep Apnea. *Journal of Pharmaceutical Research International*, 98–101. <https://doi.org/10.9734/jpri/2020/v32i2630843>
- Kalkan, S., Akben, S. B., & Çanga, D. (2019). Modeling the Microbiological Effect of Essential Peppermint Oil-supplemented Chitosan Film on Bonito Fish (*Sarda sarda*) Fillets and Analysis via Image Processing Methods. *Journal of Food Process Engineering*, 42(6). <https://doi.org/10.1111/jfpe.13232>
- Kennedy, D. O., Okello, E., Chazot, P. L., Howes, M.-J., Ohiomokhare, S., Jackson, P. A., Haskell-Ramsay, C. F., Khan, J., Forster, J., & Wightman, E. L. (2018). Volatile Terpenes and Brain Function: Investigation of the Cognitive and Mood Effects of *Mentha × Piperita* L. Essential Oil With in Vitro Properties Relevant to Central Nervous System Function. *Nutrients*, 10(8), 1029. <https://doi.org/10.3390/nu10081029>
- Koga, C., Yoneda, M., Nakayama, K., Yokoue, S., M, H., Oie, T., Suga, A., Fumiko, O., Mizunuma, H., Tsue, F.,

- Suzuki, N., & Hirofujii, T. (2014). The Detection Of*Candida* Species in Patients With Halitosis. *International Journal of Dentistry*, 2014, 1–5. <https://doi.org/10.1155/2014/857647>
- Lamadah, S. M. (2016). The Effect of Aromatherapy Massage Using Lavender Oil on the Level of Pain and Anxiety During Labour Among Primigravida Women. *American Journal of Nursing Science*, 5(2), 37. <https://doi.org/10.11648/j.ajns.20160502.11>
- Mahdavikian, S., Rezaei, M., Modarresi, M., & Khatony, A. (2020). Comparing the Effect of Aromatherapy With Peppermint and Lavender on the Sleep Quality of Cardiac Patients: A Randomized Controlled Trial. *Sleep Science and Practice*, 4(1). <https://doi.org/10.1186/s41606-020-00047-x>
- Moss, M., Jones, R. C., Moss, L., Cutter, R., & Wesnes, K. (2016). Acute Consumption of Peppermint and Chamomile Teas Produce Contrasting Effects on Cognition and Mood in Healthy Young Adults. *Plant Science Today*, 3(3), 327. <https://doi.org/10.14719/pst.2016.3.3.246>
- Mufida, L. R., & Mirzanti, I. R. (2023). Business Growth Strategy of Personal Care Brand Using VMOSA and Three Horizon Model (A Case of Evening). *International Journal of Current Science Research and Review*, 06(06). <https://doi.org/10.47191/ijcsrr/v6-i6-62>
- Sagala, R. J. (2023). Formulation of Hairspray From Cherry Leaves (Muntingia Calabura L.) With Antimicrobial Properties. *Journal of Urban Health Research*, 1(2), 27–37. <https://doi.org/10.25170/juhr.v1i2.4286>
- Sousa, E. S. A., Queiroz, L. A. D., Guimarães, J. P. T., Pantoja, K. C., Barros, R. S., Epiphanyo, S., & Martins, J. O. (2023). The influence of high glucose conditions on macrophages and its effect on the autophagy pathway. *Frontiers in Immunology*, 14(April), 1–8. <https://doi.org/10.3389/fimmu.2023.1130662>
- Swinburne, S., Bowerbank, S. L., & Moss, M. (2023). To Blend or Not to Blend? Anxiety Buffering Effects of Essential Oil Aromas. *American Journal of Plant Sciences*, 14(03), 390–414. <https://doi.org/10.4236/ajps.2023.143026>
- Yulianti, T., Pratama, R. I., Herawati, T., & Rostini, I. (2022). The Effect of Heating Duration on the Preference Level of Pindang Presto Indian Mackerel. *Asian Journal of Fisheries and Aquatic Research*, 1–9. <https://doi.org/10.9734/ajfar/2022/v19i330473>
- Zhang, W., Shi, R., Gao, T., Hu, Y., Zhou, J., Li, C., Wang, P., Yang, H., Xing, W., Dong, L., & Gao, F. (2023). Repeated Inhalation of Peppermint Essential Oil Improves Exercise Performance in Endurance-Trained Rats. *Nutrients*, 15(11), 2480. <https://doi.org/10.3390/nu15112480>
- Zuliyati, I. C., Fatmawati, A., & Mulyaningsih, S. (2023). The effectiveness of aromatherapy combination of pepperlav (peppermint and lavender) to relieve nausea vomiting in pregnant women. *JNKI (Jurnal Ners Dan Kebidanan Indonesia) (Indonesian Journal of Nursing and Midwifery)*. [https://doi.org/10.21927/jnki.2023.11\(1\).68-78](https://doi.org/10.21927/jnki.2023.11(1).68-78)