

## FORMULATION AND EVALUATION OF RED GINGER OIL (*ZINGIBER OFFICINALE ROSCOE*) BALM AS AN ANALGESIC

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### ABSTRACT

**Objective:** The purpose of this study was to obtain the best formulation of red ginger oil balm that can be used for aromatherapy as an analgesic.

**Methods:** The red ginger plant in Steam-water distillation produces red ginger oil. Red ginger oil is tested for quality and formulated. The best formulation result is then tested for product quality.

**Results:** The result of red ginger oil quality parameters is obtained in accordance with the literature. As the result of the hedonic test, formula 4 was chosen to be the best formula. The result of the total plate number is < 10 CFU/ml. The result of the identification of *Staphylococcus aureus* and *Pseudomonas aeruginosa* is negative. The result of the stability test, irritation tests, and pH test was stable during storage.

**Conclusion:** The results showed that formula 4 is the best formula and has the potential to circulate in large quantities.

**Keywords:** Red ginger oil, Balm, Aromatherapy, *Zingiber officinale Roscoe*, Analgesic

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### INTRODUCTION

Constituents of essential oils are commonly found in foods giving characteristic aroma and flavor. Essential oils are a class of natural products with promising biological properties and are traditionally used in aromatherapy for various purposes, including analgesic [1]. Essential oil components are found in many foods that give them a distinctive aroma and taste. Essential oils are natural products with promising biological properties and are traditionally used in aromatherapy for a variety of health purposes. One of the plants that have been widely used by Indonesian people for generations as traditional medicine is red ginger. The rhizome of *Zingiber officinale* has been used as a component of Jammu (Indonesian herbal medicine). This special plant is divided into three varieties according to its size, rhizome color, and chemical composition, namely white ginger, emprit ginger, and red ginger [2].

In this study, we use red ginger, which has characteristics such as having the smallest size, the color of the rhizome is light orange to red, has tough fibers, and the taste is very spicy. Generally, it is used as medicine and herbal medicine, as well as to take oleoresin and essential oil [3]. The chemical composition of red ginger oil (*Zingiber officinale Roscoe*) has been identified, namely gingerol, shogaol, and zingerone which are known to have pharmacological effects such as antioxidant, anti-inflammatory, analgesic, improving respiratory circulation, improving the digestive system, and being anti-carcinogenic [4].

Chronic pain persists for more than three to six months and is usually followed by chronic diseases or malignancies. The inflammation process generally induces the release of inflammatory mediators such as prostaglandin (PGE<sub>2</sub>) via the activation of the cyclooxygenase-2 (COX-2) enzyme. Pain can be reduced if the COX-2 activity is reduced in the hypothalamus, and it has been proven through *in vivo* research that mice induced by red ginger oil at a dose of 600 mg/kg showed the best activity in reducing COX-2 expression in the hypothalamus [5].

The number of people diagnosed with chronic pain is increasing every year. many analgesic drugs are on the market, but these drugs cause unwanted side effects such as addiction, hypersensitivity, dizziness, digestive tract disorders, etc [6]. Therefore, natural ingredients from red ginger essential oil are used to overcome the side effects of using analgesic drugs. However, ginger oil-based products are still very limited in the market. In health products,

ginger can be found in herbal medicines in liquid or tablet form [7]. However, it is still very rare to find balsam products made from red ginger oil. Balsam is a preparation with an ointment-like texture containing certain active ingredients, which is used as an external medicine. Balsam preparations also have several advantages such as being easy to use, easy to carry everywhere, reasonable, having few side effects, having good distribution, and hydrating the skin. The purpose of this study was to obtain the best formulation of red ginger oil balm that can be used for aromatherapy as an analgesic.

### MATERIALS AND METHODS

#### Plant material

The main ingredients used in this study were red ginger rhizome (*Zingiber officinale Roscoe*) obtained from Bukit Waruwangi, Serang, Banten, Indonesia.

#### Ingredients

Menthol, Glycerin, BHA (butylated hydroxyanisole), Cera Alba, Paraffin liquid, Red Ginger Fragrance, and Vaseline album were purchased from Faculty of Pharmacy, Pancasila University.

#### Plant determination

Plant determination was carried out at the Herbarium Depokensis (DEB), Departement of Biology, Faculty of Science and Mathematics, Universitas Indonesia, Depok, West Java (No.701/UN2.F3.11/PDP.02.00/2021). The purpose of determination is to get to the truth clear identity of the plant researched and avoid error in the main research material collection [8].

#### The distillation of red ginger oil

Red ginger distillation was carried out using the steam-water distillation method to obtain Red ginger oil [9].

#### Measurement of yield value red ginger oil

The purpose of measurement of ginger oil yield was to get how many grams of *Simplicia* powder to produce 1 gram of extract. The yield of the extract was calculated with the formula Eq 1 [10]:

$$\% \text{ Yield of essential oil} = \frac{\text{Extract weight obtained (g)}}{\text{sampel weight (g)}} \times 100\% \dots\dots (1)$$

### Determination of red ginger oil quality parameters

Determination of quality requirements of essential red ginger oil refers to SNI 06-1312-1998 covering parameters of organoleptically visual colour. Its density was carried out using a pycnometer. The refractive index of essential oil was carried out using a refractometer [11].

### Red ginger oil balm production

Prepare the necessary tools and materials. The formula is shown in table 1. Weighed all the ingredients to make the balm base ingredients needed, namely paraffin liquid, Vaseline album, and Cera alba, then melted on the topwater bath; after all the ingredients have melted, add glycerine and stir it until homogeneous. Dissolved menthol in red ginger oil, add Butylated hydroxyanisole (BHA), and red ginger fragrance, then stir until homogeneous and allow to cool and put it in the balm container.

### Red ginger oil balm quality evaluation

Product quality evaluation was carried out referring to the regulation of the head of the drug and food inspection agency (PerKaBPOM) No. 32 of 2019 includes organoleptic tests and microbial contamination, stability, irritation, pH, and hedonic testing [12].

## RESULTS AND DISCUSSION

### Plant determination

The results in table 2 of plant determinations carried out at Herbarium Depokensis (DEB), Departement of Biology, Faculty of Science and Mathematics, Universitas Indonesia, Depok, West Java, showed that the plants used were true surrender plants (*Zingiber officinale Roscoe*) with the Zingiberaceae family.

### Determination of red ginger oil quality parameters

The result of red ginger oil analysis was shown in table 3.

Table 1: Formula design

No.	Ingredients	Formula (%)			
		1	2	3	4
1.	Ginger oil essential oil	8	10	8	10
2.	Menthol	8	8	8	8
3.	Glycerine	5	5	5	5
4.	Cera Alba	10	10	15	15
5.	Paraffin liquid	5	5	5	5
6.	BHA	0.02	0.02	0.02	0.02
7.	Ginger fragrance	0.05	0.05	0.05	0.05
8.	Vaseline album	63.93	61.93	58.93	56.93

Table 2: Plant determination results

No.	Sample	Species	Family
1	Red ginger	<i>Zingiber officinale Roscoe</i>	Zingiberaceae

Table 3: Certificate of analysis sheet red ginger oil

Parameter	Specification	Results
Appearance	Free-flowing liquid	According to the standard
Color	Red	According to the standard
Odor	Characteristic ginger aroma	According to the standard
Density (25 °C)	0.898-0.908	0.8828
Refractive index (20 °C)	1.488 to 1.494	1.472

Based on the results obtained are under Indonesian National Standard (SNI) No. 06-1312-1998, This means that the resulting product can be used as raw material for manufacturing roll on red ginger oil as aromatherapy.

### Hedonic test

Test of interest in the final results of balsam aromatherapy preparations with an assessment using numerical parameters based on warmth and aroma. The rating scale consists of 5, namely: very like, like, neutral, don't like, and don't like it. The number of panelists consists of 30 people.

Based on the hedonic test, it is known that each roll-on formula, namely, 8% red ginger oil with 10% Cera alba (Formula 1), 10% red ginger oil with 10% Cera alba (Formula 2), 8% red ginger with 15% Cera alba oil (Formula 3), and 10% red ginger oil with 10% Cera alba (Formula 4). It can be concluded that formula 4 is more dominant and much in demand by many people in terms of warmth, aroma, and texture. Therefore, formula 4 was chosen to be the best formula.

### Microbial contamination test

The result of the total plate count of red ginger balm was shown in table 5.

Table 5: Result total plate number

Sample	Dilution					Result (CFU/ml)
	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>	10 <sup>-4</sup>	10 <sup>-5</sup>	
Balm-1	0	0	0	0	0	<10 CFU/ml
Balm-2	0	0	0	0	0	
Balm-3	0	0	0	0	0	
Balm-4	0	0	0	0	0	

In the total plate number test, 5 dilutions were carried out in duplicate on the sample. Based on the results of testing the total plate number in the Red ginger oil balm preparation, there were no growing colonies (<10 CFU/ml). The Total Plate Number required for external medicinal liquids according to the regulation of the drug and food regulatory agency number 32 of 2019 is 10<sup>7</sup> CFU/ml. So it

can be concluded that the tested red ginger oil balm preparations met the specified requirements and were microbiologically safe for use by the public.

Identification of *Staphylococcus aureus* and *Pseudomonas aeruginosa* contamination was shown in table 6.

**Table 6: Result identification of *Staphylococcus aureus* and *Pseudomonas aeruginosa***

Microbial examination	Media		
	TSB	CETA	MSA
Balm-1	Turbid	No colony growth	No colony growth
Balm-2	Turbid	No colony growth	No colony growth
Balm-3	Turbid	No colony growth	No colony growth
Balm-4	Turbid	No colony growth	No colony growth
Positive control	Turbid	Fluorescence green colony	Yellow colony
Negative control	Clear	No colony growth	No colony growth

Description: CETA: Cetrinide Agar; MSA: Mannitol Salt Agar

In the *Staphylococcus aureus* and *Pseudomonas aeruginosa* identification test, Tryptic Soy Broth (TSB) media was used as an enrichment medium and if the results were positive, then it would be carried out on Mannitol Salt Agar (MSA) media. Based on the results obtained on Tryptic Soy Broth (TSB) media is positive, this is indicated by turbidity and deposits at the bottom of the tube, so it is necessary to continue testing using selective media, namely Mannitol Salt Agar (MSA) by scratching. To perform the MSA test, an MSA plate streaked with bacteria was incubated for 24 h at 37 °C. The MSA test was deemed positive if the bacteria colonized the agar surface and the plate medium turned bright yellow, indicating that the pathogen was able to grow in a high saline environment and fermented mannitol to produce the color change. If the bacteria colonized the agar surface, but the medium did not change color (remained pink), the test was deemed negative (for mannitol fermentation) [12]. Based on the results obtained on MSA, media is negative, which means there is no *Staphylococcus aureus*. On Cetrinide agar media, negative results were obtained because it did not show the formation of fluorescent green-colored colonies. *Pseudomonas aeruginosa* required for external medicinal fluids according to the regulation of the drug and food regulatory agency number 32 of 2019 is negative/ml.

#### CONCLUSION

The results showed that formula 4 is the best formula and has the potential to be circulated in large quantities

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#### AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

#### CONFLICT OF INTERESTS

The author declares no conflict of interest.

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