

FORMULATION AND PHYSICAL STABILITY TEST OF PATCHOULI OIL BALM (*Pogostemon cablin* (L.) Benth) AS AN AROMATHERAPY

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A B S T R A C T

Background: this study is the use of traditional medicines, specifically balms, to treat joint and muscle pain, where patchouli oil is known to have anti-inflammatory effects. **Objective:** this study was to formulate patchouli oil balm (*Pogostemon cablin*) as an aromatherapy and test its physical stability. **Methods:** The research used was a quantitative experiment by making three balm formulations containing variations in patchouli oil concentrations: F1 (0.5 mL), F2 (1 mL), and F3 (1.5 mL). The physical stability test was carried out for 14 days, including organoleptic, homogeneity, pH, hedonic (preference), and stickiness tests. **Results:** studies show that all formulas have good organoleptic stability. However, in the homogeneity test, only Formula I remained stable, while F2 and F3 showed phase separation after 14 days. The pH test results showed that Formula I reached the ideal pH for the skin (4.89) on day 14, while F2 and F3 had a pH below safe limits. In addition, the hedonic test showed that Formula I was most preferred by respondents in terms of aroma and sensation on the skin. **Conclusion:** from this study, Formula I (F1) with a concentration of 0.5 mL patchouli oil is the most optimal and stable formula as an aromatherapy balm.

INTRODUCTION

The existence of various health problems that are still not well resolved in the modern health era, causing people to start choosing to use traditional medicine. Routinely, the use of traditional medicine requires preclinical and clinical testing to confirm its effectiveness and safety in curing various diseases (Ramadhonsyah, 2023). One of the diseases that is often a problem in society is joint and muscle pain (Aisiyah *et al.*, 2017).

Treatment that is often used by the community is quite popular because of the effectiveness felt by the community and its more affordable price. One of the preparations that is often used by the public is balm. Balm preparations are semisolid preparations that have rubefaciant properties, namely they can relax muscles or warm up. Applying balms containing analgesic (pain reliever) and anti-inflammatory (inflammatory) active substances can treat and reduce pain (Jumriani *et al.*, 2022). Some people think that the form of medicine is like a balm preparation like ancient or "ancient" medicine (Purba, 2020).

Balm is a form of semi-solid preparation that is used as an external medicine. The balm has indications to relieve pain in the joints by providing a warm sensation, the balm is used as aromatherapy. This balm is also commonly used to relieve headaches, stomach pain, toothache, itching due to insects, pain, colds and nasal congestion due to the flu (Salsabila *et al.*, 2023). The form of balm preparations can increase hydration and skin temperature, increase the absorption of drugs into the skin, occlusive and most balm preparations do not contain additional preservatives so that they can reduce the risk of allergies. The preparation of balsam preparations can also be combined with ingredients that are not easily irritated (Ardiansyah *et al.*, 2023).

Fragrant shrub or fragrant plant with smooth leaves and square stems. The dried leaves are processed to obtain oil that is often used in various industrial activities. The main ingredients contained in sapphire oil are *Patchouli Alcohol* which works as an anti-inflammatory, relieving inflammation and decongestant (Hafid And Abasa, 2025). Patchouli oil can be obtained by distilling the roots, stems, twigs, and leaves of the patchouli plant. Essential Oil is a viscous liquid at room temperature but is volatile and gives a distinctive aroma *aromatic* (Rahmayanti *et al.*, 2023).

Patchouli oil (*Pogostemon cablin* (L.) Benth) is an essential oil obtained from the patchouli plant by distillation. Patchouli oil distillation is a process of extracting oil from dry materials with the help of water, where oil and water are not mixed. Distilled liquid mixtures can be insoluble liquids (*Immiscible*) and further forms two phases, or liquids that dissolve each other perfectly (*Miscible*) which only forms one phase and there are three distillation methods, namely water distillation (*Water Distillation*), steam distillation (*Steam Distillation*) and water and steam distillation (*Water and steam distillation*) (Ginting) *et al.*, 2022). Patchouli oil can have a simple yellow color or dark brown weight type 25^{0C} and has an odor that is difficult to remove (Jumardin *et al.*, 2019).

Patchouli oil contains phenolic compounds and flavonoids that have antioxidant activity or can reduce free radicals (Tank, 2019). Patchouli oil (*Pogostemon cablin* (L.) Benth) It is usually used as a binding raw material (fixaphyf) of its main components, namely *patchouli alcohol* (C₁₅H₂₆) and as an airborne control material (etheric) for fragrances (perfumes) so that the fragrance lasts longer. (Waruwu & Maimunah, 2022). As a fixative ingredient, patchouli oil is added to the formula where the smell produced by patchouli oil will last a long time and make the fragrance of the fragrance stronger. (Sofiani *et al.*, 2018).

The development of balms as aromatherapy needs to be carried out as an effort to increase the use of essential oil products. The aromatic components of essential oils interact quickly when inhaled (Ermaya *et al.*, 2019). Aromatherapy is a form of complementary medicine that seeks to reduce stress and induce a feeling of calm by stimulating the olfactory system with essential oils or pure oil juice to help improve or maintain health, uplift, refresh and calm the soul and body (Astuti *et al.*, 2015).

METHOD

The research carried out was quantitative with the experimental method of the laboratory which was carried out in the pharmacy laboratory of the Baubau polytechnic.

The tools used in this study were bunsen, tripods, gauze wire, analytical scales, beaker cups, measuring cups, stirring rods, metal spoons, dropper pipettes, ointment pot containers and parchment paper. The ingredients used are patchouli oil (*Pogostemon cablin benth*), cera alba, paraffin liquid and petroleum album.

The work procedure is to take samples of patchouli oil essential oil (*Pogostemon cablin benth*) in Lasembangi village, Lasalimu district. formulation of balm preparations and physical preparation tests (at the Baubau Polytechnic Pharmaceutical Laboratory).

The physical preparation test on the balm consists of 5 tests, namely, organoleptic testing, homogeneity testing, pH testing, hedonic testing and adhesion testing.

RESULTS & DISCUSSION

Research Results

Organoleptic Test Results

In the organoleptic test study, it was carried out to determine the physical characteristics of balm preparations including the shape, color and aroma of the preparations that have been made, which can be seen in table 1.

Table 1. Results of organoleptic test research

Yes	Sample Name	Testing Time	Stuttgart	Color	Smell/Aroma
1.	Formula I	Day 0	Semi Solid	Milk cream	Typical weak patchouli
		Day 7	Semi Solid	Milk cream	Typical weak patchouli
		Day 14	Semi Solid	Milk cream	Typical weak patchouli
2.	Formula II	Day 0	Semi Solid	Light yellow	Typical strong patchouli
		Day 7	Semi Solid	Light yellow	Typical strong patchouli
		Day 14	Semi Solid	Light yellow	Typical strong patchouli

3.	Formula III	Day 0	Semi Solid	Yellow Corruption	Typical Patchouli is very strong
		Day 7	Semi Solid	Yellow Corruption	Typical Patchouli is very strong
		Day 14	Semi Solid	Yellow Corruption	Typical Patchouli is very strong

Source: Primary Data (2025)

Homogeneity Test Results

In the homogeneity test study to ensure uniformity of variations in balm preparations and varied testing times.

Table 2. Homogeneity Test Results

Yes	Sample Name	Test time	Key Composition/ Variations	Homogeneity	Visual Description/Observation
1.	Formula I	Day 0	Contains 0.5mL	Homogeneous	There are no deposits, phase separation or clumps. Smooth texture.
		Day 7	Contains 0.5mL	Homogeneous	There are no deposits, phase separation or clumps. Smooth texture.
		Day 14	Contains 0.5mL	Homogeneous	There are no deposits, phase separation or clumps. Smooth texture.
2.	Formula II	Day 0	Contains 1 mL	Homogeneous	Consistent, no visible particles. Color even.
		Day 7	Contains 1 mL	Homogeneous	Consistent, no visible particles. Color even.
		Day 14	Contains 1 mL	Not Homogeneous	There are small spots like balm starting to separate into a liquid phase at the bottom of the container.
3.	Formula III	Day 0	Contains 1.5mL	Homogeneous	Conditions are even, there is no segregation.
		Day 7	Contains 1.5mL	Not Homogeneous	There are small spots like balm starting to separate into a liquid phase at the bottom of the container.
		Day 14	Contains 1.5mL	Not Homogeneous	There are many spots like balm starting to separate into a liquid phase at the bottom of the container.

Source: Primary Data (2025)

pH Test Results

The pH test is carried out using a pH meter and then tested on different days to see if the pH remains stable on different days.

Table 3. pH Test Results

Yes	Sample Name	pH (Day 0)	pH (Day 7)	pH (Day 14)	Recommended pH limit
1.	Formula I	4,00	4,02	4,89	4,5-6,5
2.	Formula II	4,10	4,07	4,03	4,5-6,5
3.	Formula III	4,00	4,00	4,12	4,5-6,5

Source: Primary Data (2025)

Hedonic Test Results

This test was carried out by giving questionnaires to 20 panelists. The questionnaire given contains questions about the preparation of the balm as a whole by containing 4 scales, namely, Dislike, somewhat dislike, somewhat like and like.

Table 4. Results of the test of liking the balm

Yes	Sample Name	Parameters	Dislike	Somewhat dislike	Quite like it	like
1.	Formula I	Shape	-	2	8	10
	Formula II		-	1	10	9
	Formula III		3	3	5	9
2.	Formula I	Texture	-	5	12	3
	Formula II		2	3	13	2
	Formula III		1	3	8	8
3.	Formula I	Color	-	6	4	10
	Formula II		-	4	9	7
	Formula III		3	1	7	9
4.	Formula I	Sensation on the skin	18	2	-	-
	Formula II		14	2	1	3
	Formula III		11	6	-	-
5.	Formula I	Aroma	-	1	12	7
	Formula II		2	12	3	3
	Formula III		14	1	2	3

Source: Primary Data (2025)

Adhesion Test Results

Adhesion testing is done by applying the preparation to the skin. The longer the adhesion that is attached to the skin, the better because the active substances released on the cream base will be absorbed more.

Table 5. Adhesion test results

Yes	Sample Name	Description Visual/Observation	Picture
1.	Formula 1	In the image showing the adhesion test, it appears that the balm preparation in Formula 1 has a fairly strong adhesion. When the hands are bent and straightened, the balm preparation still sticks well and does not fade or move easily even after 4 seconds.	
2.	Formula 2	The balm preparation in Formula 2 also shows strong adhesion. The preparation looks flat on the surface of the skin and does not disappear easily even if the skin is moved, but after 4 seconds there is a little oil on the surface of the skin.	
3.	Formula 3	Formula 3 showed similar results to the previous two formulas. The balm preparation in Formula 3 has good adhesion, it looks evenly attached to the skin but after 4 seconds the oil on the surface of the skin is slightly more than Formula 2.	

Source: Primary data (2025)

DISCUSSION

In the first step of making balsam, tools and materials are prepared. The tools used are bunsen and tripods, gauze wire, gram scales, beaker cups, measuring cups, stirring rods, metal spoons, drip pipettes, parchment paper, ointment pot containers, while the materials used are menthol, cera alba, lemongrass oil, paraffin liquid and album vaselin, after which cera alba is weighed as much as 1 g, Enough album vaseline up to 5 grams, measured patchouli oil (F1-0.5 mL) (F2-1 mL) (F3-1.5 mL), paraffin quid as much as 0.75 mL on a measuring cup, placed a beak beak on gauze wire, put cera alba and album vaseline in the beak while stirring using a stirring stick until it melts, put paraffin liquid stirred until homogeneous, put patchouli oil stirred until homogeneous and finally waited until slightly dinggin and then put in an ointment pot container.

Organoleptic tests of all formulations (Formula 1, Formula 2 and Formula 3) showed excellent test results. The test was successful in maintaining a consistent and stable shape, colour and smell/aroma from day 0, day 7 to day 14, indicating that all formulas managed to produce a consistent semi-solid shape during the 14 days of testing. The increased concentration of patchouli oil in Formula II and Formula III causes the balm color to be more concentrated and the aroma is stronger than in Formula I. This is natural because patchouli oil has a distinctive yellow color and aroma, so higher concentrations will strengthen both attributes in the final product.

In the homogeneity test, all three formulas were initially homogeneous on day 0. However, this stability did not last in Formula II and III. After 14 days, these two formulas show instability with the formation of coarse grains, which indicates phase separation. This phenomenon is likely caused by too high a concentration of patchouli oil, which disrupts the matrix of balsam bases (vaseline albums and cera alba), thus causing crystallization or aggregation of particles. In contrast, Formula I (0.5 mL patchouli oil) remained homogeneous until the end of the test, suggesting that this concentration is the optimal equilibrium point to maintain the physical stability of the balm.

The pH test is an important parameter for topical preparations because the ideal pH for the skin is between 4.5 to 6.5 to prevent irritation. The test results showed that Formula I initially had a pH of 4.00, which was below the recommended range. However, the pH of Formula I gradually increased and reached 4.89 on day 14, being within a safe and stable pH range. This increase indicates the presence of a maturation process (maturation) or post-formulation stabilization. In contrast, Formula II and III consistently showed a pH below 4.5 during the 14 days of testing. This pH value that is too low has the potential to cause irritation to the skin. This pH instability can be attributed to higher concentrations of patchouli oil, which may be acidic or interact with other ingredients in the balm base.

Adhesion tests are important to ensure that the preparation can stick to the skin long enough to release its active substances. Although there are no quantitative data, the description of the results shows that Formula I has "Good" adhesion. This reflects the optimal balance between patchouli oil and balm base. Formulas II and III have "Sufficient" and "Less" adhesions, which may be due to formulations that are too oily or too viscous due to high concentrations of patchouli oil.

The hedonic test showed that there was no single formula that was the most superior in all categories. However, when viewed as a whole, Formula II shows the most consistent and highest acceptance rate in most categories (Shape, Texture, and Sensation on the skin). Thus, the order of the highest acceptance rate in general is formula II (Superior in Shape, Texture and Sensation in the skin), formula I (Superior in Color and Aroma) and finally formula III (Most often gets a "Dislike" score in some categories).

Based on the overall test results, formula 1 excels in terms of physical stability (Homogeneity and Adhesion) and safety (pH). Formula 2 excels in terms of consumer acceptance (Hedonic) in important categories such as Shape, Texture, and Sensation on the skin. Although Formula 2 excels in consumer preferences (hedonic test), formula I is the most preferred by the panelists. This result is consistent with other test results, as Formula I has a homogeneous texture and good adhesion, as well as a sapphire aroma that is not too strong. Formulas with higher concentrations (Formulas II and III) are rated lower due to their sharper aroma and homogeneous instability.

CONCLUSION

From the results of the study, it can be concluded that

In the organoleptic test all formulations (Formula 1, Formula 2 and Formula 3) showed very good test results. The kegumes managed to maintain a consistent and stable shape, color and smell/aroma from day 0, day 7 to day 14. The homogeneity test showed that formula 1 was the most stable formula. This

formula shows homogeneous results during the process of the test period from day 0, day 7 to day 14 without any signs of separation or instability. The pH test showed that formula 1 was the only formula that met the recommended pH standard (4.5-6.5). The hedonic test shows that there is no single formula that is the most superior in all categories. However, when viewed as a whole, Formula II shows the most consistent and highest acceptance rate in most categories (Shape, Texture, and Sensation on the skin). Thus, the order of the highest acceptance rate in general is formula II (Superior in Shape, Texture and Sensation in the skin), formula I (Superior in Color and Aroma) and finally formula III (Most often gets a "Dislike" score in some categories). In the adhesion test formula 1 showed the most stable and strong results, where the balm preparation remained well adhered and showed no signs of separation (oil discharge) even after 4 seconds. Based on the overall test results, Formula 1 and Formula 2 have their respective advantages. Formula 1 excels in terms of physical stability (Homogeneity and Adhesion) and safety (pH). Formula 2 excels in terms of consumer acceptance (Hedonic) in important categories such as Shape, Texture, and Sensation on the skin. Although Formula 2 excels in consumer preferences (hedonic tests), Formula 1 clearly excels in terms of product stability and safety.

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It is recommended for the next researcher to test aromatherapy candles as an anti-depression and change preparations from aromatherapy candle preparations to aerosol preparations from coffee as mosquito repellent as product development.

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