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Characterisation of Rhizome Extract (Curcuma xanthorrhiza Roxb) Ointment as an Anti-Acne Remedy

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ABSTRACT

Skin is one of the five senses of humans that functions as a thermostat in maintaining body temperature, protecting the body from attack by microorganisms, ultraviolet rays, and regulating blood pressure. However, insufficient protection factors make the skin easily infected by bacteria that can cause skin diseases. One such disease is acne. Acne occurs when anaerobic bacteria such as Staphyloccocus aureus multiply rapidly in the deep skin layers. This study was conducted to overcome acne on the skin by using an ointment preparation made from temulawak rhizome. This research uses qualitative and quantitative methods with data collection techniques through organoleptic testing, homogeneity, pH, spreadability, adhesion, and irritation. The subjects in this study were physics students at Surabaya State University with a total of 5 students. The results showed that the organoleptic test on the preparation of temulawak rhizome extract ointment was semi-solid, brownish yellow in colour, and the distinctive smell of temulawak rhizome extract. The pH test showed a value of 5 equal to the normal pH of the skin and no irritation on the volunteer's skin. The ointment formulation had no effect on its homogeneity and had excellent adhesion.

INTRODUCTION

Skin is one of the five human senses located on the surface of the body and functions as a thermostat in maintaining body temperature, regulating blood pressure, and protecting the body from microorganisms and ultraviolet rays (O'Neill *et al*., 2024). This is due to the fatty barrier that sits on top of the skin obtained from fat glands and sweat glands (Kour *et al*., 2021). This fatty veil is very sensitive to harmful microorganisms from outside the skin. In addition, the outer skin layer also functions as a skin barrier. However, the insufficient protection factor makes it easy for bacteria attached to the skin to enter and cause skin diseases (Kim *et al*., 2024).

Acne is one of several skin diseases that always occur in humans who are in adolescence and adulthood (Ghosh *et al*., 2019). Acne is caused by oily skin that causes clogged pores. As a result of the clogging of the skin pores, bacteria such as anaerobic and Staphylococcus aureus multiply rapidly and cause acne (Akombaetwa *et al*., 2023). Therefore, a solution is needed to overcome this problem by using anti-acne preparations in the form of gels, ointments, creams, and lotions (Chen *et al*., 2018). Ointment is a dosage form that has a consistency for the therapy of skin diseases caused by bacteria with a PEG base that can release active substances and is suitable for acne skin because it does not contain oil (Vasam *et al*., 2023). However, the use of chemicals in ointments can cause damage to the skin if used too often (Sable *et al*., 2023). According to research by Kim *et al*. (2024), the use of synthetic ointments can cause skin irritation and other disorders such as itching, difficulty breathing, and swelling of the face, lips, tongue, or throat. Therefore, natural ingredients are chosen to be used as ointment ingredients. One such natural ingredient is temulawak rhizome (Donkor *et al*., 2023).

Temulawak is a plant that lives at an altitude of 750 meters above sea level, and is bred from rhizomes in a dry state (Nieva *et al*., 2021). Several studies have been conducted on the active substances found in temulawak rhizomes, and the potential of temulawak is as an antioxidant, antilipidaemia, antibacterial, and antifungal (Gunardi *et al*., 2023). This is because the essential oil content in temulawak is a compound that functions as a

fungistatic on several types of fungi and bacteriostatic (Kim *et al*., 2024). The composition of fresh temulawak rhizomes based on dry matter consists of 75.18% water, 27.62% starch, 5.38% fat, 10.96% essential oil, 1.93% curcumin, 6.44% protein, 6.89% fiber and 3.96% ash (Shaik *et al*., 2023).

The results of this study are expected to show that temulawak rhizome extract can be used as an ointment sedian material to overcome acne disease in adolescents and have the same characteristics as synthetic ingredients in anti-acne ointments generally. t represents the relevance of this study to the development of environmentally friendly skincare products based on local natural resources. On the other hand, since society is increasingly aware of the dangers of synthetic chemical content, the formulation of a temulawak ointment is an original contribution to the market interest in natural skincare products. Meanwhile, this research scientifically supports the exploration of temulawak as an active ingredient in pharmaceutical formulations. Therefore, this study developed not only a safe and effective anti-acne ointment but also provided scientific support for the development of natural skincare products, especially those from local plants like temulawak.

METHOD

Activity Preparation

The materials used in this study include: Temulawak rhizome (Curcuma xanthorrhiza Roxb), distilled water, adeps lanae (CIMS), ethanol (CIMS 96%.), and Vaseline album (CIMS). The equipment used in this study included a mortar, pestle, spatula, digital balance, beaker glass, magnetic stirrer, measuring cup, petri dish, funnel, pH paper, oven, Whatman filter paper, rotary vacuum evaporator, aluminum foil, Erlenmeyer flask, pipette, spatula, and separatory funnel.

Activity Steps

At the initial stage, temulawak rhizome samples were collected and weighed with a fresh leaf weight of 2 kg. Samples are sorted with the aim of separating impurities or other foreign materials from the simplisia materials. Furthermore, it is washed with running water with the aim of removing impurities. The samples were then chopped to facilitate the drying process. Drying the sample is done by putting it in the oven for 3 days at 400°C. The dried samples were then blended into powder and weighed. The resulting powder was sieved with a 200-mesh sieve until a fine and homogeneous powder was obtained. Temulawak rhizome powder was obtained as much as 200 grams. After that, 200 grams of simplicial powder was put into a container, soaked with a 96% ethanol solution of 1000 mL in a ratio of 1: 5, and then covered with aluminum foil for 5 days while occasionally stirring. After 5 days of soaking, the sample was filtered using filter paper to separate the filtrate and residue. Then, the temulawak rhizome extract was evaporated and concentrated with a rotary vacuum evaporator to obtain a thick extract. The result of the thick extract is 10 grams of dark yellow color and a yield of 5%.

Table 1. Anti-acne ointment formulation

Formulation	**Concentration**			
	Basis	5%	10%	15%
Curcuma longa rhizome extract	0 g	1 g	2 g	3 g
Adeps Lanae	2.00 g	2.85 g	2.70 g	2.55 g
Vaseline Album	18.00 g	16.15 g	15.3 g	14.45 g

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According to Lidyawati *et al*. (2021), the standard ointment base formulation for 30 grams of ointment is 4.5 grams of Adeps Lanae and 25.5 grams of Vaseline album. Then, in the second stage of making this ointment, the temulawak rhizome extract used has different concentrations, namely 5%, 10%, and 15%, which are made as much as 20 grams added with adeps lanae and Vaseline album. The ointment formulation of katuk leaf extract can be seen in **Table 1**.

IMPLEMENTATION

This research uses simple tools and materials, research locations, and sample testing on students. This research was conducted in the Physics Material Lab at Surabaya State University. Students who were used as benchmarks totaled five people. The results of this study are responses to shape, color, smell, visual taste, homogeneity, acidity (pH), spreadability, adhesiveness, and irritation level on student skin. In this research cycle, there are four stages, including preparation, implementation, observation, and reflection on five research student subjects. In this study, the test method by giving effect to the sample related to the things mentioned above. After that, observations were made to determine the level of the sample's ability as an anti-acne ointment ingredient during the testing process. The data obtained was then analyzed using descriptive analysis techniques, namely by finding the best sample composition as a sample ingredient. Then, the experimental results were compared with previous research related to ointment sedan samples using natural ingredients. This research is said to be successful if the level of similarity between natural and synthetic ointments reaches 98%.

RESULT AND DISCUSSION

Organoleptic Test

This test was carried out for storage for two weeks with testing once a week. Organoleptic tests were carried out by observing the shape, smell, colour of the ointment. According to O'Neill *et al*. (2024), organoleptic results in good natural ingredient ointment preparations, namely semi-solid shape, brownish yellow color, and distinctive smell of temulawak rhizome extract. After that in this study, temulawak rhizome extract ointment sediment showed good results without any changes in shape, smell, and colour within two weeks. The results of the organoleptic test can be seen in **Table 2**.

Table 2. Organoleptic test results of ginger rhizome extract ointment

Week	Ointment type	Shape	Smell	Colour
1	Formula 1	half solid	the distinctive smell of ginger rhizome	brownish yellow
	Formula 2	half solid	the distinctive smell of ginger rhizome	brownish yellow
	Formula 3	half solid	the distinctive smell of ginger rhizome	brownish yellow
2	Formula 1	half solid	the distinctive smell of ginger rhizome	brownish yellow
	Formula 2	half solid	the distinctive smell of ginger rhizome	brownish yellow
	Formula 3	half solid	the distinctive smell of ginger rhizome	brownish yellow

Homogeneity Test

The results of the homogeneity test on temulawak rhizome ointment in both sample 1, sample 2, and sample 3 with a holding time of two weeks showed homogeneous ointment preparation results. This shows that the medicinal ingredients are dispersed in the base material evenly, so that each part of the preparation contains the same amount of medicinal ingredients with a percentage level of 100%. This is in accordance with research conducted by Lidyawati *et al.* (2021), who reported that good sample preparation is a level of homogeneity with a percentage above 90%. The results of the homogeneity test of the temulawak rhizome sample sediment can be seen in **Table 3**.

Tabel 3. Homogeneity test results of ginger rhizome ointment

Week	Ointment type	Homogeneity	Homogeneity Percentage (%)
1	Formula 1	Homogeneous	100
	Formula 2	Homogeneous	100
	Formula 3	Homogeneous	100
2	Formula 1	Homogeneous	100
	Formula 2	Homogeneous	100
	Formula 3	Homogeneous	100

pH test

According to Chen *et al*. (2018), normal skin has a pH between 4.5 and 6.5, so the ointment preparation must have the same pH as the normal pH of the skin. The suitability of the pH of the skin with the pH of the ointment preparation affects the skin's acceptance of the preparation. The pH of the ointment preparation must be ideal so as not to irritate the skin. The possibility of skin irritation will be very high if the preparation is too acidic or too alkaline. In this study, ointment preparations in formulations 1, 2, and 3 had a pH of 5 as shown in **Table 4**. This shows that the temulawak rhizome extract ointment meets the standard of ointment for human skin, which is between 4.5 - 6.5 (Bellmann *et al*., 2018).

Table 4. Results of pH test of ginger rhizome extract ointment

Week	Ointment type	pH
1	Formula 1	5
	Formula 2	5
	Formula 3	5
2	Formula 1	5
	Formula 2	5
	Formula 3	5

Spreadability Test

The spreadability test for each ointment preparation is carried out to see the ability of the preparation to spread on the skin, where an ointment base should have good spreadability to ensure satisfactory administration of medicinal ingredients. The difference in spreadability greatly affects the speed of diffusion of the active substance

through the membrane. The wider the membrane where the preparation spreads, the greater the diffusion coefficient which results in increased drug diffusion, so the greater the spreadability of preparation, the better. According to Abbasi *et al*. (2021), the spreadability requirements for ointment preparations are around 5-7 cm, so based on the results of the spreadability test on the preparation, it can be said that the preparation meets the requirements for good spreadability. In the temulawak rhizome extract ointment preparation, the spreadability was quite good at a load of 100 grams in the first week and the second week with an average of 5.56 cm and 5.46 cm respectively. This shows that the temulawak extract ointment preparation sample fulfills the requirements of an ointment preparation, as listed in **Table 5**.

Table 5. Results of the spreadability test of curcuma rhizome extract ointment

Week	Ointment type	Spreadability (100 grams) (cm)
1	Formula 1	6.0
	Formula 1	5.5
	Formula 1	5.2
2	Formula 1	5.9
	Formula 1	5.4
	Formula 1	5.1

Adhesion Test

Based on the results of the temulawak rhizome extract ointment adhesion test, it is found that formula 1 has the best adhesion strength among the other 2 formulas. This is due to the difference in the amount of weight of the Vaseline album and Adeps lane in each formula. This is in accordance with research conducted by Lidyawati et al, (2021) which shows that ointment preparations at a percentage of 10% show low adhesion, namely at 14 seconds. This is due to the low percentage of Vaseline album and Adeps lanae, namely 15 grams and 2.5 grams. Based on **Table 6**, the best adhesion value of temulawak rhizome ointment sediment is in formula 1 ointment sediment with 5% temulawak rhizome concentration. This is because the total weight of the Vaseline album and Adeps Lanae is 16.15 grams and 2.85 grams, respectively. So, the results of the adhesion test on formula 1 ointment sedian showed superior results compared to formulas 2 and 3 and did not change in both the first and second weeks.

Table 6. Adhesion test results of Curcuma longa rhizome extract ointment

Week	Ointment type	Stickiness (s)
1	Formula 1	15
	Formula 2	12
	Formula 3	10
2	Formula 1	15
	Formula 2	12
	Formula 3	10

Irritation Test

Based on the previous pH test, which showed that the Curcuma rhizome ointment had a pH of 5, an irritation test was carried out on five volunteers. The results showed that the skin of the volunteers did not experience irritation, such as redness, on the volunteer's skin, so the preparation of temulawak rhizome ointment did not cause irritation, as shown in **Table 7**.

Table 7. Irritation test results of Curcuma rhizome extract ointment

Ointment type	Irritation				
	1	2	3	4	5
Formula 1	-	-	-	-	-
Formula 2	-	-	-	-	-
Formula 3	-	-	-	-	-

CONCLUSION

In the organoleptic test on the preparation of temulawak rhizome extract ointment, the results were obtained in semi-solid form, brownish yellow color, and the distinctive smell of temulawak rhizome extract. After that, the pH test on the ointment shows a value of 5, which means that the ointment has the same pH as the normal pH of the skin and meets the pH standards of human skin, which is between 4.5 and 6.5. Likewise, the skin irritation test showed no irritation on the skin of the volunteers. Then, the ointment formulation has no effect on its homogeneity; this is shown in formulations 1, 2, and 3, all of which show homogeneous ointments. Good homogeneity also affects the adhesion of the ointment. The results of the ointment adhesion test showed very good results, which were above 10 seconds. Based on the test results that have been carried out, the best formulation of temulawak rhizome sample ointment is in formula one. This is because formula one has higher adhesion and spreadability than formulas two and three.

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