

PHYSICAL EVALUATION OF CURCUMA RHIZOME EXTRACT (*Curcuma xanthorrhiza*) FORMULATION IN ANTI ACNE LOOSE POWDER

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ABSTRACT

When *Staphylococcus aureus* and *Staphylococcus epidermis* are isolated from acne-prone skin, the essential oil and curcuminoids in curcumin (*Curcuma xanthorrhiza* Roxb) exhibit antibacterial activity against blemished skin. The purpose of this study was to create an anti-acne loose powder using *Curcuma* rhizome extract and to determine which formulations meet the best test requirements. Extraction was carried out using the maceration method with 96% ethanol solvent. The powder formulation consisted of alba bolus, magnesium carbonate, magnesium stearate, zinc oxide, oleum rosae, and talc, developed with temulawak rhizome extract at concentrations of F0 (0%), F1 (8%), F2 (10%), and F3 (12%). The evaluation of the powder preparation was organoleptic, humidity, powder flow rate, specific gravity, and pH.. The results indicated that the F1 formulation's humidity test results of less than 10%, the speed of the powder flow evaluation test results was 15.6%, the angle of repose test result was 26.6°, and the measurement of pH showed that the result of 6 fulfilled the requirements. Based on a physical test of the anti-acne loose powder, the *Curcuma* rhizome extract in the F1 formulation with an 8% concentration produced optimal results.

Keywords: anti acne, physical evaluation, loose powder, curcuma

INTRODUCTION

Acne is a skin condition caused by bacterial infections, including those caused by *Propionibacterium acnes*, *Staphylococcus Aureus*, and *Staphylococcus Epidermidis*. It develops in hair follicles that are blocked by oil and dead skin cells (Batubara *et al.*, 2020). The face, neck, and upper body are examples of body parts with comparatively higher oil gland densities that may experience long-term persistence of this skin condition. This may have financial and emotional repercussions for patients (Waranuch *et al.*, 2019).

Infectious diseases are mostly treated with antibiotics. Antibiotic side effects include skin irritation and bacterial resistance when inappropriately used. Therefore, it is essential to create alternative medications that use active antibacterial components from herbal plants for both treatment and prevention (Józsa *et al.*, 2020). The use of herbal ingredients in Indonesia has increased and is considered to have fewer side effects (Sambou Wibowo and Taurhesia, 2017). Topical therapy using herbal substances is a feasible option because it is risk-free, familiar, easy to administer, affordable, and multipurpose. (Nihal *et al.*, 2018), Therefore, in this research the development of herbal medicine was carried out by making loose powder preparations from curcuma rhizome extract.

As the loose powder has a powdery texture and is smooth, soft, light, and suitable for use on oily skin, especially on the face, ladies tend to use it daily. (Chubinidze, Abuladze and Iavich, 2019). Facial skin care using curcuma extract as a powder can be applied to

prevent acne caused by bacterial infections (Putri, 2013). Curcuma consists of curcuminoids in essential oils, which have numerous applications, including against acne bacteria or germs (Anastasya, Rahmat and Budiati, 2020).

The colorful molecule curcumin and its derivatives, which have effects on *acne vulgaris*, cancer, tumors, and hepatoprotection, as well as being antioxidants and hypocholesterolemic, create the curcuminoid portion of curcuma. as opposed to volatile essential oils that exhibit fungistatic and bacteriostatic characteristics (Natalia, Sari and Pratiwi, 2015).

The research Soebagio, soeryati and K, 2006 demonstrated that Curcuma rhizome extract in cream compositions with an oil-in-water base at concentrations of 1.9%, 3.8%, and 7.6% successfully suppressed the growth of acne-causing bacteria. The most effective antibacterial activity was observed at a 7.6% concentration of Curcuma rhizome extract without irritation.

MATERIAL AND METHOD

Tools and Materials

The instrument used in this research was a 100 mL Pyrex measuring cups, 25 mL pycnometers, analytical balances, vessel containers, tongs, rotary evaporators, ovens, and pH meters. The materials used in this study were Curcuma rhizome, 95% ethanol, alba bolus, zinc oxide, magnesium stearate, magnesium carbonate, talc, liquid paraffin, and oleum rosae.

Research Procedure

1. Simplicia Preparation

Curcuma rhizomes (determination number 048/KET/lab) PHB/G/2021) from Cileuleuy Village, Cigugur District, Kuningan Regency, were collected when they were ready to be harvested, which took approximately 9–10 months. Large, brownish-yellow curcuma rhizome samples were cleaned under running water before being sliced, dried in an oven at 0°C, and ground in a blender.

2. The Preparation of Curcuma Rhizome Extract

The extract was prepared using the maceration method. Simplicia (500 g) were macerated in 96% ethanol at a ratio of 1:5. The simplicia were macerated for 24 hours under continuous stirring. Subsequently, a re-maceration was performed. This extract was filtered and evaporated using a rotary evaporator to obtain the concentrated extract.

3. Formulation of Powder Preparation of Curcuma Rhizome Extract

All ingredients were weighed in accordance with a predetermined dosage to produce a loose powder from the Curcuma rhizome extract. Zinc oxide was passed through a sieve number of 100 before being weighed, and the powder was homogenized. It must be ground again to create uniform, soft particles (M1), after which it should be smoothed out in a mortar with the addition of Curcuma rhizome extract and dried with talc. After being combined in a mortar, alba bolus alba, magnesium stearate, magnesium carbonate, and zinc oxide were finely ground to homogeneity (M2). M1 and M2 were mixed with three drops of oil from the roses. The preparation was packed in a container for loose powder after sifting once more with a sieve number of 100. Table I lists the ingredients used to create the Curcuma rhizome extract formulations for loose acne powder.

Table I. Formulation of anti-acne preparation of Loose Powder Curcuma Rhizome Extract

Material Name	F0	F1	F2	F3
Extract Curcuma Rhizome	-	8	10	12
Bolus Alba	10	10	10	10
Zinc oxide	10	10	10	10
Magnesium carbonate	5	5	5	5
Magnesium stearate	6	6	6	6
Oleum rosae	qs	qs	qs	qs
Talc	ad 100	ad 100	ad 100	ad 100

Description:

F0 = without curcuma rhizome extract (0%),

F1 = curcuma rhizome extract (8%),

F2 = curcuma rhizome extract (10%)

F3 = curcuma rhizome extract (12%)

4. Physical Evaluation

a. Organoleptic Measurement

Researcher did an Organoleptic measurements were performed to examine loose powder preparations using the senses of odor shape and color (Elisabeth, YamLean and Supriati, 2018).

b. Moisture Test

The powder was weighed up to 5 g, placed in a porcelain crucible with a diameter of 2-4 cm, and dried in an oven at 110 °C until the weight remained constant. (Akelesh *et al.*, 2010).

c. Powder Flow Rate Test

The researcher took 20 g of each ingredient, added it to the bottom of the funnel, closed it with fingers, and then lifted the lid. The process time was set using a stopwatch, and the results were noted. Calculating the flow rate involves dividing the powder weight by the unit flow time (g/second) (Khairunnisa *et al.*, 2016).

Measuring the Angle of Repose

The observations were conducted using a funnel with a large diameter, entering the powder (the funnel had previously been closed with a finger) and then released from the mouth of the funnel until the powder flowed. The height of the powder was measured (h), the base diameter was measured (r), and the pile angle (f), which is the angle of repose that is computed, can make the powder appear conical (Lacham, Lieberman and Kanig, 1994; Voigt, 1994).

$$\tan = \frac{\text{Height}}{\text{Radius}}$$

d. (ρ) Specific Gravity Test

Specific gravity (ρ) was calculated using a pycnometer. When paraffin was added to an empty picometer with a known volume (a), it was weighed again (b) and the specific gravity was calculated using equation (c):

$$\rho = \frac{c - b}{a}$$

Analysis Data

Research data were collected, processed, analyzed, and presented in tabular form.

RESULT AND DISCUSSION

Curcuma rhizome extraction was completed using a maceration process with 96% ethanol as the solvent. Because the active ingredient is not resistant to high-temperature conditions, this technology is based on a straightforward, simple-to-do process. (Santoso and Riyanta, 2020). Sample extraction using 96% ethanol was chosen because it can separate out the simple content, polar, semi-polar, and non-polar (Sambou, Wibowo and Taurhesia, 2017). The extraction of Curcuma rhizome yielded a thick extract of 59.3 g with a yield of 11.86%.

Organoleptic Test

The results of the organoleptic tests are presented in [Table II](#).

Table II. The Result of Organoleptic Loose Powder Preparation for anti-acne from Curcuma Rhizome Extract

Formulas	Indikator Uji Organoleptik		
	Texture	Color	Aroma
F0	Smooth	White	oleum rosae typical
F1	Smooth	Yellowish white	oleum rosae and curcuma typical
F2	Smooth	Yellow	Curcuma typical
F3	Smooth	Light Yellow	Curcuma typical

F0's organoleptic results were white in color and had a characteristic oleum rosae odor, whereas F1, F2, and F3 were yellowish in color and had a curcuma odor. Curcuma rhizome extract contains curcuminoids and produces a yellow tint. In the food and cosmetics industries, curcuminoids are employed as natural colors with a distinctive yet non-toxic odor (Dermawaty, 2015). In addition, the essential oil in Curcuma rhizome also gives a sharp taste and a distinctive aromatic odor, so that it can be used as a fragrance ingredient (Putri, 2013).

The moisture Test

A moisture test was carried out to determine the presence of levels in the anti-acne loose powder preparation of Curcuma rhizome extract; the results are shown in [Error! Reference source not found. Table III](#).

Table III. Moisture Test Results for Loose Powder Anti-Acne Extract of Curcuma Rhizome

Formulas	Before baked (g)	After Baked (g)	Humidity (%)	Water Level (%)
F0	5	4,9	2	2
F1	5	4,92	1,6	1
F2	5	4,91	1,8	1
F3	5	4,86	2,8	2

The moisture test results of the four formulations were within 10% of those required for preparations using the loose curcuma extract powder. The ability of this loose powder to absorb facial sweat is correlated with moisture content. The water content in loose powder preparations aims to increase the thickness of the layer absorbing water, which will increase the strength of the liquid bridge formed between the powder particles. The water content was considered good when it was less than 14% (Hadisoewignyo and Fudholi, 2013).

Oil secretion may be more easily absorbed when the moisture content is high. Long-term storage may result in an increase in moisture content, which leads to natural conditions. Thus, it is difficult to absorb oil under these conditions. Because moisture is not absorbed by

the components of loose powder preparations, it is necessary to store them in closed containers.

Powder Flow Rate Measurement

a. Measuring the speed of powder flow time

Measurement of the flow time velocity is needed to determine whether the powder used has good flow properties before starting or further processing (Lestari *et al.*, 2014). The results of the flow rate measurements are listed in **Table IV**.

Table IV. The Results of the Flow Rate Test of powder for Anti-Acne loose powder of Curcuma Rhizome Extract

Formula	Powder Weight (g)	Average Repetition Time of Powder Flow	Powder Flow Rate Results (g/minute)
F0	20	00:02:05	16,0
F1	20	00:02:08	15,6
F2	20	00:01:49	18,3
F3	20	00:01:37	20,61

According to the specifications for good powder flow characteristics, it is 12–16% based on the good powder flow rate produced by F0 and F1. F0 had a flowability of 16.0%, and F1 had a flowability of 15.0%. The flow times for F2 and F3 were respectively 18.3% and 20.6%. The higher the Carr's index value, the worse the flowing powder.

The flow properties of the powder are affected by particle shape, particle size, particle size distribution, moisture content, and interparticle cohesiveness (Khairunnisa *et al.*, 2016). The high moisture content of the powder can strengthen the cohesive force that holds the powders together. The powder finds it challenging to flow freely because of the strong cohesive forces. When the powder can flow easily, it is considered good and suitable for use as a preparation (Elisabeth, YamLean and Supriati, 2018). Thus, the flow rate of the powder in the powder preparation of Curcuma rhizome extract was considered to be good.

b. Determination of Angle Repose

The angle of repose was determined to determine the cohesiveness of the powder particles in the powder preparations. The results for determining the angle of repose are listed in **Table V**.

Table V. Results of Determining the Angle of repose for Anti-Acne Loose Powder of Curcuma Rhizome Extract

Formula	High Average	Spoke Average	Tan
F0	3	4,5	31°
F1	3,5	11,8	26,6°
F2	3	8,9	31°
F3	3,4	9	35°

The results of the four formulas' angles of repose ranged from 20 °to 40°, as shown in the table above. There was a variation in how well the conditions were met; F1 fell into the category of a good angle of repose, which was between 25° and 30°, whereas F0, F2, and F3 had a reasonably good angle of repose, which was between 30° and 40°.

The angle of repose is a measure of powder cohesiveness, which occurs when the interaction force between the particles exceeds the gravitational attraction of the particles (Gibson, 2009). The particle size has an impact on the size of the angle that results; the

stronger the cohesive force, the smaller the particle size. High cohesiveness makes the powder harder to flow and increases the angle of repose (Elisabeth, YamLean and Supriati, 2018).

Specific Gravity Test (p)

The specific gravity test was used to determine the thickness and purity of a substance by calculating its specific gravity; if the specific gravity was close, then the substance had high purity. The results of the specific gravity tests are listed in [Table VI](#).

Table VI. Specific Gravity Test for Anti-Acne Loose Powder of Curcuma Extract rhizome

Details	F0	F1	F2	F3
Pycnometer volume (mL)	25	25	25	25
Empty pycnometer weight (g)	23,45	13,28	13,28	23,46
Pycnometer + paraffin (g)	43,54	33,02	33,02	43,54
Pycnometer + 2 g of powder (g)	25,51	15,30	15,48	34,69
Pycnometer + 2 g of powder + paraffin (g)	45,30	34,24	34,28	44,78
Density (ρ)	0,8	0,8	0,8	0,8
Correct specific gravity (g/mL)	0,43	0,49	0,5	0,72

F0 = 0.46, F1 = 0.49, F2 = 0.5, and F3 = 0.72 were the findings of the specific gravity test. The F2 formula results in a value of 0.72, which is close to the density of the liquid paraffin weight, which is 0.8. This indicates that the purity of the extract increased with increasing extract concentration.

According to Soehatmo, Brotosudarmo and Limantara, 2014 the higher the molecular weight of each preparation, the higher is the specific gravity will also increase. (Handayani, Hidayati and Aprilianti, 2018) claimed that the greater quantity of Curcma rhizome extract was a contributing factor in the rise in the specific gravity of each recipe, which also affected the preparation's anti-acne loose powder.

pH Measurement

The purpose of the pH test was to ascertain the product's storage stability and compliance with the pH of the human skin to prevent skin irritation. [Table VII](#) presents the results of the pH test for formulations using loose powder.

Table VII. pH Test Results for Loose Powder for anti-acne of Curcuma Rhizome Extract

Formula	pH
F0	5
F1	6
F2	6,5
F3	6,5

The pH test findings revealed that the base (F0) of the loose powder formulation had a pH of 5, while F1 had a pH of 6 after the addition of 8% Curcuma rhizome extract. In the meantime, a pH of 6.5 was achieved for formulae 2 and 3. According to physiological pH, all formulations satisfied the requirements for loose powder; additionally, the addition of more extract resulted in a higher final pH value. Because the physiological pH range of human skin is 4.5 and 6.5, powder preparations must match this range (Tranggono and Latifah, 2013). As a result, the compatibility of pH can affect how well the preparation is received on the skin. Preparations are considered optimal when they do not irritate the skin.

Itching may result from the overly acidic or alkaline pH of the preparation (Ulaen, Banne and Suatan, 2012).

CONCLUSION

Based on the findings of this study, it can be stated that Curcuma rhizome extract can be made into a loose powder that meets the physical quality requirements, and formula F1 with 8% curcuma extract concentration is the best formula that is suitable for loose powder preparation testing.

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