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Formulation and evaluation of soap preparations from *Curcuma zedoaria* rhizome

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Abstract

Background: Maintaining skin cleanliness is one of the effective ways to maintain the health of the body caused by infections caused by microorganisms. A simple way to maintain skin cleanliness is to clean the skin using soap. Soap functions to clean dirt and can inhibit pathogens found on the surface of the epidermis. The purpose of this study is to determine the effect of different concentrations of temu putih rhizome infusion on solid soap preparations
Method: this study is experimental. The difference in the concentration of active ingredients in the infusion of temu putihs was 0%, 5%, 7.5%, and 10%. The process of making infusions starts from making simplicia powder. The preparation tests carried out are organoleptic testing, pH test, foam height test and foam stability.
Results: the results of the study showed that the amount of simplicia powder obtained was 535.1 grams with a percentage of simplicia yield of 17.40%. The results of the characteristic evaluation were obtained in the organoleptic test of the color of the difference influenced by the difference in the concentration of the added infusion. The results of the pH test of the solid soap formula of the temu putih rhizome infusion meet the set standards, namely with a pH value between 9.27 – 9.87 so that it is safe to use on the skin.
Conclusion: Based on the research conducted, it can be concluded that the infusion of rhizome of Curcuma zedoaria can be formulated into preparations in the form of solid soap and the difference in the concentration of infusion of curcuma has an influence on organoleptic testing, pH, and foam height as well as foam stability.

Keywords: Solid soap; Formulation; *Curcuma zedoaria* rhizome

INTRODUCTION

The skin has a function as a protective organ that covers the entire surface of the body. The skin layer provides protection against the body's organs from various physical threats, including friction, pressure, and temperature changes, as well as exposure to radiation and ultraviolet rays. When damage or injury occurs to the skin, the skin barrier can be disrupted, allowing the entry of pathogenic microorganisms or other infectious agents (1). So maintaining skin hygiene is one of the efforts to protect the skin from these various problems. One simple way to maintain skin hygiene is to clean the skin using soap.

Soap is an oil-based compound produced through the saponification process, namely the reaction between fatty acids and alkalis (Sodium hydroxide or Potassium hydroxide)(2). Soap functions as an essential cleaning agent in daily life with a working mechanism that lowers the surface tension of the water so as to increase the ability of water to wet and clean surfaces more efficiently. Soap also has an important role in eliminating organisms by inhibiting and eradicating pathogens found on the surface of the epidermis so that reduce the risk of infections caused by pathogenic microorganisms. In addition, soap is also designed to provide additional benefits such as softening, brightening and maintaining healthy skin (3).

One of the active ingredients that can improve the function of soap as a cleaning agent and inhibit microorganisms in soap preparations is the rhizome of temu putih. Temu putih putih is one of the plants that are easy to find in Indonesia. The content of flavonoid compounds. Saponins and tannins in temu putih have benefits as antibacterial

so that they can inhibit the growth of bacteria on the skin(4).

Temu putih *(Curcuma zedoaria)* contains curcumin compounds of 3-5%. Curcumin compounds contained in temu putih are proven to have various properties, including as anti-inflammatory and antioxidant which is beneficial for skin health, anticancer, antifungal, antimicrobial, and hepatoprotective agents. In addition, curcumin can also contribute to overcoming metabolic disorders by increasing bile acid secretion (5).

The content of metabolite compounds contained in temu putih includes essential oils, starch, curcumin, gum, terpenoids, alkaloids, saponins, flavonoids, glycosides, carbohydrates, phenols, tannins, and phytosterols. Flavonoid compounds, saponins, and tannins are compounds found in temu putih that have activity in inhibiting bacterial growth (6)

Based on the above context, researchers are interested in making a solid soap preparation infusion of temu putih rhizomes.

METHOD

This research was conducted in the Biomedical Laboratory of the Faculty of Medicine, University of Jambi. This research is experimental in several stages including the production of temu putih simplicia from the rhizome, temu putih rhizome infusion, solid soap preparations and the evaluation of the physical characteristics of soap preparations.

The rhizome of temu putih is made by drying the rhizome of temu putih that has been cleaned and in the oven at a temperature of 45°C for 48 hours. The results of the temu putih rhizome oven are weighed as dry weight. Next, dry sorting is carried out to separate the remaining impurities. After that, pollination is carried out using a grinder to produce temu putih simplicia powder and the percentage of simplicia yield obtained is calculated, namely the percentage of simplicia powder weight (b/b) between the yield and the weight of simplicia powder used by weighing.

The infusion was made as much as 50g of temu putih simplicia powder was put into a 100 ml aquadest test tube to be processed into an infusion solution with a concentration of 50%. Next, the mixture is heated in a water heater with a temperature of 90°C for 15 minutes. The volume of the aquadest solvent is adjusted until it reaches a volume of 100 ml with the addition of aquadest. After that, the solution is filtered with filter paper and accommodated in a 100 ml erlenmeyer glass and tightly closed.

1. Temu Putih Rhizome Infusion Solid Soap Formula

Table 1. Formula of Solid Soap

Ingredients	Consentration %(w/w)			
	Basis	F1	F2	F3
Infusion of Temu Putih	0	5	7.5	10
Coconut oil	18	18	18	18
NaOH	7.5	7.5	7.5	7.5
Acid Stearic	11	11	11	11
Etanol 96%	15	15	15	15
Gliceryn	18	18	18	18
Aquadest	Ad 100	Ad 100	Ad 100	Ad 100

Research by Sujono et al. demonstrated that infusions of white ginger rhizome at concentrations of 5%, 10%, and 20% exhibit anti-inflammatory effects in rats induced with carrageenan (7). A 10% concentration of white ginger infusion was found to be the most effective for healing laparotomy wounds, attributed to its antioxidant and antibacterial activity (8). These antibacterial and antioxidant activities contribute to maintaining skin health and preventing skin diseases.

2. Production of Solid Soap Infusion of Temu putih Rhizomes

The soap preparation formulation process consists of several stages, starting with weighing raw materials. Dissolve 7.5 grams of NaOH in 10 ml of water. The weight of the beaker glass to be used is weighed. Next, on a hot plate, melt 11 grams of stearic acid in a glass beaker at a temperature of 60 -70, put 18 grams of coconut oil in the stearic acid solution and stir until homogeneous. Add 18 grams of glycerin and stir until homogeneous. Pour the dissolved NaOH

into the beaker glass, mixing performed a hand mixer and carried out in hot conditions (on a hotplate). Add 15 grams ethanol 96%. Infusion of temu putih rhizome is added and stirred until homogeneous, and then aquadest are added up to 100 grams. All ingredients homogeneously mixed before proceeding to the printing stage.

Evaluation of Physical Characteristics of Temu putih Infusion Soap

1. Organoleptic Test

Organoleptic testing is carried out by physical observation by directly looking at the color, shape and aroma of soap preparations that have been tested for stability (9).

2. pH Test

pH testing is carried out with a pH meter. A total of 1 gram of soap preparation that has been tested for stability is cut into small pieces and put into a glass beaker, then dissolved with aquades until the volume reaches 10 ml. Next, the calibrated pH meter is dipped into the solution. The results of the pH degree measurements of each preparation are recorded for further analysis (10).

3. Foam Height Test and Foam Stability

Solid soap samples that have been tested for stability are weighed as much as 1 gram, then put into a test tube containing 10 ml of aquadest and closed. The tube is beaten for 5 minutes, and the height of the foam formed is measured. For foam stability testing, 1 gram of soap that has passed the stability test is put into a test tube with 10 ml of aquaades, then shaken by turning the tube over for 5 minutes. After shaking, the height of the initial foam is measured using a ruler. Five minutes later, the foam height is measured again to get the final foam height. The stability of the foam is calculated.

RESULTS

1. Manufacture of Temu Putih Simplicia

The sample of the temu putih was taken as much as 4.32 kilograms, then a wet sorting and washing process was carried out to prepare the sample to be used. After cleaning the rhizomes that are not needed, such as the skin is peeled off and the rhizomes that have been cleaned are cut into pieces until 3074.88 grams of samples are obtained that are ready to be dried.

Table 2. Simplisia Yield

Categories	Result
Initial sample weight	3074,88 gram
Weight of simplicia obtained	535,18 gram
Rendemen of simplicial	17,40%

1. Identification of Temu putih Rhizome Infusion

The following are the results of the observation of the infusion of the rhizome of the temu putih produced

Table 3. Observation Results of Temu Putih rhizome infusion

Observation parameters		Result
Plant Identity	Latin Names of Plants	*Turmeric zedoaria*
	Indonesian names	
	Parts used	Temu Putih Rhizome
Organoleptic Testing	Shape	Liquid
	Color	Brownish light yellow
	Taste	Bitter
	Smell	Typical temu putih

1. Preparation of Solid Soap Infusion of Temu putih Rhizomes

Solid soap preparations are made in several formulations with different concentrations of infusion of temu putih rhizomes. The concentration of infusion for each formulation was the base formula (0%), formula 1 (5%), formula 2 (7.5%) and formula 3 (10%).

The preparation obtained is in the form of a solid soap that is white at the base and yellow to brownish-orange in formula 1 to 3 based on differences in infusion concentration and has a distinctive odor of oleum rosae. Furthermore, the resulting soap is evaluated against organoleptic test, pH test and foam height test as well as foam stability.

2. Physical Characteristics Evaluation

1. Organoleptic Testing

The results of the organoleptic test of solid soap preparations infusion of temu putih rhizomes were observed to have changes in color, shape and odor, namely

Table 4. Organoleptic Test Results

Formula	Organoleptic Testing		
	Color	Form	Smell
Base	White	Solid	Rose
F1	Yellow	Solid	Rose
F2	Brownish yellow	Solid	Rose scent
F3	Brownish orange	Solid	Rose scent

Information:
Infusion composition (Base= 0%; F1 =5%; F2 = 7.5%; F3 = 10%)

The increasingly intense color is the influence of the higher concentration of the temu putih rhizomes infusion on the solid soap formulation.

The color of the infusion is brownish-yellow. The higher the concentration added, the darker the brown color of the soap becomes

Table 5. pH Test Results

Formulation	pH Test Results			
	R1	R2	R3	Avera-ge ± SD
Basis	9.72	9.87	9.73	9.77 ± 0.068
F1	9.5	9.27	9.6	9.46 ± 0.138
F2	9.56	9.44	9.7	9.57 ± 0.106
F3	9.76	9.28	9.56	9.53 ± 0.197

Information:
Infusion composition (Base= 0%; F1 =5%; F2 = 7.5%; F3 = 10%)

2. pH Test

The pH test results of each solid soap preparation formula of temu putih infusion have met the pH requirements by the National Standards Agency for Solid Soap.

3. Test Foam Height and Foam Stability

The results of the observation of the foam height in the solid soap infusion of temu putih rhizome ranged from 98 mm to 130 mm.

Table 6. Foam High Test Results

Formulation	Foam Height Test Result (mm)			
	R1	R2	R3	Average ± SD
Basis	130	98	115	114.33 ± 13.072
F1	125	130	110	121.67 ± 8.498
F2	110	132	102	114.67 ± 12.684
F3	115	125	118	119.33 ± 4.189

Information:
Infusion composition (Base= 0%; F1 =5%; F2 = 7.5%; F3 = 10%)

The results of the foam stability test obtained ranged from 90.91% to 96.15% showing that the foam produced had good stability.

Table 7. Foam Stability Test Results

Formulation	Foam Stability Test Results (%)			
	R1	R2	R3	Average ± SD
Basis	96.15	91.84	95.66	94.55 ± 1.927
F1	96	96.13	92.73	94.95 ± 1.573
F2	90.91	96.99	94.12	94.01 ± 2.483
F3	95.66	94.4	91.53	93.86 ± 1.728

Information:
Komposisi infusa (Basis= 0%; F1 =5%;F2 = 7,5%; F3 = 10%)

The higher the percentage of foam, the more stable the foam produced. Foam is produced from the influence of the saponification process between fatty acids and alkalis.

DISCUSSION

The sample of the temu putih was taken as much as 4.32 kilograms, then a wet sorting and washing process was carried out to prepare the sample to be used. After cleaning the rhizomes that are not needed, such as the skin is peeled off and the rhizomes that have been cleaned are cut into pieces until 3074.88 grams of samples are obtained that are ready to be dried. The drying process is carried out with an oven at a temperature of 50°C for 48 hours, this is

done to accelerate the reduction of moisture content, while maintaining a stable temperature so that the quality of the simplicia remains optimal (11).

After drying, the sample was crushed using a grinder to produce temu putih simplicia powder weighing 535.18 grams. Based on the calculation results, a simplified yield of 17.40% was obtained. This value is in accordance with the requirements of the yield of a raw material or simplicia, which is > 10%. If the number of active compound yields is higher, the number of active compounds contained in simplicia is higher (12).

The extraction process was carried out by the infusion method with a concentration of 50% temu putih so that the amount of temu putih powder used was 50 grams which was added in 100 ml of aquadest and heated at a temperature of 90°C for 15 minutes. The infusion method was chosen to be able to attract compounds in white meet that have a hard texture. In addition, the solvent used in the infusion method, namely aquadest, is very easy to obtain.

Based on the observation of the infusion of temu putih rhizomes produced and used in the research, the material used is the areca nut plant which has the Latin name Curcuma zadoaria. The part used in making infusions is the rhizome part. From the results obtained, the infusion of the rhizome of temu putih has a liquid form of light yellowish brown, bitter taste, and has a distinctive aroma or smell of temu putih (13).

The process of making temu putih infusion solid soap in this study was carried out by a heating process at a temperature of 60-70°C. The heating process at this temperature aims to melt and maintain the effectiveness of soap raw materials. If heated at temperatures that are too high or too low, it can cause the seponification process to be disrupted.

The principle of the saponification process is the melting of fatty acids with alkali. Fatty acids are found in a free state or bound state as oils or fats (glycerides) that are reacted with alkali to produce soap and glycerol(14). The fatty acids used in soap preparations are coconut oil and the type of alkali used by sodium hydroxide as alkali and alkaline compounds.

The process of making solid soap infusion of temu putih rhizomes begins by dissolving Sodium Hydroxide into aquades and letting it sit until the solution reaches room temperature. Sodium hydroxide is used as an alkali that will help the soap saponification process. The stearate acid used must be diluted first at a temperature of 60-70°C. Stearate acid serves as a pH lowering and hardens the solid soap that is made. After that, oil and glycerin are added. The addition of glycerin can soften the skin. Furthermore, ethanol is added and an infusion of temu putih rhizomes is added, the addition of ethanol will function as a solvent so that after adding the texture of the preparation will be in the form of a paste and will melt. After finishing printing, a solid soap was obtained.

Evaluation of Solid Soap Preparation Infusion of Temu putih Rhizome

1. Uji organoleptic

   Organoleptic observation was carried out with the aim of finding out whether or not there were organoleptic changes during the storage process from week to week. Organoleptic observation of solid soap is carried out by observing soap preparations in terms of color, shape, and aroma of the preparations that have been made(15).

   Based on organoleptic observations on the color of the solid soap base formula produced is white due to the heating process of coconut oil and NaOH to obtain a soap paste that has a white color and the influence of white soap ingredients (16).

   Meanwhile, In the solid soap preparation, temu putih rhizome infusion with concentrations of of F1 (5%) produced a yellow color, the concentration of F2 (7.5%) produced a brownish yellow color and the concentration of F3 (10%) produced a brownish orange color. This is because the higher the concentration of the temu putih infusion formulated in solid

soap, the more intense the color produced.

The yellow color in soap preparations is caused by the content of curcuminoids (diarylheptanoids) and chemical compounds such as essential oils, zingiberen, sineols, polysaccharides, and other groups that give the white meeting a yellow color (8).

The results of organoleptic observation of the form of solid soap preparations produced are in solid form. Organoleptic observation of the aroma of the four solid soap formulas produced, namely the scent of roses. The aroma produced in soap preparations is influenced by the addition of oleum rosae fragrance added to the soap formulation.

1. pH Test

Acidity degree is a chemical parameter to determine whether the solid soap produced is acidic or alkaline. The pH value of soap that has been set by the national standardization body in 2016 is between 9 – 11 (17). Soap with a pH value that does not meet the standard can cause problems for the skin, one of which can cause irritation and cause allergies (18). So this test is carried out to find out whether the pH value of the preparation made is in accordance with the value that has been set.

The pH test results obtained from the four formula variations had values that met the pH value standard. The resulting pH values are with 3 consecutive replications for the base formula are 9.72, 9.87, and 9.73; Formula 1 (F1) is 9.5, 9.27 and 9.6; Formula 2 (F2) is 9.56, 9.44 and 9.7; Formula 3 (F3) is 9.76, 9.28 and 9.56. Based on the results of the pH test, the acidity value that was reduced was in formulation 2 replication 2, which was 9.27, while the highest acidity value in the base formula, which was 9.87, showed that the pH value obtained met the set standard, namely 9-11 (17).

2. Foam Height Test and Foam Stability

One of the important parameters in determining the quality of soap is the presence of foam that is formed. The resulting foam has a function in preventing redeposition or so that dirt particles that have been dissolved by soapy water do not scavenge or settle again, so that dirt can be wasted with water (2). The characteristics of foam are influenced by the presence of soap active ingredients such as surfactants, foam stabilizers and the combination of fatty acids used 96.15% shows that the foam produced has good stability (19).

CONCLUSIONS

Based on the results of the study, it can be concluded that the infusion of the rhizome of *Curcuma zedoaria* can be formulated into a preparation in the form of solid soap and the difference in the concentration of the infusion of Curcuma white has an influence on organoleptic testing, pH, and foam height as well as foam stability.

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