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RESEARCH PAPER

Cinnamon (Cinnamomum burmannii) bark essential oil as raw material for skin cream and anti-bacterial

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Abbreviation
Gas chromatography-mass spectroscopy (GC-MS)

Abstract: Research has been carried out to identify the essential oil components of cinnamon bark (Cinnamomum burmannii) which will be used in the manufacture of face creams and to test its inhibition against Staphylococcus aureus bacteria. Cinnamon bark essential oil was separated by steam distillation method. The essential oils obtained were identified by gas chromatography-mass spectroscopy (GC-MS) and infrared spectra. The GC-MS chromatogram of cinnamon bark essential oil yielded 3 peaks. The compound that has the largest retention time and concentration is 1,3 octadien-3-ol (linalool). Analysis of absorption data in the infrared spectrum resulted in 3 specific bonds, namely C=O (aldehyde), C=C (aliphatic), and C=N (imin) groups. The results of the formulation and characteristic test of cinnamon bark essential oil cream, all formulations met the National Standard, namely pH 7, adhesion 28.61 seconds, spreadability of 6.1 cm. Inhibition against Staphylococcus aureus was tested using the diffusion method. The greatest inhibitory power was found at a concentration of 15% with a clear zone formed of 2.15 mm.

Keywords: essential oil, cinnamon bark, face cream, antibacterial

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INTRODUCTION

Indonesia is a tropical country that has abundant natural wealth. Various types of flora that grow in Indonesia there are many plants that have the potential as medicine and have been used for traditional medicine [1]. The use of medicinal plants as an effort to deal with health problems has been widely applied by the community. Currently, the price of medicines is relatively expensive, so that Indonesian people tend to use alternatives for treatment. By utilizing medicinal plants in the surrounding environment or better known as traditional medicine. One of the medicinal plants is the bark of Cinnamomum burmannii. The problem is that people do not know about the procedures for using traditional medicines properly and correctly. Therefore, it is necessary to make a formulation in the form of a skin cream.

Essential oil is a substance found in various parts of plants. It is volatile when left in the open air and has an odor like the original plant. Essential oils can be obtained by pressing, steam distillation, and using diethyl ether [2]. Most of the compounds in the bark of the cinnamon plant are cinnamaldehyde, which has an anti-bacterial effect. Cinnamon bark essential oil has an anti-bacterial effect

against Staphylococcus aureus [3]. Cinnamon bark essential oil was obtained using the hydrodistillation technique method. This method is a process of separating chemical components that can be in the form of liquids or solids which are distinguished by their boiling points. The major components of essential oils contained are trans-cinnamaldehyde (60.72%), eugenol (17.62%), and coumarin (13.39%) [4].

Cream is a semi-solid dosage form in the form of an emulsion containing one or more medicinal ingredients. According to Pradipta, the cream is dissolved or dispersed in a suitable base material and contains not less than 60% water [5]. Characteristic test on cinnamon bark essential oil cream was carried out by observing the physical changes of the cream including organoleptic, homogeneity, pH, spreadability and adhesion [6].

This study focused on the isolation of the essential oil of the skin of Cinnamomum burmannii using the steam distillation method. The test of chemical components contained in cinnamon bark essential oil was carried out by gas chromatography-mass spectroscopy and infrared spectroscopy. Test the raw material of a mixture of skin cream that functions as an anti-bacterial according to the Indonesian National Standard, namely the Indonesian Pharmacopoeia Edition IV.

MATERIALS AND METHODS

The tools used in this research are a set of steam distillation apparatus, gas chromatography, infrared spectrophotometer, stative and clamps, erlemeyer, measuring cup, brown glass bottle, stirring rod, analytical balance, oven, beaker, separating funnel, spatula. , dropper, glass object, porcelain dish, water bath, temperature thermometer, cream mixer, autoclave, petri dish, incubator, ose needle, test tube, pH meter.

The materials used in this study were cinnamon bark, aquades, sodium sulfate (Na2SO4), ice cubes, aluminum foil, stearic acid, adeps lanae, liquid paraffin, methyl paraben, propyl paraben, TEA, nutrient agar, 70% alcohol. , cotton, Staphylococcus aureus bacteria, n-hexane.

The study was initiated by preparing 2 kg of cinnamon bark. It was washed and then dried by air drying at room temperature. Furthermore, it was mashed about 1 - 2 cm and sieved with a mesh size 18 sieve, the cinnamon sample was weighed as much as 500 grams for one distillation. A sample of 500 grams of cinnamon was distilled for 8 hours using 1000 mL of distilled water, the distillate obtained was collected in a separating funnel and allowed to stand for 24 hours to separate the water and essential oils. The essential oil obtained was then dried using sodium sulfate in a beaker and covered with aluminum foil for 24 hours and stored in a cool room. The essential oil obtained was taken as much as 2 mL, then analyzed using a gas chromatograph and an infrared spectrophotometer to determine the chemical components contained in the cinnamon bark essential oil sample.

Cream Formulation and Cream Characteristic Test

The essential oil cream formulation made was an oil type cream in water as much as 20 grams. Preparations with different concentrations of the amount of oil used are F0 = 0%, F1 = 5%, F2 = 10%, F3 = 15%. Cream preparations were evaluated for physical characteristics including organoleptic by looking at the shape, color and odor of all cream preparations. Homogeneity test was done by placing sufficient cream preparation on a glass object and covered with deglass and viewed under a microscope, for pH testing was carried out using a pH stick dipped in each cream preparation (F0, F1, F2, F3), and matched the color matched. embossed with the standard pH color (pH box). The dispersion test was carried out by weighing the cream preparation as much as 0.5 grams on a glass plate and then placing a load weighing 50 grams. This was done successively by adding loads of 100 grams, 150 grams, 200 grams, 250 grams, 300 grams, 450 grams and 500 grams. on all preparations (FO, F1, F2, F3,). The adhesion test was carried out by weighing 0.25 grams of cream on a glass object and placing a weight of 1 kilogram, the glass object was mounted on an adhesive test equipment that had been given a load of 80 grams on the left and 80 grams on the right to be pulled until the two glass objects were released. and recorded the time using a stopwatch.

Preparation of Agar Medium and Test of Staphylococcus aureus Bacteria.

In the test of the inhibitory power of cinnamon bark essential oil against Stapylococcus aureus bacteria using nutrient agar (NA) as a bacterial culture medium, the medium made was F0 as a negative control without essential oil, F1 with an essential oil concentration of 5%, F2 with an essential oil concentration of 10 % and for F3 with an essential oil concentration of 15%. The bacterial inhibition test used the agar diffusion

method by measuring the clear zone formed in a petri dish containing cinnamon bark essential oil at each concentration and the medium without essential oil as a positive control using a caliper

$$\text{Essential oil levels} = \frac{\text{Essential Oil Volume}}{\text{Cinnamon bark weight}} \text{ X } 100\ \%$$

$$= \frac{16}{2000} \text{ X } 100\ \% = 0.08\ \%$$

RESULTS AND DISCUSSION

Determination of Cinnamon Bark Essential Oil Content.

The essential oil was obtained by steam hydrodistillation method using distilled water as a solvent. A total of 4 treatments from the hydrodistillation of a 2 kilogram sample obtained 16 mL of light yellow essential oil with an average oil of 12.625 mL (Table 1). The amount of oil obtained is small, namely 16 mL because the samples used are samples purchased in traditional markets. The solvent used is aquadest, so essential oils are difficult to dissolve. In general, essential oils in their fresh state are colorless, smell like the plants they produce and are soluble in organic solvents, but are difficult to dissolve in water [7]. The oil content is 0.8%, during the steam distillation process which can be distilled with water vapor. Only essential oils are on the surface of the material so that the essential oil content obtained is small, namely 0.8%. To obtain as much essential oil as possible, the essential oil which is also distilled with water vapor must have the highest partial pressure possible, this can only be achieved when the temperature of the essential oil is equal to the temperature of the water vapor [8].

Table 1. Essential oil from cinnamon bark obtained by hydrodistillation method

Sample	Oil yield	Average oil yield
Cinnamon bark essential oil	16 mL	12.625 mL

Mass spectrophotometric gas chromatography analysis

Cinnamon bark essential oil obtained was analyzed using a KG-MS-QP2010S instrument with an Rtx column of 30 meters in length which was fed with helium gas. From the gas chromatography results obtained 3 chromatogram peaks can be seen in Figure (1). From the chromatogram image, there is one highest peak, namely the first peak with a retention time of 16.311 minutes and an area of67.96%.

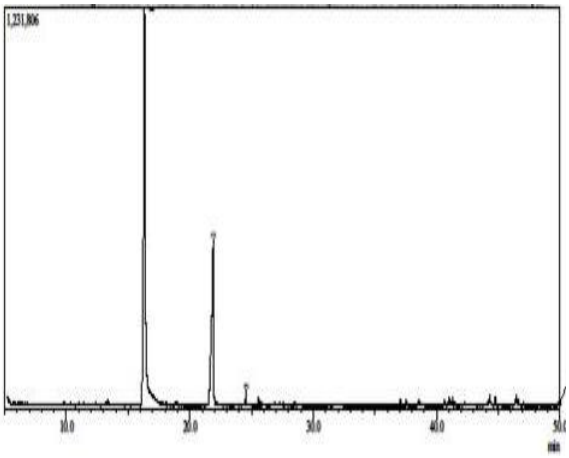

Figure 1. Cinnamon Bark Essential Oil Chromatogram

The results of the mass spectrophotomer analysis based on the NIST62 LIB library data approach and the fragmentation pattern on the mass spectrum showed the first peak of retention time was 16.311 minutes. The area is 67.96, the similarity index (SI) with the molecular formula C10H18O is a compound of 1.6 octadien-3-ol (linalool) with a mass/charge of 136. This compound is the giver of a distinctive aroma in cinnamon plants. The compound that gives cinnamon a distinctive aroma is the linalool compound [9]. Based on the data approach of the WILEY229LIB Library and the fragmentation pattern in the mass spectrum, it is estimated that two peak retention times are 21.896 minutes, area 31.05, similarity index (SI) with the molecular formula C9H8O is a compound 2 propenal,3-phenyl (cinamaldehyde) with mass/charge 154. This compound is the largest compound contained in the cinnamon plant, especially in the skin which functions as an anti-bacterial.

The essential oil of cinnamon bark is also efficacious as an anti-bacterial because of the content of cinnamaldehyde [10]. Based on the WILEY229LIB data library approach and the fragmentation pattern in the mass spectrum, it is estimated that three peaks of retention time are 24.545 minutes, area is 0.99, similary index (SI) with the molecular formula is a trans-caryophyllene compound with a mass/charge of 204 (Table 2).

Table 2. The main constituent components of cinnamon bark essential oil as a result of GC-SM analysis

No. Peak	Retention time (minutes)	Area (%)	Suspected Compound	m/z
1	16.311	67.96	Linalol 1,6 oktadien-3-ol	136
2	21.896	31.05	2 propenal,3-phenyl Cinnamaldehyde	153
3	24.545	0.99	Trans-Caryophyllene	204

Infrared Spectrophotometer Analysis

Infrared spectrophotometer is a tool that can be used to analyze the functional groups present in the sample compound, in this case cinnamon bark essential oil. From the results of the infrared spectrophotometer analysis, there are groups with specific bonds, namely hydroxide, methylene, aldehyde, aliphatic, and imine which are linalool and cinnamaldehyde compounds, which can be seen in Table 3.

Based on the results of infrared spectra of linalool compounds and cinnamaldehyde compounds have an absorption band in the wave number region of 3456.44 cm-1 which has an O-H group (alcohol) in the presence of O-H bonds indicated by an absorption band with a wave number between 3750-3000 cm-1. Next is a straight chain alkane, namely the C-H sp3 bond which has a strong tenuous absorption band and characteristically overlaps each other at wave numbers 2924.09 cm-1 and 2854.65 cm-1. The presence of C-H bonds in the saturated carbon chain as seen from the presence of a methyl (-CH3) and aldehyde can be seen in Figure (2), this is the same as the results of Silverstein's research, namely the C-H sp3 bond is in the absorption band 2800-3000 cm-1 [11] .

Table 3. Infrared absorption data of Linalool and Cinnamaldehyde Functional Groups Cinnamon Bark Essential Oil

BOnd	Bond Specific	Absorption	Vibration
O-H	hydroxide	3456.44 cm^{-1}	stretching
C-H	Methyl	2924.09 cm^{-1}	stretching
CH3	Methylen	2854.65 cm^{-1}	bending
C=O	Aldehide	1674.21 cm^{-1}	stretching
C=C	Aliphatic	1627.92 cm^{-1}	stretching
C=N	imine	1126.43 cm^{-1}	stretching

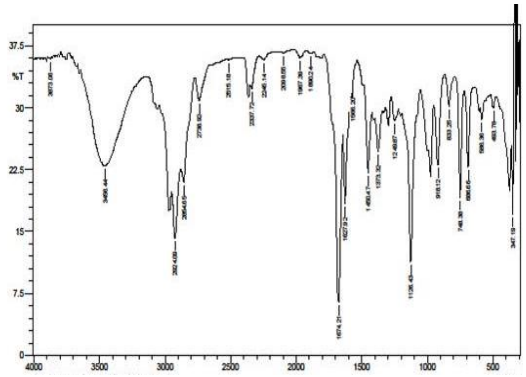

Figure 2. Infrared Spectrum of Cinnamon Bark Essential Oil

Cinnamon Bark Essential Oil Cream Formulation and Cream Characteristic Test

Cinnamon bark essential oil cream made was of the type of oil in water as much as 20 grams for all preparations with different

concentrations of oil used, namely F0 = 0%, F1 = 5%, F2 = 10%, and F3 = 15%. The organoleptic results of the cream preparation at F0 were odorless, white, and semi-solid. The cream preparations F1, F2, and F3 have a characteristic smell of cinnamon, light yellow in color, for F1 it is semi-solid, F2 and F3 are semi-solid and tend to be liquid, it can be seen in Table 4. This means that differences in the composition of the active substance of cinnamon bark essential oil affect the organoleptic properties of cream preparations.

Table 4. Results of Cinnamon Bark Essential Oil Cream Preparations

Cream 20g	FO	FI (5%)	F2 (10%)	F3 (15 %)
Smell	No smell	Cinnamon aroma	Cinnamon aroma	Cinnamon aroma
Color	White	yellow	yellow	yellow
Shape	semi solid	semi solid	semi solid	semi solid

Table 5. Test Results of Cinnamon Bark Essential Oil Cream

Cinnamon Bark Essential Oil Cream	Characteristic Test	
	pH	Homogeneity
F0	6	Homogen
F1	7	Homogen
F2	7	Homogen
F3	7	Homogen

The characteristic test of cinnamon bark cream in this study included pH test, homogeneity test, spreadability test, and adhesion test. The results of the pH and homogeneity test for the F0 preparation obtained a pH value of 6, for F1, F2, F3, the pH value was 7 and all homogeneous preparations can be seen in Table 5. A good cream must have a pH of 4.5-7, namely the pH of the skin, the results obtained in all preparations are pH 6 and pH 7, this means that the pH of the preparation of cinnamon bark essential oil cream can be accepted by the skin and in accordance with national standards, namely the Indonesian Pharmacopoeia. Edition IV.

Table 6. Spreadability Test Results of Cinnamon Bark Essential Oil Cream

Spreadability Test Weight (g)	Cinnamon Bark Essential Oil Cream Formulation			
	F0 (cm)	F1 (cm)	F2 (cm)	F3 (cm)
50	2.5	2.6	2.8	3.0
100	2.7	2.8	2.8	3.4
150	2.9	3.1	3.1	3.8
200	3.0	3.7	3.3	4.2
250	3.3	3.8	3.6	4.4
300	3.6	4.2	4.0	4.6
350	3.6	4.6	4.1	5.0
400	4.3	4.7	4.5	5.3
450	4.3	5.4	4.8	5.6
500	5.4	5.5	5.6	6.1

The results of the dispersion test carried out on the cinnamon bark essential oil cream in the F0 formulation without the active substance of the essential oil, the size of the cream spread at a final load of 4.3 cm did not meet the standardization of cream spreadability of 5-7 cm. This is because on the basis of the cream is not mixed with the active substance of essential oils. The results of dispersion for cream preparations F1 5.5 cm, F2 5.6 cm, F3 6.1 cm, can be seen in Table 6. These results indicate that these three cream preparations meet the National standard of 5-7 cm (Indonesian Pharmacopoeia Edition IV), and this cream can spread either into the epidermis or the middle of the skin perfectly.

The results of the adhesion test on the preparation of cinnamon kilit essential oil cream to release it on the glass object are F0 the resulting time is 16, 26 minutes, F1 22 minutes 70 seconds, F2 24 minutes 36 seconds, and F3 28 minutes 61 seconds can be seen in (Table 7). These results indicate an increase in the adhesion time of all preparations and meet the standardization of the cream stickiness test, which should not be less than 5 minutes (Indonesian Pharmacopoeia Edition IV). This shows that the cinnamon essential oil cream produced has the ability to adhere to the skin perfectly because the longer it takes the cream to stick to the skin, the better the active substance can be absorbed. These results are also the same as those obtained in a study conducted by Elya, in the test of the stickiness of the anti-oxidant cream Solanum licopersicum the average time obtained was above 15 minutes [12].

Table 7. Cinnamon Bark Essential Oil Cream Stickiness Test Results

Adhesion Test	Cinnamon Bark Essential Oil Cream Formulation			
Weight (g)	F0 minute	F1 minute	F2 minute	F3 minute
1 kg	16:26	22:70	24:36	28:61

Inhibitory Test of Cinnamon Bark Essential Oil Against Staphylococcus aureus

Determination of the sensitivity of pathogenic bacteria to antimicrobials can be done by one of 2 methods, namely dilution and diffusion [13]. This study used the agar diffusion method using an anti-bacterial agent of cinnamon bark essential oil with various oil concentrations of 5%, 10%, 15% against Staphylococcus aureus bacteria using n-hexane solvent as a positive control. The results obtained at a concentration of 15% clear zone formed by 8.7 mm, 10% 12 mm, and 15% 15.2 mm for positive control without oil no clear zone formed can be seen in Table 8. The clear zone with the largest concentration contained 15% which is 15.2 mm, the effectiveness of the active substance cinnamaldehyde contained in cinnamon bark essential oil is able to inhibit the growth of Staphylococcus aureus bacteria by preventing cleavage. Inside the bacterial cell there is a plasma membrane that envelops the cytoplasm, ribosomes which are composed of protein and deoxyribonucleic acid [14].

Table 8. Inhibitory Test Results of Cinnamon Bark Essential Oil

Inhibiton test	Resistance Zone Diameter (mm)
F0 Negative Control (n-hexane)	0.0
F1 (5%)	8.7
F2 (10%)	12.0
F3(15%)	15.2

The chemical reaction that occurs in the inhibition test process in this study is an oxidation-reduction reaction with the help of enzyme catalysis in this case nutrient agar which contains protein, carbohydrates, lipids to produce energy which is then synthesized by Staphylococcus aureus cells to produce movement. Based on the results of infrared spectra showing the appearance of the C=N (imin) group at the absorption peak of the wave number region of 1627.92 cm-1 and the -C=O (carbonyl) group, the two groups formed can act as anti-bacterial in which the nitrogen atom has free electrons, the presence of an imine group that has a cationic charge that is able to bind to the food source of the bacteria so that it inhibits food nutrients from entering the cell of staphylococcus aureus bacteria resulting in inhibition of bacterial growth and an inhibition occurs which is characterized by the formation of a clear zone. Reaction of cinnamaldehyde with glutamic acid to produce an imine group that functions as an anti-bacterial for Stapylococcus aureus [15,16].

CONCLUSION

The results of the KG-SM identification of cinnamon bark essential oil obtained a

compound of 1,6 octadien-3-ol (linalool) and a compound 2 propenal, 3-phenyl (cinamaldehyde) while the results of the infrared spectrophotometer identification showed a specific bond, namely the C=O (aldehyde) bond. , C=C (aliphatic) and C=N (imin). Based on the results of characteristic tests and physical tests on cinnamon bark essential oil cream, all cream preparations F1, F2, F3, meet national standards [16] and can be used as raw materials for skin cream mixtures. The results of the test of the inhibitory power of cinnamon bark essential oil against staphylococcus aureus bacteria, the largest clear zone was found at a concentration of 15% at 15.2 mm.

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