Malaysian Journal of Chemistry, 2023, Vol. 25(5), 251-261
(Special Issue: *The 4th International Conference on Chemistry and Material Sciences 2022*)

Antioxidant and Sunscreen Activities of Cananga Oil and Its Formulation Test as A Facial Spray

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Ylang flower (*Cananga odorata*) contains essential oils that have the potential as antioxidants and sunscreens based on their constituent components. Based on its potential, cananga oil is very possibly to be applied as a cosmetic in the form of a facial spray. The research aimed to isolate the cananga essential oil, characterize its physical properties, identify the components, antioxidant, and sunscreen activity test, and formulate cananga essential oil as a facial spray. This research consisted of 5 stages, namely: 1) isolation of cananga essential oil using the steam-water distillation method, 2) characterization of cananga oil which included shape, color, density, boiling point, refractive index, and optical rotation, 3) identification of components of cananga oil using Gas Chromatography-Mass Spectrometer 4) antioxidant activity test using radical scavenging method by DPPH and sunscreen activity using the spectrophotometric method, and 5) formulation test and evaluation of cananga oil as a facial spray using mixing method which refers to SNI 16-0218-1987. Isolated cananga flower essential oil obtained 0.66% yield. This oil is liquid, light yellow, has a distinctive aroma of cananga flower, density of 0.916 $g.cm^{-3}$, the refractive index of 1.492 (25 °C), boiling point of 121.0–123.0°, and specific rotation -25.76$°dm^{-1}g^{-1}mL$. The main component of cananga oil is β-caryophyllene with a content of 46.04%. Cananga oil has 15 components that show the characteristics of antioxidant activities and 7 components that show the characteristics of sunscreen activities. The antioxidant activity test of cananga oil is IC_{50} 1414 $g.mL^{-1}$ which indicates a weak category. The sunscreen activity of cananga oil based on SPF value is 7.6060 which indicates a weak protection category. The formulation of cananga oil as facial spray obtained a liquid form, light yellow, with a fresh aroma and the pH value met the safe limit value to be applied to the skin.

Keywords: Ylang essential oil; antioxidant; sunscreen, facial spray

Received: October 2023; Accepted: October 2023

Ylang (*Cananga odorata*) is a plant that produces essential oils. The type of ylang plant that is commonly found in Indonesia is Java ylang (*C. odorata forma macrophylla*). The parts of this plant that can produce essential oils are flowers, leaves, stems, and fruit [1]. In general, flowers are part of the ylang plant that is often used to produce essential oils and is known as ylang flower essential oil. Ylang flower essential oil is widely used as raw material for perfumes and aromatherapy, in the food, pharmaceutical, and cosmetic industries [2–5]. The wide use of this essential oil is due to the complexity of the active compound content and its very fragrant nature [6].

According to the International Organization for Standardization (ISO 3063: 2004) the components of ylang flower essential oil are β-caryophyllene, linalool, eugenol, geraniol, geranyl acetate, benzyl benzoate, α-farnesene, germacrene-D, and methyl benzoate [7]. β-caryophyllene is a major component of ylang flower oil. This compound belongs to the sesquiterpene group. The literature states that β-caryophyllene can ward off free radicals (antioxidants), antibacterial, anti- depressant, anti-inflammatory, and anti-tumor, and has the potential as an anti-cancer [8].

Based on their structure, the compounds that make up the ylang flower essential oil are characterized by the presence of C=C double bonds (mono and poly), hydroxyl, carbonyl, and phenolic groups. The presence of these characteristics in the components of ylang flower essential oil has the potential as an antioxidant. The characteristics of compounds that have the potential as antioxidants are the presence of phenolic groups, hydroxyl groups (primary or secondary), aldehyde groups, or structures with C=C double bonds [9,10].

Another characteristic of the ylang flower essential oil component is the presence of conjugated double bonds and carbonyl groups. These clusters are absorbing UV light radiation. This shows that it is very possible that ylang flower essential oil can work as a sunscreen. Sunscreen is a substance used to protect organs, especially the skin, from UV radiation. The characteristics of these compounds can be characterized by the presence of a conjugated double-bond system

†Paper presented at the 4th International Conference on Chemistry and Material Sciences 2022 (IC2MS2022)

or an aromatic system. Conjugated double-bond systems can occur between C=C bonds and with carbonyl groups [11]. These groups can play a role in carrying out electronic transitions by UV light radiation. Previous study showed that essential oil from different plant source which are lavender oil, orange oil, and lemon oil shown sunscreen activity by SPF value which are 5.624, 3.975, and 2.810 respectively [12]. Therefore, it is suspected that ylang flower essential oil has potential as a sunscreen. Until now, information regarding the sunscreen activity of ylang flower essential oil has not been reported.

Based on its potential, ylang flower essential oil is very possible to be applied as a cosmetic ingredient in the form of facial spray. Facial sprays generally function to provide a refreshing and moisturizing effect on facial skin. Cosmetics in the form of facial spray are widely used because they are practical and economical. In addition, ylang flower essential oil is an important asset in the cosmetic industry. In addition to providing a distinctive aroma, ylang flower essential oil has important potential that have a good impact on the skin [6]. According to the Food and Drug Administration (FDA) and the European Food Safety Authority (EFSA), β-caryophyllene contained in ylang flower essential oil has been confirmed to be safe when used in cosmetics [8].

There is no scientific report on the use of ylang flower essential oil as a facial spray. Therefore, it is necessary to develop the potential of ylang flower essential oil in the form of facial spray. This study aimed to isolate the essential oil from the ylang flower, characterize its physical properties, identify its constituent components, test antioxidant and sunscreen activity, and formulate ylang flower essential oil as a facial spray. The success of this research can be used as innovation in the application of ylang flower essential oil and expand its use.

EXPERIMENTAL

This research was conducted experimentally at the Organic Chemistry Research Laboratory, Department of Chemistry, Universitas Negeri Malang (January to June 2022). This research consisted of five stages. The *first stage* is the isolation of essential oils from ylang flowers. The *second stage* is the characterization of the physical properties (color, shape, aroma, density, boiling point, refractive index, and optical rotation) of ylang flower essential oil. The *third stage is* to identify the components of the ylang flower essential oil using GC-MS. The *fourth stage* tested the antioxidant activity and sunscreen of the ylang flower essential oil. The *fifth stage* is formulation and evaluation (organoleptic and pH test) of the facial spray of ylang flower essential oil.

EQUIPMENT AND MATERIALS

Material and Chemicals. Fresh ylang flower (collected at Malang Regency, East Java, Indonesia), magnesium sulfate anhydrous (technical grade), DPPH (2,2-diphenyl-1-picrylhydrazil, Sigma-Aldrich), ascorbic acid (Merck, pro analysis), aluminum foil, methanol (Merck, pro analysis), glycerin (technical grade), PVP (polyvinylpyrrolidone), K-30 (technical grade), lemon flavor (Merck, pro analysis), mint flavor (Merck, pro analysis), universal indicator, and distillate water.

Equipment. A set hydro-distillation, glassware, alcohol thermometer 200 °C, mechanical stirrer, analytical balanced (Dura Scale DAB200, accuracy 0.001 g), ABBE refractometer (Atago Japan), digital polarimeter (Biobase Biodustry, type BK-P2S), Gas Chromatography-Mass Spectrometer, GC-MS (SHIMADZU, type QP2010S), UV-Visible Spectrophotometer (SHIMADZU, type UV-1700), Spectronic 20+ Analog Spectrophotometer (Thermo Fisher Scientific), and Spectronic-Genesys 20 Visible Spectrophotometer (Thermo Fisher Scientific).

PROCEDURES

Isolation of Ylang Flower Essential Oil

Ylang flower essential oil was isolated by hydro-distillation under ambient conditions. Amount 2-3 kg of fresh ylang flowers are put into a hydro-distillation apparatus. Distillation was carried out until there was no oil in the distillate. The essential oil was separated from the distillate by decantation and centrifugation, then dried with anhydrous magnesium sulfate, weighed, and yield was determined.

Characterization of Ylang Flower Essential Oil

The isolated ylang flower essential oil was characterized by its physical properties including phase, color, odor, density, boiling point, refractive index, and optical rotation. Characterization of phase and color was done by organoleptic with good lighting. Density was determined by injecting 5 mL of ylang flower essential oil into a 5 mL pycnometer to the limit mark and weighed with a digital balance to determine the density. The measurement of the boiling point was carried out by inserting 2 mL of ylang flower essential oil into a test tube that already contained boiling stones and a percolator in it. The boiling point was determined by observing the heated oil began to boil and the temperature is read through a thermometer when it reaches a constant point. The refractive index was measured by inserting 1-2 drops of ylang flower essential oil on the prism of the refractometer, then adjusting the dark-light position by intersecting each other at the boundary point. The results of the measurement of the refractive index converted at a temperature of 25 °C. The optical rotation of the essential oil was measured with a digital polarimeter in the form of a solution of 5% in methanol. The optical rotation of the measurement results was converted into a specific rotation. Each measurement was repeated three times and then the average was calculated.

Identification of Components Ylang Flower Essential Oil

Chemical compounds contained in ylang flower essential oil were identified by GC-MS with a DB-5MS column (length 30 m, internal diameter 0.25 mm) with the following operational conditions: injector temperature 300°C, oven temperature 50°C, carrier gas He with a flow rate of 0.62 mL/min at a temperature of 300 °C, a split ratio of 129.9, a pressure of 21.0 kPa, ionization technique by EI 70 eV. MS conditions are time analysis 5.20–50.00 minutes, analysis time 0.50 seconds, scanning speed 1250, and m/z between 28.00–600.00. Mass spectra were compared with the database on the instrument.

Antioxidant Activity Test of Ylang Flower Essential Oil

Antioxidant activity test was carried out by radical scavenging technique using DPPH (2.2-diphenyl-1-picrylhydrazil). A total of 25 mg of essential oil was dissolved in 25 mL of methanol (a stock solution of the sample with a concentration of 1000 $\mu g.mL^{-1}$ was obtained). This stock solution was diluted to obtain solutions with concentrations of 100, 200, 300, 400, and 500 $mg.mL^{-1}$ which were used as sample solutions tests. Ascorbic acid solutions with concentrations of 1, 2, 3, 4, and 5 $mg.mL^{-1}$ were used as positive controls. Experiments were carried out by mixing 0.5 mL of the sample solution and 4.5 mL of DPPH solution at each concentration. The absorbance of this solution was then measured at a wavelength of 497, 517, and 537 nm at minute 30 [13]. The antiradical capacity (radical scavenging) of DPPH was measured from the scavenging of the purple-red color of DPPH at 517 nm with the following formula [14]:

$$A_{calc.}\,517 = A_{517} - \frac{A_{497} + A_{537}}{2}$$

$$\%\,DPPH\ radical\ scavenging\ = 1 - \frac{A_t}{A_o} \times 100$$

where A_{497} is the absorbance at 497 nm, A_{517} is the absorbance at 517 nm, A_{537} is the absorbance at 537 nm, A_0 is DPPH calculated absorbance, and A_t is the sample calculated absorbance. Calculated absorbance was conducted to DPPH (blank) and test samples. The IC_{50} value was determined through a linear regression equation of the percentage of DPPH radical scavenging from each concentration of the sample solution tested, namely y = ax + b, with x as concentration ($\mu g.mL^{-1}$) and y as percentage of DPPH radical scavenging.

Analysis of Spectrophotometry UV and Sunscreen Activity Test

UV spectrometry analysis was done with a 5% sample solution in methanol. Spectrum scanning was carried out at a wavelength between 200–400 nm with methanol as a blank. UV spectra analysis was carried out by dissolving 1.25 g of the sample in 25 mL of methanol to obtain a concentration of 5%. Further analysis was carried out using UV spectrophotometer instrumentation at a wavelength of 200–400 nm with methanol as blank.

Testing the activity of sunscreen based on the results of the measurement of the UV spectrum through the determination of SPF (Sun Protection Factor). The absorption pattern from the measurement of the UV spectrum was studied further for absorbance at a wavelength of 290–320 nm with a wavelength interval of 5 nm. The SPF value as the basis for determining sunscreen activity is determined by the following equation [15]:

$$SPF = CF \times \sum_{290}^{320} EE_\lambda \times I_\lambda \times A_\lambda$$

where $EE_{(l)}$ is erythemal effect spectrum, $I_{(l)}$ is solar intensity spectrum, $A_{(l)}$ is the absorbance of the test sample, CF is correction factor (= 10). The value of EE x I are constant and presented in Table 1. The calculation of resilience based on the SPF value is calculated based on Drug and Food Administration Board *(Badan Pengawas Obat dan Makanan, BPOM*) Regulation No. 30/2020 Republic of Indonesia, namely:

Resistance (minute) = 10 x SPF

Table 1. The value of EE_λ x I_λ [16].

Wavelength (nm)	EE x I
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180

Formulation and Evaluation of Facial Spray Preparation

Facial spray formulation is done by mixing technique. 20 mL glycerin and 4 mL PVP K-30 were added into the beaker glass, and stirred with a mechanical stirrer until homogeneous. Amount 0.3 mL of lemon and mint flavor was added, and distilled water was added until the volume was 100 mL, while continuously stirring until homogeneous (30-60 minutes), and filtered. The filtrate is put into a spray bottle. This formulation is a Blank Formula (without essential oil). Furthermore, Formula 1 and 2 were prepared, namely by adding 0.5 and 1.0 mL of ylang flower essential oil, respectively, into the Blank Formula. Evaluation of the product formulation was carried out by organoleptic and pH. Organoleptic tests were carried out by physical observation with good lighting including shape, color, aroma, and aroma resistance. The pH test was carried out with universal indicators.

RESULTS AND DISCUSSION

Isolation of Ylang Flower Essential Oil

The results of the isolation of ylang essential oil using the hydro-distillation method resulted in an average yield of 0.66%. The result of each experiment is listed in Table 2. The results of this study were compared with previous studies using a similar method with a yield of 0.43% [2]. Based on the results obtained, the isolation results of ylang flower essential oil in this study were better than previous studies. The yield of ylang essential oil is influenced by several factors which are flower variety, flower picking time, growth environment, climate, and the isolation method used [3]. The hydro-distillation method is used based on its ability to extract good oil from tissue in relatively short time, produce a lot of essential oils, and good quality [17].

Physical Properties of Ylang Flower Essential Oil

The product isolation of ylang flower essential oil is shown in Figure 1, with the physical properties of the characterization results listed in Table 3. The physical properties of the experimental results of essential oils are referred to in the literature and previous research. The results of the characterization of the physical properties of ylang flower essential oil in the study were under SNI (Standar Nasional Indonesia, Indonesia National Standard) 06-3949-1995, namely shape and color. The difference in yield on density can be caused by the water content that is still present in the oil, causing the value to not match the standard range [17]. Inaccurate results in the measurement of the refractive index can be caused by differences in time and measurement conditions so that it affects the measurement results. The results of an inappropriate specific rotation can be influenced by the number of components with chiral groups, causing the magnitude of the resulting specific rotation. The more components with chiral groups, the greater the specific rotation.

Table 2. Yield of Ylang Flower Essential Oil.

Experiment	Ylang flower (kg)	Essential oil of ylang flower (g)	Duration	Yield (%)
1	3	24.024	10 hours 25 minutes	0.80
2	3	19.382	9 hours 50 minutes	0.65
3	2	10.429	8 hours 25 minutes	0.52
Average				**0.66**

Figure 1. Ylang Flower Essential Oil.

Table 3. Physical Properties of Ylang Flower Essential Oil.

No.	Physical properties	This research	SNI 06-3949-1995
1.	Color	light yellow	light yellow–dark yellow
2.	Phase	liquid	liquid
3.	Odor	ylang flower aroma	ylang flower aroma
4.	Density ($g.cm^{-3}$)	0.916	0.904−0.920 (25°C)
5.	Boiling point (°C)	121–123	-
6.	Refractive index	1.492 (25°C)	1.493–1.503 (20°C)
7.	Specific rotation (° $dm^{-1}.g^{-1}.mL$).	-25.76	(-15)−(-30)

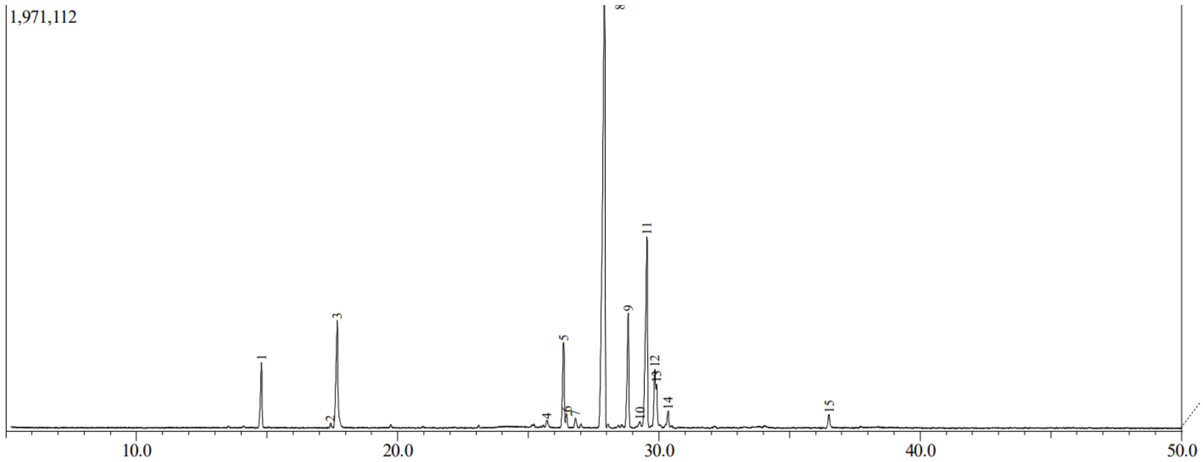

Figure 2. Gas Chromatogram of Ylang Flower Essential Oil.

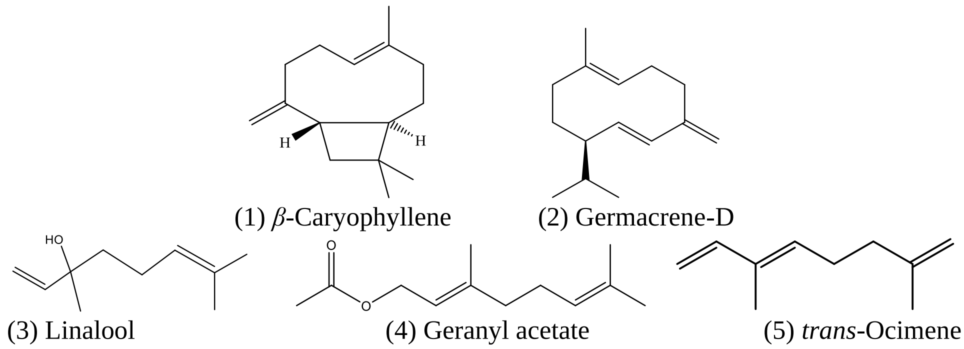

Figure 3. Structure of five dominant components in ylang flower essential oil.

Identification of Component Ylang Flower Essential Oil

Gas chromatographic analysis resulted in 15 peaks indicating that there are at least 15 compounds that make up the essential oil of the ylang flower. The chromatogram of the results of the GC-MS analysis is shown in Figure 4. The 8th peak as the highest peak with a retention time (t_R) of 27.912 minutes is the main component with an area of 46.04%, which is *β-caryophyllene*.

Mass spectrometric analysis of each peak on the chromatogram (Figure 2) and interpretation of its mass spectra followed by the comparison of the WILLEY229.LIB GC-MS instrument database showed that the 3rd, 5th, 9th, and 11th peaks are linalool, geranyl acetate, *trans*-ocimene, and germacrene-D respectively.

The compound structure of the five dominant components in ylang flower essential oil can be seen in Figure 3. These four compounds are classified into monoterpenoids, monoterpenes, and sesquiterpenes. The total of 15 component compounds contained in the essential oil of ylang flower skin is listed in Table 4.

Table 4. Chemicals Constituent in Ylang Flower Essentials Oil.

Peak	Relative content (%)	Compounds	
		Trivial name	**IUPAC name**
1	4.41	*p*-methylanisole	1-methoxy-4-methylbenzene
2	0.32	methyl phenyl ester	methyl benzoate
3	9.11	linalool	3,7-dimethylocta-1,6-dien-3-ol
4	0.58	eugenol	2-methoxy-4-(prop-2-en-1-il)phenol
5	5.86	geranyl acetate	(*E*)-3,7-dimethylocta-2,6-dien-1-yl acetate
6	0.80	*α*-copaene	1,3-dimethyl-8-(1-methylethyl)-tricyclo-[4.4.0.0$^{(2,7)}$]dec-3-ene
7	0.74	*α*-humulene	(*E,E,E*)-2,6,6,9-tetramethylcycloundeca-1,4-8-triena
8	46.04	*β*-caryophyllene	(1*R*,4*E*,9*S*)-4,11,11-trimethyl-8-methylenabicyclo[7.2.0]undec-4-ene
9	8.02	*trans*-ocimene	3,7-dimethylocta-1,3,7-triene
10	0.43	*trans*-caryophyllene	(1*R*,4*E*,9*S*)-4,11,11-trimethyl-8-methylidenabicyclo[7.2.0]undec-4-ene
11	15.85	germacrene-D	(1*E*,6*E*,8*S*)-1-methyl-5-methylidene-8-(propan-2-yl)cyclodeca-1,6-diene
12	3.86	*trans*-geraniol	(*E*)-3,7-dimethyl-2,6-octadien-1-ol
13	1.99	*β*-mircene	7-metil-3-metilidieneocta-1,6-diene
14	0.89	*δ*-cadinene	(1*S*-cis)-4,7-dimethyl-1-(propan-2-yl)-1,2,3,5,6,8a-hexahydronaphtalene
15	1.09	benzyl phenyl ester	benzyl benzoate

Table 5. The absorbance of Antioxidant Activity Test of Ylang Flower Essential Oil.

Sample Concentration (μg.mL^{-1})	**A_{497}**	**A_{517}**	**A_{537}**	**$A_{calc.}$**	**DPPH radical scavenging (%)**
Blank	0.585	0.658	0.538	0.0965	-
100	0.561	0.602	0.502	0.0705	26.9430
200	0.523	0.561	0.469	0.0650	32.6425
300	0.488	0.523	0.432	0.0630	34.7150
400	0.456	0.488	0.398	0.0610	36.7876
500	0.438	0.475	0.382	0.0650	32.6425

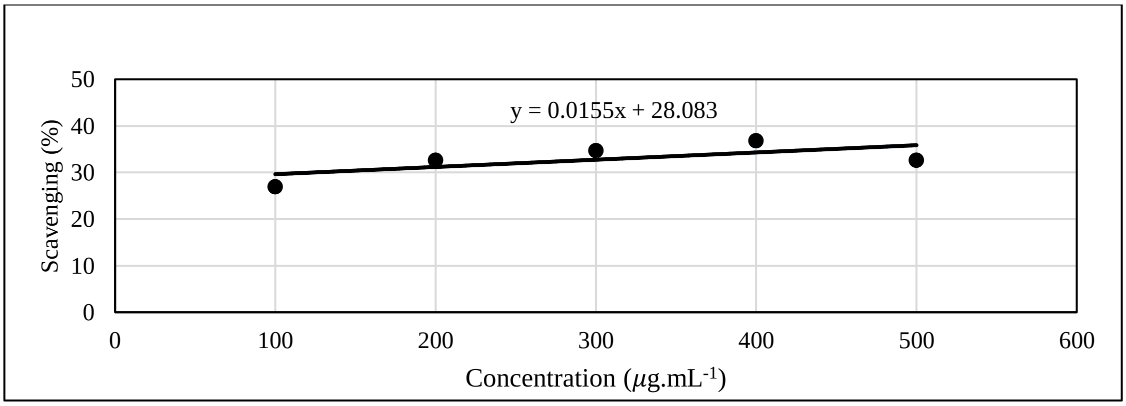

Figure 4. Inhibition Graphic of DPPH against Ylang Flower Essential Oil.

Table 6. Absorbance of Antioxidant Testing of Ascorbic Acid.

Sample (μg.mL^{-1})	**A_{497}**	**A_{517}**	**A_{537}**	**$A_{calc.}$**	**Scavenging (%)**
Blank	0.509	0.621	0.541	0.0960	-
1	0.476	0.551	0.476	0.075	21.87
2	0.474	0.548	0.474	0.074	22.92
3	0.432	0.495	0.431	0.064	33.33
4	0.414	0.474	0.414	0.060	37.50
5	0.385	0.440	0.384	0.056	41.67

Antioxidant Activity of Ylang Flower Essential Oil

The antioxidant activity test of ylang flower essential oil was carried out using the radical scavenging method using DPPH. Measurements were made at wavelengths of 497, 517, and 537 nm after 30 minutes of the reaction between the essential oil and DPPH. Ascorbic acid was used as a positive control. The absorbance of the antioxidant activity test of the ylang flower essential oil and the calculation of the percentage of radical scavenging is shown in Table 5, and the graph of the percentage of radical scavenging DPPH of the ylang flower essential oil is shown in Figure 4. The absorbance value of the ascorbic acid antioxidant activity test is shown in Table 6 and the graph of DPPH scavenging radicals against ascorbic acid is shown in Figure 5.

Antioxidant activity was determined based on the IC_{50} value. IC_{50} is a concentration of antioxidant compounds required to reduce DPPH radicals by 50%. The smaller of IC_{50} value, the higher the antioxidant activity [18,19]. The antioxidant activity test of ylang flower essential oil against DPPH (Table 5) resulted in a linear regression equation y = 0.0155x + 28.083 (Figure 4). Based on the linear regression equation, the IC_{50} value of ylang flower essential oil is 1414 g.mL^{-1}. This indicates that the antioxidant activity of ylang flower essential oil is weak. Meanwhile, ascorbic acid antioxidant activity test as a positive control (Table 6) resulted in a linear regression equation y = 5.5208x + 15.104 (Figure 5). Based on the linear regression equation, the IC_{50} value of ascorbic acid was obtained at 6.32 g.mL^{-1}. This shows the antioxidant activity of ascorbic acid with a very strong category. The antioxidant activity of ylang flower essential oil is in the weak category, with its antioxidant activity 100 times weaker than ascorbic acid. However, the results of this study were more active than before (IC_{50} value of ylang flower essential oil was 2290 g.mL-1). Thus, the antioxidant activity of ylang flower essential oil in this study was better than in previous studies [2]. Figure 6 shows the reaction scheme between an antioxidant and DPPH radical.

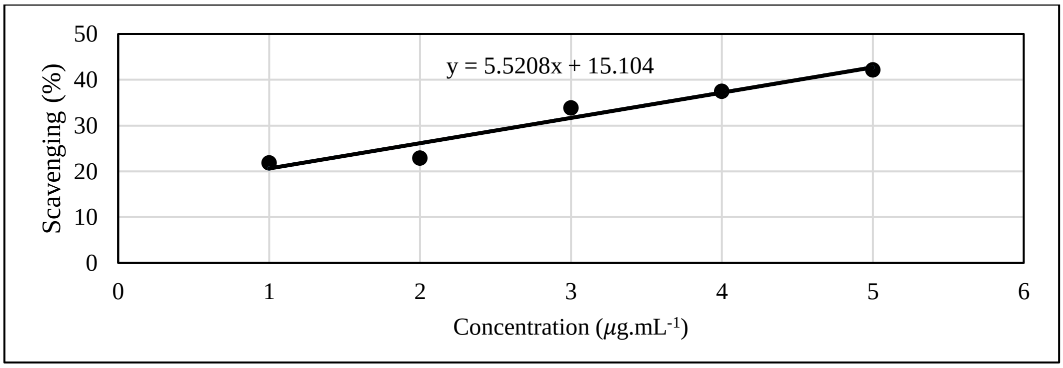

Figure 5. Inhibition Graphic of DPPH against Ascorbic Acid.

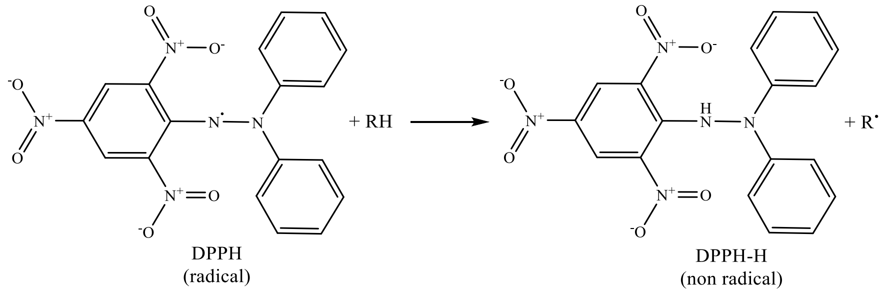

Figure 6. Reaction Scheme of Antioxidant (RH) with DPPH Radical [20].

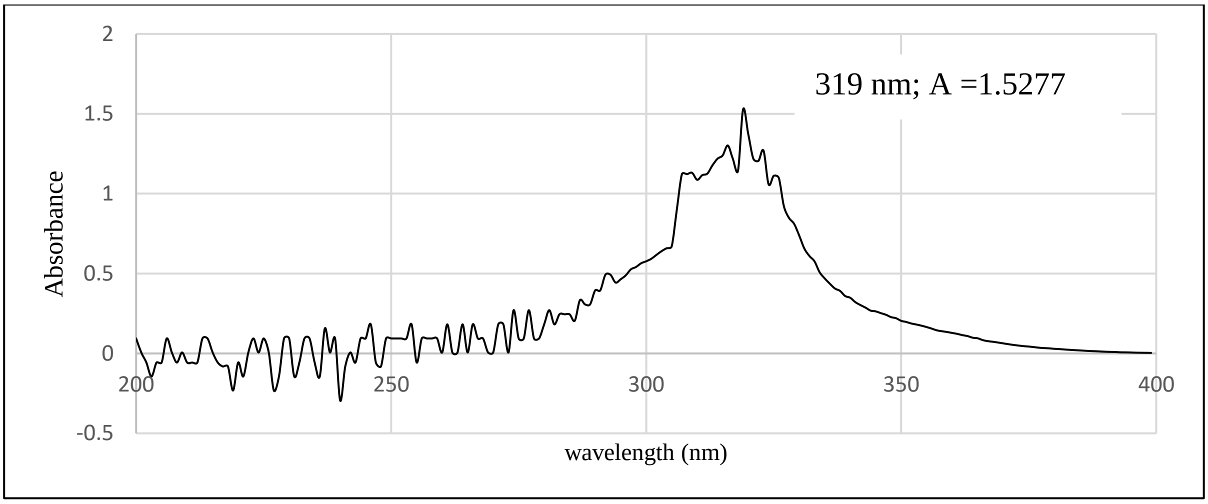

Figure 7. UV Spectrum of Ylang Flower Essential Oil.

UV Spectrophotometric Analysis of Ylang Flower Essential Oil

Figure 7 shows the UV spectrum as result of spectrophotometric analysis at 200–400 nm of solution 5% ylang flower essential oil solution in methanol.

Based on its UV spectrum, ylang flower essential oil absorbs UV radiation at a maximum absorbance at 319 nm with an absorbance of 1.5277. This indicates the presence of R and K bands. The R band indicates the n $\rightarrow \pi^*$ transition in atoms that have non-bonding electron pairs, namely the C=O group. The K band indicates a transition n $\rightarrow \pi^*$ by the conjugated C=C double bond system. The absorption of UV radiation is played by the compounds contained in this essential oil which actively absorb it. The presence of a K band is a result of the presence of a C=C conjugated double bond as a reference in determining sunscreen activity [11].

Sunscreen Activity of Ylang Flower Essential Oil

The UV spectrum of ylang flower essential oil obtained λ_{max} 319 nm indicating that it absorbs UV light radiation. This absorption is thought to be from the constituent compounds, such as germacrene-D, geranyl acetate, and benzyl phenyl ester, and some of them have UV radiation absorbing characteristics (Table 4). Thus, ylang flower essential oil has activity as a sunscreen. Analysis of the sunscreen activity of ylang essential oil based on its UV spectrum and calculations using the formula as described in the previous section are listed in Table 7.

The result of the calculation of the SPF of the ylang flower essential oil is 7.6060 (Table 7). Referring to this SPF value, the protective power of ylang flower essential oil sunscreen is in the weak category. That is, the protection from UV radiation by ylang flower essential oil is low. The SPF value in this study showed the efficiency of ylang flower essential oil in absorbing UV rays for 76.06 minutes. The effectiveness in absorbing UV radiation on the skin is indicated by the higher SPF value [21]. However, according to SNI 16-4399-1996, the quality requirements of ingredients that can be applied to cosmetic products have a SPF $\geq$ 4. Thus, ylang flower essential oil meets the standards to be applied to cosmetic products in the form of facial spray.

Table 7. Sunscreen Activity of Ylang Flower Essential Oil.

wavelength (nm)	EE x I	Absorbance	SPF
290	0.0150	0.3948	0.0592
295	0.0817	0.4642	0.3793
300	0.2874	0.5769	1.6580
305	0.3278	0.6699	2.1959
310	0.1864	1.0869	2.0260
315	0.0839	1.2396	1.0400
320	0.0180	1.3754	0.2476
SPF Total			**7.6060**

Formulation and Evaluation of Ylang Flower Essential Oil Facial Spray

The evaluation results of a facial spray of ylang flower essential oil obtained in the three formulations are listed in Table 8. Ylang flower essential oil is formulated into a facial spray with several additional ingredients, namely glycerin, PVP, lemon flavor, and mint flavor. These additional ingredients are used as a support that refers to research on the manufacture of facial spray [22]. Supporting ingredients used in facial spray formulations have different functions. Glycerin is used as a moisturizer because it can keep the facial skin moist, PVP is an emulsifier, lemon, and mint flavors are used to reduce the ylang flower scent which is too strong and gives a refreshing effect on facial skin. PVP is used because it is considered safe enough to be applied in cosmetics, such as not irritating to the skin and low toxicity [23]. The concentration of PVP that is safe to use for cosmetics is a maximum of 5%. As for glycerin, a good concentration to use is 10–20%. The use of glycerin in formulations with high concentrations can cause an irritating effect on the skin [24].

Table 8. Evaluation Result of Facial Spray.

Formulation	Organoleptic Test		pH
	Appearance	Description	
F0		Phase: liquid Color: colorless Odor: Fresh Aromatic Resistant: ± 1 hour	5
F1		Phase: liquid Color: light yellow Odor: fresh and mild Aromatic Resistant: ±2 hours	5
F2		Phase: liquid Color: light yellow Aroma: fresh and strong Aromatic Resistant: ±3 hours	5

The results of the evaluation of the facial spray of ylang flower essential oil organoleptically obtained identical shapes and colors, in liquid form and light yellow. The aroma produced in the second formulation is sharper. In addition, the aroma resistance of the F2 formulation is better. This is due to the higher concentration of ylang flower essential oil. Based on this, the F2 formulation can be categorized as good. Based on the evaluation results, both formulations have a pH value under SNI 16-4399-1996. pH testing aims to adjust the pH of the skin. If the pH is too alkaline it will cause scaly skin, while if it is too acidic it can irritate [25].

The pH test also aims to ensure that the facial spray of ylang flower essential oil can be categorized as safe to use and apply to the skin. The requirements for pH values that meet the criteria based on SNI are pH 4.5-8.0. Based on this, ylang flower essential oil formulated as a facial spray is safe to be applied to the skin.

CONCLUSION

Ylang flower essential oil isolated from fresh ylang flower by hydro distillation with a yield of 0.66%. This oil is liquid, light yellow, has a distinctive aroma of ylang flower, density of 0.916 g.cm^{-3}, refractive index of 1.492 (25 °C), boiling point of 121.0–123.0 °C, and specific rotation –25.76 ^{0}.dm^{-1}.g^{-1}.mL. The components of ylang flower essential oil were *p*-methyl anisole (4.41%), methyl benzoate (0.32%), linalool (9.11%), eugenol (0.58%), geranyl acetate (5.86%), α-copaene (0.80%), α-humulene (0.74%), β-caryophyllene (46.04%), *trans*-ocimene (8.02%), *trans*-caryophyllene (0.43%), germacrene-D (15.85%), *trans*-geraniol (3.86%), β-myrcene (1.99%), δ-cadinene (0.89%), and benzyl benzoate (1.09%). The anti-oxidant activity of this ylang flower oil is in the weak category (with the DPPH method obtained IC_{50} 1414 g.mL^{-1}). The sunscreen activity test at 290–320 nm obtained a total SPF 7.6060 which indicates that it has the potential to be applied to cosmetic products. The formulation in the form of a facial spray of ylang flower essential oil obtained a liquid material, light yellow color, fresh aroma, and the pH value met the safe limit value to be applied to the skin. The success of this research can be used as innovation from the application of ylang flower essential oil as a facial spray. Ylang flower essential oil formulated in the form of a facial spray can be developed by conducting a sunscreen activity test, to determine the effectiveness of the ylang flower essential oil formulation in the form of a facial spray. The importance of this research is to provide information regarding the relationship between antioxidant and sunscreen activity in ylang oil, where the results of this research show that anti-oxidant compounds can play a role in absorbing UV lights.

ACKNOWLEDGEMENTS

This work was supported by the State University of Malang, Indonesia, through the 2022 PNBP scheme of *Hibah Penelitian Skripsi* with contract number: 19.5. 1020/UN32.20.1/LT/2022 based on Decree of UM Rector No. 18.5.60/UN32/KP/2022, May 18th 2022.

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